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Socio-Demographic Study of Victims of Homicide in South Bangalore

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ABSTRACT

Homicide is unlawful killing of a person by another with the intention of harm prior to the act. Incidence of Homicide is on the rise worldwide. A prospective study on Homicidal deaths were conducted in the Department of Forensic medicine, Kempegowda Institute of medical sciences, Bangalore from November 2012 to May 2014 for a period of 18 months to assess the socio-demographic profile of victims of homicidal deaths, to understand the motive behind the homicidal deaths, to analyse the methods of disposal of the deceased, to know the time of occurrence of homicidal deaths and to study the relationship between the offender and the victim of homicide. A Total of 36 cases of Homicidal deaths occurred during the study period and most of the victims belonged to the age group of 20-29 years, 11 cases (30.56%), majority being males, native of Bangalore, married and of middle socioeconomic status 21 cases (58.34%). Most of the victims were killed in the street, 15 cases (41.66%) and the Homicide occurred between 12 am to 6 am 16 cases (44.46%). Most of the offenders being acquaintance 18 cases (50%), the motive was mainly revenge 10 cases (27.78%).

Keywords: Homicidal death, Socio-demographic profile, motive, Victim-offender relationship.

INTRODUCTION

Homicide is defined as taking of a person’s life by another human being. Manslaughter is an extreme form of aggression by the perpetrators.

There are three basic types of homicide. The first type of Homicide that is permitted under law is Justifiable Homicide. Justifiable Homicide are the execution of a state prisoner or the killing of an enemy of one’s country in the line of duty. This may be considered as justifiable killing for the good of society. In a case of self defense Justifiable Homicide is also considered, as the person will be protecting themselves against harm or loss of life.

Another type of Homicide is Excusable Homicide. This type of Homicide relates to cases in which there are killing in a manner that the criminal law does not prohibit. An accident resulting in the death of an individual without negligence is an example of Excusable Homicide.

The third type of Homicide is Criminal Homicide that is based upon the fact that there has been a purposeful, knowing, reckless or negligence causing the death of one human being by another. Any homicide that cannot or is not characterized, as excusable or justifiable homicide is criminal Homicide.
With increasing awareness of sense of knowledge to commit a crime and different means used to conceal the crimes, so as to be left undetected, has brought in a lot of difficulty in solving these crimes and at times pose a challenging task to the investigating officer and the forensic expert to solve the crime.

In view of the magnitude and frequency of such Homicidal deaths in south Bangalore and its impact on the society, we have undertaken this present study so as to study the Socio- demographic profile of victims of Homicide

MATERIAL AND METHODS

A prospective study on Homicidal deaths were conducted at Mortuary, Kempegowda Institute of Medical Sciences (KIMS) Hospital, Bangalore for a period of 18 months from November 2012 to May 2014.

All the cases brought to the department for medico legal autopsy with alleged history of Homicide and also the cases which were later registered as Homicide during and after autopsy were included in the study.

All cases subjected for autopsy with alleged history of homicide but which were later recorded as accidental deaths after medico legal autopsy were excluded in the study.

Using pre-tested structured proforma information were collected which fulfilled the Inclusion and Exclusion criteria, perusal of hospital records in cases of Hospitalization. Socio Economic status of the victim were based on modified Kuppuswamy’s classification (Modified for 2014).

Table No. 1: Distribution of cases based on Age Groups and Sex of Victims:

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Age group in years</th>
<th>Male</th>
<th>%</th>
<th>Female</th>
<th>%</th>
<th>Total</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0-9 Years</td>
<td>00</td>
<td>0.00</td>
<td>00</td>
<td>0.00</td>
<td>00</td>
<td>0.00</td>
</tr>
<tr>
<td>2</td>
<td>10-19 Years</td>
<td>01</td>
<td>5.26</td>
<td>00</td>
<td>0.00</td>
<td>01</td>
<td>2.78</td>
</tr>
<tr>
<td>3</td>
<td>20-29 Years</td>
<td>07</td>
<td>36.84</td>
<td>04</td>
<td>23.52</td>
<td>11</td>
<td>30.56</td>
</tr>
<tr>
<td>4</td>
<td>30-39 Years</td>
<td>05</td>
<td>26.32</td>
<td>05</td>
<td>29.42</td>
<td>10</td>
<td>27.78</td>
</tr>
<tr>
<td>5</td>
<td>40-49 Years</td>
<td>05</td>
<td>26.32</td>
<td>03</td>
<td>17.65</td>
<td>08</td>
<td>22.22</td>
</tr>
<tr>
<td>6</td>
<td>50-59 Years</td>
<td>00</td>
<td>0.00</td>
<td>03</td>
<td>17.65</td>
<td>03</td>
<td>08.33</td>
</tr>
<tr>
<td>7</td>
<td>&gt;60 Years</td>
<td>01</td>
<td>5.26</td>
<td>02</td>
<td>11.76</td>
<td>03</td>
<td>08.33</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>19</td>
<td>100</td>
<td>17</td>
<td>100</td>
<td>36</td>
<td>100</td>
</tr>
</tbody>
</table>

Table No. 2: Distribution of Cases based on Motive behind the Attack:

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Motive</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Argument</td>
<td>04</td>
<td>11.11</td>
</tr>
<tr>
<td>2</td>
<td>Revenge</td>
<td>10</td>
<td>27.78</td>
</tr>
<tr>
<td>3</td>
<td>Financial Conflict</td>
<td>07</td>
<td>19.44</td>
</tr>
<tr>
<td>4</td>
<td>Property Gain</td>
<td>04</td>
<td>11.11</td>
</tr>
<tr>
<td>5</td>
<td>Infidelity</td>
<td>03</td>
<td>08.34</td>
</tr>
<tr>
<td>6</td>
<td>Mental Illness</td>
<td>00</td>
<td>00.00</td>
</tr>
<tr>
<td>7</td>
<td>Others</td>
<td>03</td>
<td>08.34</td>
</tr>
<tr>
<td>8</td>
<td>Not Known</td>
<td>05</td>
<td>13.88</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>36</td>
<td>100</td>
</tr>
</tbody>
</table>

Table No. 3: Distribution of Homicides according to place of Occurrence:

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Place Of Occurrence</th>
<th>Number of homicides</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Victim’s House</td>
<td>10</td>
<td>27.78</td>
</tr>
<tr>
<td>2</td>
<td>Assailant’s House</td>
<td>01</td>
<td>02.78</td>
</tr>
<tr>
<td>3</td>
<td>Victim + Assailant shared Residence</td>
<td>06</td>
<td>16.67</td>
</tr>
<tr>
<td>4</td>
<td>Street</td>
<td>15</td>
<td>41.66</td>
</tr>
<tr>
<td>5</td>
<td>Remote Area</td>
<td>03</td>
<td>08.33</td>
</tr>
<tr>
<td>6</td>
<td>Others</td>
<td>01</td>
<td>02.78</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>36</td>
<td>100</td>
</tr>
</tbody>
</table>
Table No. 4: Distribution of cases Based On Time of Occurrence of Homicide:

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Time Of Occurrence</th>
<th>Number of Homicides</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Morning (6 AM to 12 PM)</td>
<td>05</td>
<td>13.88</td>
</tr>
<tr>
<td>2</td>
<td>Afternoon (12 PM to 6 PM)</td>
<td>05</td>
<td>13.88</td>
</tr>
<tr>
<td>3</td>
<td>Evening (6 PM to 12 AM)</td>
<td>10</td>
<td>27.78</td>
</tr>
<tr>
<td>4</td>
<td>Late Night (12 AM to 6 AM)</td>
<td>16</td>
<td>44.46</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>36</td>
<td>100.00</td>
</tr>
</tbody>
</table>

Table No. 5: Distribution of cases Based on Victim – Offender’s Relationship:

<table>
<thead>
<tr>
<th>Sl.No</th>
<th>Relationship of the Offender to Victim</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Acquaintance</td>
<td>18</td>
<td>50.00</td>
</tr>
<tr>
<td>2</td>
<td>Blood Relation</td>
<td>01</td>
<td>02.77</td>
</tr>
<tr>
<td>3</td>
<td>Spouse</td>
<td>06</td>
<td>16.67</td>
</tr>
<tr>
<td>4</td>
<td>Relatives</td>
<td>04</td>
<td>11.11</td>
</tr>
<tr>
<td>5</td>
<td>Strangers</td>
<td>06</td>
<td>16.67</td>
</tr>
<tr>
<td>6</td>
<td>Not Known</td>
<td>01</td>
<td>02.78</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>36</td>
<td>100.00</td>
</tr>
</tbody>
</table>

RESULTS

During the study period a total of 36 cases of Homicidal deaths were studied that were subjected for autopsy at Kempegowda Institute of Medical Sciences (KIMS) Hospital, Bangalore, and the results are tabulated under various parameters.

In this Study, the highest Incidence of Homicidal death were of age-group 20-29 years, 11 cases (30.56%). The next vulnerable group is 30-39 years, 10 cases (27.78%) while the least number of victims were in the age group of 10-19 years, 1 case (2.78%). (Table no-1)

The maximum numbers of victims 26 cases (72.22%) were residents of Bangalore City as compared to Immigrants 9 cases (25%). It can be seen that married persons constituted the most 23 cases (63.89%).

Based on Kuppuswamy’s classification, it was observed that Middle class people 21 cases (58.34%) are most often the victims of homicide followed by Lower socio-economic class 14 cases (38.88%). In most of the homicides the motive was revenge 10 cases (27.78%), which included gang rivalry, business contract disputes etc. Financial conflicts were responsible for 7 cases (19.44%) of homicides, most often occurring due to household conflicts and dowry related. (Table no-2)

TABLE 3

It was noted that most of the victims 15 cases (41.66%) were killed on the street (Table no-3). In 3 cases the dead body was moved from the scene of the crime

Maximum number of the homicides took place in late night 16 cases (47.46%) and in the evening 10 cases (27.78%) (Table no-4)

In most of the homicides, offenders were acquaintance 18 cases (50%) i.e. the victim knew the assailant or the victim recognizes the assailant but were not well acquainted. Acquaintance includes friend, neighbor, employee and enemy etc. In all 6 spousal homicides the offender were the male wherein the motive being Infidelity and dowry. Strangers (16.67%) committed homicide for the monetary gain or argument in 6 cases (Table no-5)

DISCUSSION

The highest Incidence of Homicidal deaths were in the age group of 20-29 years, which could be due to the fact of gang rivalry, unemployment and arguments in case of males and Marital disputes, problems related to dowry in case of married females. In the 30-39 years age group, the reasons could be attributed to the fact of rivalry, property gain and arguments.

This preponderance of adult age group (21 – 40 yrs) being more common victims of homicide could be attributed to the fact that the persons in this age group bears the thrust of responsibilities of various kinds including family, commitments, and in carrying out the responsibility of interacting frequently with other persons and in this process they are bound to clash with each other. Also the young adults being more enthusiastic and energetic are generally ready to fight rather than to flight or to compromise. Similar findings were observed in the studies conducted by Scott KWM 4, and Mohanty MK 5 and were in contrast with the study conducted by Kominato 6, Henderson 7, Saint Martin 8 where most of the victims belonged to 50 -59 years. The ratio of
male victims (52.77%) to female victims (47.22%) were almost equal. Similar observation was found by Kominato where the male to female ratio was 1:1.

This study was confined to a particular urban region. There could be a possibility of rivalry arising between the local people and the immigrants who have come in search of job opportunities resulting in gang wars, real estate rivalry and the notion that the immigrants are depriving the local people of job opportunities as they have more responsibilities and obligations to fulfil.

The major reasons for homicide in married people are infidelity, marital disharmony, etc. In case of unmarried males and females, the reason was unemployment forcing them to take up crime, arguments arising while under the influence of alcohol and romantic disputes. Similar observations were made by Ambade where majority of victims were married.

This is in contrast to the observations made by Wahlsten where only 46% victims were married, co-inhabitant or otherwise involved in long relationships.

The least involved were from the upper socio-economic class. This illustrates that unemployment, illiteracy and financial problems are the major factors influencing the patterns of homicide.

Since the study involved the subjects residing more in urban setup, the annual income of the upper lower class could not suffice to meet the basic amenities resulting in disillusionment in life amongst them.

Similar observations were made by Mohanty MK, Hugar et al wherein maximum homicides occurred in the evening and night. And is in contrast to studies conducted by Vougiouklakis T wherein maximum number of cases occurred during noon.

A similar observation made in studies conducted by Henderson JP, Gupta Avnesh, Mohanty MK, and Hugar et al wherein maximum homicides occurred in the evening and night. And is in contrast to studies conducted by Vougiouklakis T, wherein maximum number of cases occurred during noon.

A similar observation was made by Mohanty MK et al where more deaths occurred in outdoors. In studies done by Hugar et al Victim’s residence was the common place of occurrence of homicide.

In 3 cases attempts were made by the assailants to obliterate the identity as well as the evidence of crime in the form of burying the body in a drain and covering with the slab, by burning or putting them by the railway tracks.

The presence or absence of blood stains, signs of struggle or disturbance at the spot of recovery of body were taken into account for the above inference, by visiting the scene, observing the spot photographs and information furnished by the police.

Homicidal deaths occurred during 12am-6am which can be attributed to the fact that in night fall or darkness the chances of assailant being recognized is reduced, after a day’s hard work the chances of victims and assailant engaging in arguments be it domestic or financial are high as they meet up after work, most of the victims belonged to low socio-economic status.

The perpetrators were acquaintance to the victim in most number of cases. This is similar to observations made by Kominato Y, Vougiouklakis T, Saint Martin P, Mohanty MK but it is in contrast with the observations made by Henderson JP, where in the perpetrators were strangers.

**CONCLUSION**

Among 36 cases of homicidal deaths most of the victims belonged to the age group of 20-29 years (30.56%), majority being males, native of Bangalore, married and of middle socioeconomic status (58.34%). Most of the victims were killed in the street and the homicide occurred between 12am to 6 am (47.46%). Most of the offenders being acquaintance (50%) and the motive behind Homicidal death was revenge (27.78%).

**Conflict of interest:** nil

**Source of funding:** self funding.
**Ethical clearance:** Ethical clearance from the institutional ethical committee obtained for the study.

**REFERENCES**


A Study of Neck Injuries in Hanging

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ABSTRACT

Out of total 737 medico legal autopsies conducted between May 2010 and August 2012, 45 cases were of hanging deaths, which constituted about 6.10% of medico legal autopsies conducted. The age groups of 21-30 years of age and 31-40 years of age group recorded the maximum number of cases with 14 (31.11%) and 13 (28.88%) cases respectively, with 8 female and 6 male in 21-30 years age group and 6 female and 7 male in the age group of 31-40 years. Atypical hanging 39 (86.68%) predominates typical hanging 6 (13.32%) and majority of the victims 28 (62.22%) had no injury in the neck, except pressure abrasions and ligature mark.

Keywords: Hanging, ligature mark.

INTRODUCTION

Hanging is a process in which the body is suspended with a ligature around the neck which causes constriction of the air passage preventing exchange of air between the atmosphere and the alveoli of lungs, leading to asphyxia and death. It can be carried out by a wide variety of methods with materials and numerous other devices depending on availability. Commonly, when the person steps from his support, the stretch in the ligature rope is sufficient to allow the feet to reach the ground, but this by no means prevents a fatal outcome.

Hanging remains to be one of the common methods of committing suicide. Depending on the area of the country and the sex of the victim, hanging is either the second or third most popular method of suicide. Internationally, death by hanging ranks among the most common method of suicide. In India, according to National Crime Bureau Report 2015, hanging constitutes 45.6% which shows increasing figure as compared to 41.8% in 2014 in committing suicides by hanging. In hanging one of the most conspicuous findings is the ligature mark. Apart from this, certain injuries may be sustained from hanging which include fractures of the hyoid bone and / or laryngeal cartilages, cervical fractures, muscles hemorrhages and vascular lesions. The present study highlights the incidence and pattern of neck injuries observed in hanging and various factors responsible for the development and magnitude of severity of those injuries.

MATERIALS AND METHODS

The study is an institutional based descriptive study where 45 cases of hanging deaths brought to the mortuary of Regional Institute of Medical Sciences, Imphal, for autopsy during May 2010 to August 2012 have been considered for the study.

Criteria for selection of cases:

1. All cases of death from hanging irrespective of any age brought to the mortuary was included in the study.
2. Visit to the site of incident was excluded from the preview of this study.
3. Putrefied bodies were excluded from this study.

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OPERATIONAL PROCEDURE

(A) External examination:
1. Detailed external examination by noting the height, weight, general condition of the body, ligature mark and injuries was done.
2. Ligature material, dribbling of saliva from the mouth and nostril, faecal matter, seminal stains etc. was recorded.
3. Petechial hemorrhages in the conjunctivae, the eyelids, the face and oral mucosa was examined and recorded.

(B) Internal examination:
1. All the three cavities of the body was opened and explored as done in routine postmortem examination.
2. The neck organs were removed en block for a detailed dissection and examined for ruptures and hemorrhages.
3. The carotid vessel was dissected and examined for any transverse rupture of intima.
4. The hyoid bone, the thyroid cartilage was dissected thoroughly and inspected for fractures.
5. Histological examination/toxicological investigation of other viscera were carried out, whenever it was required.

RESULTS & OBSERVATIONS

In the present study, among the age groups, the 21-30 years of age and 31-40 years of age group recorded the maximum number of cases with 14 (31.11%) and 13 (28.88%) cases respectively. The Male: Female ratio is 1:1.14 (As shown in table-1)

<table>
<thead>
<tr>
<th>Age (yrs)</th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
<th>Mean ± SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 10</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>11 - 20</td>
<td>3</td>
<td>6.67</td>
<td>6</td>
<td>20.00</td>
</tr>
<tr>
<td>21 - 30</td>
<td>6</td>
<td>13.33</td>
<td>8</td>
<td>28.89</td>
</tr>
<tr>
<td>31 - 40</td>
<td>7</td>
<td>15.56</td>
<td>6</td>
<td>31.11</td>
</tr>
<tr>
<td>41 - 50</td>
<td>3</td>
<td>6.67</td>
<td>1</td>
<td>8.89</td>
</tr>
<tr>
<td>51 - 60</td>
<td>2</td>
<td>4.44</td>
<td>3</td>
<td>11.11</td>
</tr>
<tr>
<td>Total</td>
<td>21</td>
<td>46.67</td>
<td>24</td>
<td>53.33</td>
</tr>
</tbody>
</table>

As shown in Bar Diagram - 3, 11 (24.45%) cases each used chunni and nylon rope, 20% used jute rope, 13.34% used lungie/khudei (local loin cloth), 4.44% used cable wire, bedsheet, saree and 2.22% used cotton belt and shawl as a ligature materials for hanging themselves.

In the present study, out of 45 cases of hanging, majority of the victims 28 (62.22%) had no injury in the neck, except pressure abrasions and ligature mark. Out of 17 cases, rupture of sternomastoid muscle was observed in 11 (24.45%) cases. 2 (4.45%) cases had transverse tear of carotid artery whereas fracture of hyoid bone and
carotid tear, or fracture of thyroid cartilage and carotid
tear was observed in 1 (2.22%) case each. Fracture of
hyoid bone alone or the thyroid cartilage alone was also
seen in 1 (2.22%) case each. The injuries are depicted in
Bar Diagram 4.

DISCUSSION

In the present work, higher number of female cases
was observed compared to males in the ratio of 1:1.14.
This finding is in concurrence with the finding of Naik
SK and Patil DY\textsuperscript{4}, whereas several workers like Singh
A et al\textsuperscript{3}, Sharma BR et al\textsuperscript{6}, O.P. Saini et al\textsuperscript{7} and Azmak
D\textsuperscript{8} observed that male predominated the incidence than
their counterparts which reflects a changing scenario in
the sex ratio of hanging deaths.

Singh A et al\textsuperscript{4}, O.P. Saini et al\textsuperscript{7}, Singh PK et al\textsuperscript{8},
Yadav A and Gupta BM\textsuperscript{10} observed the highest number
of cases in 21 - 30 years followed by 31 - 40 years
which can also be seen in this study where 21- 30 years
(31.11%) and 31- 40 years (28.88%) dominates the age
group. This could be explained by the fact that the age
group of 21- 40 years is the most active phase in life
wherein exposure to anxiety, stress, strain and various
adverse circumstances occur.

In a study by Dixit PG et al\textsuperscript{11}, Peñaranda JMS et
al\textsuperscript{12} and Sharma BR et al\textsuperscript{13}, observed that complete
type of hanging was more than partial hanging which is
in accordance with the findings of this study where
complete hanging constituted 62.22% and partial
hanging 37.78%. In contrast, workers like Uzün I et
al\textsuperscript{14} and Charoonnate N et al\textsuperscript{15} observed the maximum
number was that of partial type of hanging.

Again, in this study it was observed that hanging
was mostly of Atypical type than Typical type with the
incidence of 86.68% and 13.32% respectively which is
in concurrence with the studies of Naik SK and Patil
DY\textsuperscript{4}, O.P.Saini et al\textsuperscript{7}, Sharma BR et al\textsuperscript{13} and Talukder
MA et al\textsuperscript{16}.

In this study, victims of hanging used mostly chunni
and nylon rope (24.45%) each, jute rope (20%), lungi/
khudei (13.34%) etc., which is in agreement with the
findings of Fimate L et al\textsuperscript{17} where they observed
that ligature materials commonly used were jute rope
(52.1%) followed by nylon rope (35.8%), cloth (9.4%),
etc. Sharma BR et al\textsuperscript{6} also observed that chunni (30.9%)
was the most common ligature material used followed
by nylon rope (18.8%). These ligature materials were
means which were easily available to the victim at the
material moment.

From the present study it was observed that the
prevalence of sternomastoid muscle rupture was 24.45% whereas other studies by Nicolic S et al\textsuperscript{18}, Sivasuthan S et
al\textsuperscript{19}, Peñaranda JMS et al\textsuperscript{12}, Sharma BR et al\textsuperscript{13}, observed
a higher incidence of more than 50% of sternomastoid
rupture in their works. A study by Peñaranda JMS et
al\textsuperscript{12} and Hejna P\textsuperscript{20}, observed carotid intimal tear in 9.1% and
16.1% of cases whereas Jani CB and Gupta BD\textsuperscript{21}
observed that the incidence of carotid artery injury was
47.8%. In the present study, tear of carotid artery was
observed in 4.45% of cases and fracture of the hyoid
bone alone or the thyroid cartilage alone or both together
was seen only in one case (2.22%) each. According to
Green H et al\textsuperscript{22} and Nikolić S et al\textsuperscript{23}, hyoid bone and/or
thyroid cartilage fractures was observed to be on higher
side than in this series and are encountered in persons
completely suspended and in older age ranges.

However, Naik SK and Patil DY\textsuperscript{4} did not observe
a single case of hyoid bone fracture in hanging victims.
Similarly, Singh D et al\textsuperscript{24} observed that no associated
trauma was present other than the ligature mark in 76% of
cases which is in concurrence with this study where
no vital injury was seen in 62.22% of the cases.

CONCLUSION

This study concludes that majority of victims in
hanging deaths can present itself with no injuries except
ligature mark. However, neck injuries if sustained, they
are dependent on different factors like ligature material,
time of suspension, type of knot, height of drop, etc. It
also shows that there is no clear correlation between
frequency of neck injuries and type of hanging.

Conflict of interest: None

Source of funding: Self
**Ethical issues:** Ethical approval from Institutional Ethics Committee, Regional Institute of Medical Sciences, Imphal, was obtained before the study.

**REFERENCES**


A Case of Suicide by a Large Number of Sharp Force Injuries

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ABSTRACT

A 36-year-old psychotic man was found dead in a field that was not far from the location where he used to live. An external examination showed more than 100 sharp force wounds that were localized at the lumbosacral region, gluteal regions, and the lower limbs, but not on the face, neck, chest, and abdomen. Data from judicial inspection and autopsy findings suggested suicidal death due to hemorrhagic shock by superficial venous vessel lesions.

Keywords: suicide, stabbing, cutting, autopsy

INTRODUCTION

Sharp force trauma is one of the main fields in forensic pathology. Determination of death, and in particular, the differential diagnosis between suicide and homicide, is not always easy. In the past, self-inflicted wounds were a common finding in suicides. However, currently, only 2%–3% of self-inflicted wounds are found in suicides¹. According to a recent review, the ratio of murder/suicide is 5/2 in deaths where autopsy revealed sharp force wounds². Therefore, judicial inspection, examination of the medical records belonging to the victim, and autopsy with ancillary investigations, such as toxicological analysis, are essential for a differential diagnosis. We report an autopsy case in which more than 100 wounds caused by a sharp object were predominantly found on the surface of the upper limbs, lumbosacral region, gluteal regions, and lower limbs, but not at the level of head, neck, chest, and abdomen. In particular, the autopsy revealed stab wounds at the level of the gluteal regions, while the venous circulation had been drawn at the level of the dorsal surface of the right foot. After evaluating all technical aspects noted during our investigation, we considered that this case was a suicide.

CASE REPORT

A 36-year-old psychotic man was found dead in a field that was not far from the location where he used to live. The corpse was lying in the prone position on muddy ground due to rain. He was only wearing a wool sweater, which similar to the rest of the body (naked), was uniformly smeared in mud that had largely dried. In the vicinity of the corpse, there was a small trace of partly dried blood and blood still in liquid form. There were no sharp objects nearby. The medical history of the deceased was characterized by psychosis, which was diagnosed a few years earlier.

AUTOPSY FINDINGS

An autopsy was performed 6 days after the body was found. No radiopaque body referring to ballistic agents and no skeletal fracture coeval with the time of death was highlighted by a Rx total body performed before the corpse section.

An external examination of the corpse did not show any type of injury in the head, chest, and abdomen.
However, there were more than 100 stab and cut wounds as follows. In the right upper limb: there were 12 wounds along the dorsal surface of the forearm and the proximal-middle third of the arm, with lengths ranging between 0.5 and 2.5 cm. Four injuries occurred on the anteromedial surface of the forearm. In the left upper limb, there were 31 wounds that were not any deeper than the subcutaneous tissue and had a length ranging between 0.5 and 4 cm. The hand and the proximal third of the arm had no cuts. In the lumbosacral region and the buttocks, there were 30 wounds that were not any deeper than the subcutaneous tissue and presented with variable lengths from 1 to 4 cm (figure 1). On both gluteal surfaces, we find parallel linear excoriations, of different lengths and depths. Some of them formed ‘figures’ type ‘grid’, as well as parallel lines, with predominantly three or four lines. At the anterolateral surface of the leg, there were 10 wounds, with a maximum length of 1 cm. The depth of these wounds did not exceed the subcutaneous tissue. At the lateral surface of the right thigh, there were four wounds that reached the subcutis. Their length was comprised between 1 and 1.5 cm, and sometimes were joined together to form acute angles. On the dorsal surface of the foot, there were 10 wounds that did not always have regular margins, and their length ranged between 1 and 5 cm. Additionally, some of them got to the region’s vessels and consequent bleeding left highlight a greater hemorrhagic infiltration of the margins.

In the left leg, along the lateral surface, the medium-proximal third of the thigh, and to the entire lateral surface of the leg, approximately 30 wounds were observed in the skin and subcutaneous tissue. At the dorsal region of the foot, particularly on the lateral surface, seven cutaneous wounds were mostly parallel to each other. These wounds did not always have regular margins and the length of the wounds ranged between 1 and 3 cm. In some of these wounds, got to the region’s vessels and for the consequent hemorrhage left highlight a greater hemorrhagic infiltration of the margins (figure 2).

At the level of the plantar surface of the feet, we observed a detrimental complex represented by widespread excoriated areas. The size of these areas was no greater than a lentil, and there were numerous superficial wounds, which were almost linear and 0.5–1 cm long.

**Histopathological Findings**

Microscope slides were prepared with skin patches taken at different injury levels of the gluteal regions and a the level of all the arts, in particular at the level of the feet back. Particularly in samples taken at the foot, microscopy showed flattening of epithelial loss line with the pattern of epidermal layers. Additionally, we observed a hemorrhagic halo of the dermis, which also extended to the septa of subcutaneous adipose tissue with related vascular lesions.

**Toxicological Findings**

During the autopsy, biological samples were taken in the following order to perform toxicology tests: femoral blood, bladder (bladder appeared empty), bile, pericardial fluid, and liver. Enzyme immunoassays of bile were performed and the bladder was washed. GC/MS of bile, blood, and pericardial fluid did not show any presence of drug-related peaks or antipsychotic drugs. The blood alcohol content was 0.03 g/L.
DISCUSSION

Suicide by weapon is rare in recent series, with a rate of approximately 2%–3% of cases. Generally, a single lesion is found and the most affected part of the body is the thorax 3-5. The majority of suicide cases are characterized by the presence of lesions compatible with attempts. In the case of fatal injury to the wrists, several attempts near the lethal injury can be observed 6. However, in suicide, the weapon is typically found near the corpse. Additionally, the presence of numerous stab injuries in the first instance arouses suspicion of murder. In some cases, the cause of death is confirmed by a detailed analysis of injuries and the presence of other technical data, such as injury by other means and wounds sustained by the victim in efforts to ward off blows (defensive wounds). Cases of suicide by stabbing are characterized by a high number of injuries. The forensic medical diagnosis of suicide is reached by exclusion (i.e., when there is no clear evidence in support of homicide) 4,5.

Such is the case that is shown, for which the failure to find the means detrimental could orient toward hypothesis of murder. However, the absence of other relevant technical data (e.g., no signs of a struggle [bruising] or injury by defense and skeletal fractures contemporary with the time of death) suggested the hypothesis of suicide. So, numerous sharp wounds have been interpreted, for their characteristics, both as ‘hesitation marks’ and - the evolution of the dynamic self-destructive - as lesions connected to the ‘psychosis ‘from which she was suffering the victim. Case studies have shown a strong correlation between psychiatric illness and suicide by stabbing too many stripes 7-10. With regard to the lack of weapon, it can find that the subject has had physical activity subsequent to the progressive self-produce wounds that may have left a half sharp in another place and come into that place where he was found deceased also staggered distance from the first. This was also demonstrated by injuries of the soles of the feet, indicating that the path traveled was by barefoot. Fukube reported cases in which the victim after he collected the injury leaves the place 9.

For the absence of lesions at the level of major bleeding vessels was slow and gradual until the onset of the condition of unconsciousness with falling to the ground and subsequent deaths from hemorrhagic shock. Negative results of toxicological investigations of our case excluded the presence of behavior induced by the action of psychoactive substances or a murder with a decreased resistance to the offender.

Conflict of Interest: The authors have no conflicts of interest to declare.

Ethical Clearance: Informed consent was obtained from legal guardian for uses of the case materials for research purposes and publication findings.

Source of Funding: Self funding.

REFERENCES


Study of Ligature Mark in Cases of Hanging

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¹Associate Professor, ²Assistant Professor, ³Professor & HOD, Department of FMT, IGIMS, Patna

ABSTRACT

Hanging is one of the common methods of suicide practices in India. Almost all death caused by hanging is considered suicide till contrary is proved. Ligature mark is important findings whose careful examination may reveal so many facts which will be helpful in investigation. A thorough internal examination must be correlated with ligature mark otherwise chance of wrong interpretation increases.

Aims & objectives: To know the different patterns of ligature mark in cases of hanging and also to differentiate cases of ante mortem hanging and post mortem hanging by examination of ligature mark.

Materials and methods: Study was conducted in the department of Forensic Medicine and department of Pathology at RIMS Ranchi. Total 83 cases of asphyxial deaths due to hanging were taken for the study. Complete external, internal and histopathological examination was done in all case.

Results: Most of the case falls in third decade of life. Males are more common victims. Most common type of hanging observed was complete hanging. In histopathological examination breaking, wrinkling, and compression of skin along with hemorrhagic spots and inflammatory changes were observed under the ligature mark.

Conclusion: In cases of hanging deaths, a complete external, internal as well as histopathological examination should be carried out. Before making any final opinion all these findings must be correlated, this will definitely help in differentiating ante mortem hanging from post mortem.

Keywords: Hanging, Asphyxial Death, inflammatory changes, histopathological, Ante-mortem, Post-mortem.

INTRODUCTION

Deaths by ligation of neck are in practice from the time immemorial. On an average, more than one lakh persons commit suicide every year in the country during the decadal period from 2004 to 2014. According to WHO India has highest number of suicides in the world. Most suicides in the world occur in the South-East Asia Region with India accounting for the highest estimated number of suicides overall in 2012.

The various means adopted for committing suicides varied from easily available means such as consumption of poison, jumping into the well etc. to more painful means such as self inflicted injuries, hanging, shooting etc. Like previous year, hanging, consuming poison, self-immolation and drowning were the prominent means of committing suicide. In India during the year 2014, the share of poisoning, drowning, and fire/self immolation as means adopted by suicide victims, has decreased while share of hanging, and jumping from building or other sites or from moving trains/vehicles has increased.

Among the different method of suicide, hanging was found to be increasingly being adopted, lagging behind the pesticide intake and is considered as a painless form of death. Hanging is a form of death produced by suspension of the body by a ligature around the neck, constriction force being the weight of the body (or a part of the body weight) 2. In hanging proper observation and study of ligature mark, which is the characteristic hallmark of hanging, needs greater emphasis. Ligature material may be any substance that is available at the time of impulse has been used by the suicides as ligature.

Increased frequency of hanging cases have developed interest to take up this for the study.
AIMS AND OBJECTIVE

1. To know the different patterns and variations in ligature mark of hanging with respect to age, sex, social status, mode of hanging, type of knot and different types of ligature material.

2. To decide whether the hanging is ante mortem or post-mortem by gross and histopathological examination.

MATERIALS AND METHODS

The present study was conducted in the department of Forensic Medicine and department of Pathology at RIMS Ranchi. A total number of 83 cases of death due to hanging were selected for the study. A complete external examination was carried out in every case with respect to age, sex, position of body, clothings, body hairs, salivary stains, blood stain, seminal stain etc. A thorough external examination of neck was made with naked eye and hand lens to ascertain appearance of ligature mark in relation to its material, pattern, colour, impression, course, type of knot, level of ligature, etc. Other external injuries, if present were also noted. Autopsy was carried out with dissection of thoraco-abdominal and cranial cavities first followed by dissection of neck. All important findings were noted and portion of skin and subcutaneous tissue under the ligature mark was taken and preserved in 10% formalin for histopathological examination.

Table 1: showing marital status of victims of different sex.

<table>
<thead>
<tr>
<th>Sex</th>
<th>Married No. (%)</th>
<th>Unmarried No. (%)</th>
<th>Not known No. (%)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>33(39.75)</td>
<td>11(13.25)</td>
<td>8(9.63)</td>
<td>52</td>
</tr>
<tr>
<td>Female</td>
<td>19(22.89)</td>
<td>10(12.04)</td>
<td>2(2.4)</td>
<td>31</td>
</tr>
</tbody>
</table>

Table 2: Distribution of cases (age and sex wise)

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Age in Year</th>
<th>Male No. (%)</th>
<th>Female No. (%)</th>
<th>Total No. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>0-10</td>
<td>0 (0)</td>
<td>1 (1.2)</td>
<td>1 (1.2)</td>
</tr>
<tr>
<td>2</td>
<td>11-20</td>
<td>7 (8.4)</td>
<td>5 (6)</td>
<td>12 (14.4)</td>
</tr>
<tr>
<td>3.</td>
<td>21-30</td>
<td>24 (28.91)</td>
<td>13 (15.6)</td>
<td>37 (44.5)</td>
</tr>
<tr>
<td>4.</td>
<td>31-40</td>
<td>12 (14.4)</td>
<td>6 (7.2)</td>
<td>18 (21.6)</td>
</tr>
<tr>
<td>5.</td>
<td>41-50</td>
<td>6 (7.2)</td>
<td>3 (3.6)</td>
<td>9 (10.8)</td>
</tr>
<tr>
<td>6.</td>
<td>51-60</td>
<td>2 (2.4)</td>
<td>2 (2.4)</td>
<td>4 (4.8)</td>
</tr>
<tr>
<td>7.</td>
<td>61-70</td>
<td>0 (0)</td>
<td>1 (1.2)</td>
<td>1 (1.2)</td>
</tr>
<tr>
<td>8.</td>
<td>71-80</td>
<td>1 (1.2)</td>
<td>0 (0)</td>
<td>1 (1.2)</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>52 (62.6)</td>
<td>31 (37.3)</td>
<td>N=83 (100)</td>
</tr>
</tbody>
</table>

Table 3: Different ligature material used for hanging.

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Ligature material</th>
<th>No. Of cases (83)</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Dupatta</td>
<td>25</td>
<td>30.12</td>
</tr>
<tr>
<td>2.</td>
<td>Nylon rope</td>
<td>15</td>
<td>18.07</td>
</tr>
<tr>
<td>3.</td>
<td>Saree</td>
<td>14</td>
<td>16.86</td>
</tr>
<tr>
<td>4.</td>
<td>Jute rope</td>
<td>13</td>
<td>15.66</td>
</tr>
<tr>
<td>5.</td>
<td>Bed sheet</td>
<td>6</td>
<td>7.22</td>
</tr>
<tr>
<td>6.</td>
<td>Electric wire</td>
<td>5</td>
<td>6.02</td>
</tr>
<tr>
<td>7.</td>
<td>Curtains</td>
<td>3</td>
<td>3.61</td>
</tr>
<tr>
<td>8.</td>
<td>Aluminium wire</td>
<td>1</td>
<td>1.2</td>
</tr>
<tr>
<td>9.</td>
<td>Plastic tape</td>
<td>1</td>
<td>1.2</td>
</tr>
</tbody>
</table>
Table 4: Microscopic changes in cases of hanging

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Microscopic details</th>
<th>No. of cases (N=83)</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Breaking</td>
<td>21</td>
<td>25.3</td>
</tr>
<tr>
<td>2.</td>
<td>Wrinkling</td>
<td>30</td>
<td>36.14</td>
</tr>
<tr>
<td>3.</td>
<td>Compression</td>
<td>28</td>
<td>33.73</td>
</tr>
<tr>
<td>4.</td>
<td>All the three</td>
<td>04</td>
<td>04.81</td>
</tr>
</tbody>
</table>

Table 5: Comparisons of ligature materials found in different studies

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Ligature Material</th>
<th>Present Study(%)</th>
<th>Sadikhusen et al.(%)</th>
<th>Sharma et al.(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Dupatta</td>
<td>30.12</td>
<td>34.44</td>
<td>30.90</td>
</tr>
<tr>
<td>2.</td>
<td>Nylon rope</td>
<td>18.07</td>
<td>31.10</td>
<td>18.18</td>
</tr>
<tr>
<td>3.</td>
<td>Saree</td>
<td>16.86</td>
<td>16.66</td>
<td>-</td>
</tr>
<tr>
<td>4.</td>
<td>Jute rope</td>
<td>15.66</td>
<td>-</td>
<td>12.73</td>
</tr>
<tr>
<td>5.</td>
<td>Bedsheet</td>
<td>07.22</td>
<td>-</td>
<td>16.36</td>
</tr>
<tr>
<td>6.</td>
<td>Electric insulation wire</td>
<td>06.02</td>
<td>-</td>
<td>05.46</td>
</tr>
<tr>
<td>7.</td>
<td>Curtain</td>
<td>03.61</td>
<td>-</td>
<td>07.27</td>
</tr>
<tr>
<td>8.</td>
<td>Aluminium wire</td>
<td>01.20</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>9.</td>
<td>Plastic tape</td>
<td>01.20</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>10.</td>
<td>Other</td>
<td>-</td>
<td>16.66 (cotton rope)</td>
<td>01.82 7.27 (cable wire)</td>
</tr>
<tr>
<td>11.</td>
<td>Unknown</td>
<td>-</td>
<td>-</td>
<td>39.56</td>
</tr>
</tbody>
</table>

Table 6: Comparison with other studies regarding the hyoid bone fracture in cases of hanging.

<table>
<thead>
<tr>
<th>Authors</th>
<th>Sarangi et al.</th>
<th>Tripude BH et al</th>
<th>Sheikh et al</th>
<th>Meera et al.</th>
<th>Saisudheer and Nagaraja</th>
<th>Present study</th>
</tr>
</thead>
<tbody>
<tr>
<td>% of cases showing hyoid bone fracture</td>
<td>9.4</td>
<td>64.51</td>
<td>5.08</td>
<td>3.57</td>
<td>4.0</td>
<td>1.20</td>
</tr>
</tbody>
</table>

Table 7: Distribution of cases in different socio-economic class

<table>
<thead>
<tr>
<th>Socio-economic class</th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper class</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Middle class</td>
<td>25</td>
<td>12</td>
<td>37</td>
<td>45</td>
</tr>
<tr>
<td>Lower class</td>
<td>29</td>
<td>7</td>
<td>36</td>
<td>43</td>
</tr>
<tr>
<td>Not known</td>
<td>7</td>
<td>3</td>
<td>10</td>
<td>12</td>
</tr>
</tbody>
</table>

RESULTS

Among the total number of autopsy conducted during study only 83 (2.25%) cases of asphyxial deaths was due to hanging. In the present study 52 (62.6%) male victims and 31 (37.3%) female victims were seen. Among this 33 (39.75%) males were married and 11 (13.25%) were unmarried, however in 8 (9.63%) marital status was not known. In case of females 19 (22.89%) victims were married, 10 (12.04%) unmarried and marital status was not known in 2 (2.4%) cases [Table 1].

The deaths were more in the age group of 21-30 years. Total 37 (44.5%) numbers cases seen were young adults in third decades (21-30 years). It was followed by fourth decade (31-40 years), during which 18 (21.6%) cases were observed [Table 2].

Majority of victims belongs to middle 37(45%) and lower 36(43%) socio economic group. Socio economic status of 10(12%) victims was not known. Interestingly no case was found from upper socio economic group [Table 7].
The different ligature material used by the victim was examined. Dupatta was the most common ligature material utilised in 25 (30.12%) cases, followed by nylon rope in 15 (18.07%) cases [Table 3].

The typical pattern of ligature was observed in 12 (14.45%) cases. As far as number of ligature mark is concerned it was single in 80 (96.38%) and in multiple rows in 3 (3.61%) cases. Dribbling of saliva was found in 27 (32.53%) cases. Partial encirclement of ligature mark around the neck was observed in 71(85.54%) cases and in 12 (14.45%) cases there was complete encirclement of ligature mark was observed. In 76 (91.56%) cases ligature mark was found above thyroid cartilage, while in 5 (6.02%) cases it was at the level of thyroid cartilage. Only 2 (2.4%) cases were found in which ligature mark was situated below the thyroid cartilage.

Blood tinged fluid from mouth and nostrils were seen in 2 (2.4%) cases only. Fracture of hyoid bone was seen in single case. External injuries besides ligature mark was found in 3 (3.61%) cases. Soft tissue below the ligature mark was grossly normal in 60 (72.28%) cases but in 23 (27.71%) cases soft tissue under ligature were pale, white and glistening with some small area of hemorrhagic collections in the muscular layer.

Histopathological examination was done in all cases [Table 4]. Breaking of skin (epidermal and dermal layers) was found in 21 (25.3%) cases. Wrinkling i.e. increased waviness of epidermal and dermal layers of skin was found in 30 (36.14%) cases. Decreased skin thickness with increased basophilia i.e compression was observed in 28 (33.73%) cases. In 4 (4.81%) all the three features i.e breaking, wrinkling and compression was found.

**DISCUSSION**

Complete examination of ligature mark is required in terms of inspection, palpation, internal examination of tissues below the ligature mark as well as histopathological examination. Ligature material examination is also necessary in terms of nature and texture of ligature materials. Type of hanging i.e complete or partial also plays important role in correlation of findings. Incomplete examination may give wrong evidence which may lead to confusion in many cases.

It has also observed that most of the cases were males (62.6%), While 36.3% were females. Similar observation was made by different authors.

In this study person falls in third decade have maximum number of cases 44.5%. These findings were also observed by many workers and authors. In both sex cases were more in third decade.

In the present study it has been also observed that hanging is more common in married person. 37.75% belongs to male and 22.89% belongs to female were married persons. Similar observations were also made by Saisudheer and Nagraja. In the observation of present study majority of cases were married males but married females outnumbers males in the study done by Saisudheer and Nagraja. This is possibly due to stress of increasing responsibilities of males after marriage. In this study 45% cases are from middle socioeconomic group and 43% were from lower socioeconomic group. Familial issues as well as financial scarcities and high ambitions probably play impotent role leading to psychological disturbance and untimely increased suicidal tendencies in these group of society. These findings consistent with findings of Saisudheer and Nagraja.

In this study 91.56% cases were found to be of complete hanging. This may be due to fix motive to commit suicide and believe that complete hanging will definitely lead to death to a person. This is also consistent with findings of Saisudheer and Nagraja. In this study different ligature materials used for hangings were also studied in details and compared with other workers in Indian subcontinent [Table 5].

In all the study dupatta was the commonest ligature material followed by nylon rope and saree. It is an established facts that examination of ligature material can give various important facts like pattern over skin etc. Characters of ligature mark also depends on the type of material used. It is also evident that in most of the cases material used is household [Table 5]. It gives impression that committing suicide by hanging is mostly unplanned.

Single ligature mark was most common, seen 96.38% cases. The same was observed by Sadikhusen et al. No particular type of knot was found in most of the cases (71.08%). This is contrary to findings of Sadikhusen et al who observed 58% cases are having fixed knot. This findings may be due to the fact that
at the time of committing suicide by hanging persons are in extreme psychology stress due to which was not able to form a particular knot at that time. In this study in 91.56% cases are having ligature mark above the thyroid cartilage which is close to the findings observed by Saisudheer and Nagraja (88%), Sharma et al (85%), and others\textsuperscript{4,8,9}. In hanging ligature mark is commonly situated in the upper part of neck above the laryngeal prominence. The ligature mark of hanging is situated above the level of thyroid cartilage in between larynx and chin in 80% cases, at the level of thyroid cartilage in 15% and below the level of thyroid cartilage in about 5% cases\textsuperscript{10\&11}. All the above findings are the similar with the observation in present study.

Surest sign of ante-mortem hanging is dribbling of saliva. It was justified by study done by Palliwal PK et al\textsuperscript{12}. This was found in 32.5% cases in this study. Blood tinged fluid coming out from mouth and nostrils in 2.40% cases only. These are consistent with findings of Sarangi M.P. et al\textsuperscript{13}. Bleeding from natural orifices does not play any key role in investigation in hanging cases, though it is one of the sign of asphyxia.

Fracture of hyoid bone was found in single case (1.20%). It was compared with the observations of the several studies it is almost close to study done by Sarangi et al, Saisudheer and Nagraja, Meera at al, Sheikh at al. In the study of Tripude BH et al the fracture of hyoid bone is found very high\textsuperscript{14} [Table 6]

External injuries other then ligature mark was found in 3.61% cases. Similar findings were also noted by Saisudheer and Nagraja.

On internal examination of neck shows congestion of neck structures and hemorrhagic spots in the soft tissue of neck in 27.71% cases. It is consistent with the findings of Saisudheer and Nagraja\textsuperscript{6}.

On microscopic examination various skin changes, breaking (25.30%), wrinkling (36.14%) and compression (33.73%) was found. Similar findings were noted by Anil Yadav and Gupta\textsuperscript{15}, where breaking (35.16%), wrinkling (46.15%) and compression (43.95%) was observed. Congested blood vessels (42.16%), haemorrhage (21.68%) and infiltration of cells (9.63%) was noted in present study; which was near close i.e. 52.7%, 20.8% and 32.9% respectively in the study of Anil Yadav and Gupta\textsuperscript{15}. Presence of vital tissue reactions is indicative of ante-mortem hanging.

**CONCLUSION**

1. Ligature mark must be evaluated along with other external as well as internal and histopathological features.

2. If all the procedure are to be followed in routine practice the final opinion in doubtful in cases of asphyxia death due to hanging will become easy.

3. Ante-mortem ligature mark must be differentiated with post-mortem ligature mark with all the present findings very cautiously to established cause and mode of death.

**Ethical clearance:** Taken from departmental research committee  

**Source of funding:** Self.  

**Conflict of Interest:** None

**REFERENCES**


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Proper and Correct Interpretation of Artefacts during Autopsy

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¹Associate Prof., ²Asst. Prof., ³Prof. & HOD, FMT Department, IGIMS, Patna; ⁴Asst. Prof., FMT Department, AIIMS, Patna

ABSTRACT

Post-mortem artefacts (misleading signs) are one of the commonly encountered problems in routine autopsy. They lead to wrong interpretation of findings in large number of medico-legal cases especially at the hands of an inexperienced autopsy surgeon. Responsibility of correct interpretation of artefacts lies on medical jurist. Any type of artefacts must be interpreted correctly as it may adversely affect post-mortem findings. Any change produced or feature introduced in a body after death which is accidentally or physiologically unrelated to the natural state of the body is termed as artefacts. This may adversely affect the course of justice in the court of law. The underlying biological processes that a human body or its remains undergoes after death are complex and, as with other biological phenomena, there is a broad range of variables influencing post-mortem changes by the alteration of the underlying progress of tissue destruction. The understanding of the artefacts is of great importance for the forensic pathologist and medical examiner as such artefacts may be introduced before death (therapeutic artefacts), at the time of death (agonal artefacts) or after death (post-mortem artefacts) So it is recommended that all the physician concerned with medico-legal works, especially autopsies, should have detailed knowledge with these artefacts. Purpose of present review paper is to discuss and update the knowledge about different types of artefacts commonly encountered during the post-mortem examination. This paper also attempts to highlight the more important and common ones as far as known.

Keywords: Post-mortem, Artefacts, Medico-legal, Jurist, Pathologist.

INTRODUCTION

Post-mortem artefacts (misleading signs) are commonly encountered problems in day to day autopsy. They may lead to wrong interpretation in number of cases especially at the hands of an inexperienced autopsy surgeon. The responsibility of medical jurist is very great as it can mislead the course of justice. Often the doctor is the chief source of evidence upon which legal decisions are made. Therefore, the doctor should learn to draw conclusions logically and correctly, instead of forming hasty judgment otherwise he will have a tough time in the court during cross-examination as lawyer aware of these pitfalls, may attempt to discredit his evidence.

For medico-legal purposes, an artefact may be defined as change in natural state of body that is likely to be misinterpreted at autopsy. Post-mortem Artefacts are due to any change caused or features introduced in a body after death. The artefacts are physiologically unrelated to the natural state of the body or tissues or the disease process, to which the body was subjected to before death. It is a spurious post-mortem presentation which simulated a finding which would be significant in the course of ante-mortem events.

They are important as they are likely to lead misinterpretation of medico-legally significant findings by inexperienced pathologist. There are several inherent pitfalls that must be avoided in the course of medico-legal autopsies which can lead to erroneous or fallacious conclusions. Every forensic pathologist must familiarize himself with these post-mortem artefacts that are liable to misinterpretation.

Ignorance and misinterpretation of post-mortem artefacts may lead to
I. Wrong cause of death
II. Wrong manner of death.
III. Undue suspicion of criminal offences.
IV. Halt in investigation of criminal deaths.
V. Unnecessary spending of time and efforts as a result of misleading findings.
VI. Miscarriage of Justice.
VII. Autopsy surgeon himself will face tough and critical cross-examination in the court of trial 2&4.

A responsibility of correct interpretation of artefacts lies totally on medical person conducting post-mortem examination. It must be differentiated from genuine post mortem findings which helps forensic pathologist in coming a definite conclusion regarding time, cause or manner of death or other questions related to medico-legal investigations.

The understanding of artefacts is of great importance for forensic pathologist and medical examiner; as such an artefact may be introduced before death (Therapeutic artefacts) or at the time of death (agonal) or after death (PM artefacts).

CLASSIFICATION

Artefacts can be broadly divided into two groups i.e., those introduced in the period between Death and Autopsy and those introduced during autopsy.

Groups of artefacts:

<table>
<thead>
<tr>
<th>Artefacts introduced during period between death and autopsy</th>
<th>Artefacts introduced during autopsy</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Agonal artifacts</td>
<td>Postmortem fractures</td>
</tr>
<tr>
<td>2. Resuscitation</td>
<td>Artifacts introduced during opening of the skull cap.</td>
</tr>
<tr>
<td>3. Embalming artefacts</td>
<td>Artefacts introduced during examination of the meanings and brain.</td>
</tr>
<tr>
<td>4. Exhumation</td>
<td>Artefacts introduced during dissection.</td>
</tr>
<tr>
<td>5. Artefacts due to handling of body</td>
<td>Artefacts of preservation.</td>
</tr>
<tr>
<td>6. Artefacts related to rigor mortis</td>
<td></td>
</tr>
<tr>
<td>7. Artefacts related to postmortem lividity.</td>
<td></td>
</tr>
<tr>
<td>8. Artefacts of decomposition</td>
<td></td>
</tr>
<tr>
<td>9. Third party artefacts</td>
<td></td>
</tr>
<tr>
<td>(a) Animal activity-Arthropophagy</td>
<td></td>
</tr>
<tr>
<td>(b) Insect activity-Arthropophagy</td>
<td></td>
</tr>
<tr>
<td>10. Toxicological artifacts</td>
<td></td>
</tr>
<tr>
<td>11. Artifacts of environment</td>
<td></td>
</tr>
<tr>
<td>(a) Postmortem burning</td>
<td></td>
</tr>
<tr>
<td>(b) Postmortem corrosion</td>
<td></td>
</tr>
<tr>
<td>(c) Postmortem maceration</td>
<td></td>
</tr>
<tr>
<td>12. Miscellaneous artefacts</td>
<td></td>
</tr>
</tbody>
</table>

Artefacts may be:

A. Caused before death during resuscitation (Resuscitation artefacts):

I. Injection mark in cardiac region may produce hemopericardium.

II. Use of Defibrillator will leave a ring-like mark of contusion over precordial region.
III. During the external cardiac massage fracture ribs, laceration of lungs, liver & spleen may occur.

IV. Due to gripping by hands of face and neck in mouth to mouth respiration – Bruising of face and neck, finger mark, nail mark, damage to lip and inner gum can occur.

V. Introduction of artificial air ways, ETT or laryngoscope may produce damage to mouth, gum, lips, and teeth.

VI. Surgical suturing, excision, exploration, repair etc may alter the size, shape & direction of wounds which misleads interpretation during autopsy in later period.

B. Caused during the period between death and autopsy.

I. Agonal Artefacts (produced just after death): Agonal period is the time between cardio respiratory arrest and brain dysfunction or death.

One of the common examples are Regurgitation of gastric contents in respiratory tracts may confused with ante mortem aspiration( if food particles are found beyond secondary bronchioles it indicates ante mortem in origin).

II. Embalming Artefacts: Trocar wound may simulate stab wound13, it may also obliterate track of wound in case of firearm injury8. Embalming fluid when pushed under pressure in arterial system may result in effusion of blood in and around injured tissue which is commonly mistaken as bruise.

III. Exhumation Artefacts: Exhumed body may show extensive fungal growth in and around the injured areas, eyes, ears, nostrils and other natural orifices8.

IV. Toxicological Artefacts: Toxicological artefacts may result due to introduction of contaminants in the viscera or body fluid preserved during autopsy due to faulty technique of collection, preservation, or from the preservative used giving erroneous results.

V. Decomposition artefacts: Decomposition may bring a lot of significant changes in the dead body which may be mistaken on naked eye examination as:

Postmortem blisters may be mistaken as antemortem blisters of burn and scald13.
Discharge of blood stained fluid from mouth and nostrils may be mistaken as pulmonary edema, massive pulmonary hemorrhage or head injury.
Gastromalacia may simulate antemortem corrosive acid poisoning or blunt force trauma.
Holes produced by maggots may be mistaken as gunshot or stab wound.

VI. X-Ray Artefacts: False missile shadow may be obtained if bullet is left inside clothing.

VII. Artefacts due transportation of dead body: Abrasions and lacerations are very common. Fracture are also not uncommon.
Breakage of rigor mortis also may occur leading to misinterpretation of Time Since Death.

VIII. Artefacts due to Rigor Mortis: Rigor affected heart may simulate concentric hypertrophy. Semen may be found at tip of penis.

IX. Artefacts due to postmortem staining: Localised area of hypostasis may resemble bruise. Hypostasis in the heart may be mistaken as myocardial infarction.
Prinsloo and Gordon artifact- generally thought to postmortem lividity is actually due to leakage of blood outside the vessels13.

X. Artefacts due to Chemical: In air craft or automobile accidents, postmortem detachment of epidermis occur due to gasoline. On drying dermis may appears resembling abrasion or thermal burn.

XI. Artefacts due to animal or insect bites: Postmortem gnawing of soft tissues by rats, rodents are very common. In cases of drowning soft tissues from lips, cheeks, eyelids, etc. may be eaten away by fishes or other aquatic lives. Marks produced by ants, cockroaches over moist parts of dead body may resemble ante mortem abrasions or brush burns.

XII. Artefact due to gunshot injury: Drainage wound over chest or abdomen may simulate gunshot wound.

XIII. Artefacts by accused: Dismemberment, mutilation of body parts may cause problem in identification.
Sometime postmortem injury may be inflicted by accused.

C. Caused during holding of autopsy.

I. Fracture of bones: New fracture line or enlargement of already existing fracture can occur while opening skull with chisel and hammer which is still common practices in mortuary. Presence of blood streak within the fracture can help to differentiate artifactual fracture\(^\text{13}\).

II. Fracture of hyoid bone and thyroid cartilage: This is commonly observed in rough handling during removal of neck structure.

III. Introduction of air in blood vessel: Air may enter into blood vessels during stripping off dura in sagittal line. This is also very common in neck layer dissection during which veins accidentally get punctured. A false perception of air embolism may be produced in both instances.

IV. Artefacts associated with burn: Heat rupture may resembles lacerated or incised wound. Heat hematoma resembles extradural hemorrhage.

V. Extravasations of blood: This type of Dissection artifact is very difficult to differentiate from ante-mortem bruise by naked eye. There may be spurious subdural hemorrhage. To avoid such artifact, brain and heart are to be removed prior to neck dissection and plain forceps should be used.

**CONCLUSION**

Medico legal Autopsy is not a simple procedure. It is best learned by a judicious combination of theoretical and practical knowledge.

The doctor conducting the autopsy appears in the court of law as expert witness so he carries great responsibility over his shoulders. It is obvious that if he is unable to extract proper interpretation of the findings, the pangs of justice will be disturbed. It is necessary therefore that all unusual findings which are not readily identified with certainty after complete examination must be photographed both in colour and black and white and if needed, some experienced, better qualified experts may be approached then and there for assistance in correct interpretation of such types of findings.

One of the criteria for good forensic expert is who has trained himself to make precise and correct interpretation of the findings not only that has got a vast experience only in conducting large numbers of autopsies. The doctor should learn to draw conclusions logically and rationally, instead of forming hasty judgment. One must not allow dogmatism or inflexibility to cloud one’s judgment. A self-opinionated expert is a poor expert.

The Medical officer must be aware of possibility of artefacts whenever he conducts Post mortem examination. Once he keeps in mind these possibilities and proceeds with examination chances of error are minimized and even eliminated.

**RECOMMENDATIONS**

I. Careful documentation of all resuscitative measures including treatment details should be made available to autopsy surgeon by investigating officer before conduction of Autopsy.

II. Details of case history should be inquired before Autopsy.

III. Increase practical feasibility of Doctor’s visit to scene of crime.

IV. Autopsy surgeon must keep updated himself with use of newer medical equipments.

V. Careful and proper transport facility should require for dead body.

VI. For autopsy proper instruments should be used.

VII. Proper preservation of dead body before autopsy is required.

VIII. Proper sampling of viscera and body fluid without any contaminations are to be done.

IX. Better and more frequent interaction is needed between law enforcement agencies and medical professionals.

X. Regular medico legal training programs are need of hour

**Ethical clearance:** Not Any (Review Paper)

**Source of funding:** Self

**Conflict of Interest:** Nil
REFERENCES


**Abstraction**

**Introduction:** Forensic Anthropology is the application of anthropological knowledge in criminal investigation. Reconstruction of stature is one of the important aspects of various parameters of identification. Such a study can assist in the identification of deceased individuals whose remains are unrecognizable. The identification of individual from skeletal remains and badly decomposed or otherwise unidentified human remains is important in both legal and humanitarian contexts and also to give closure.

**Aim:**
- To estimate the stature by using upper arm length
- To find out variability in males and females by using upper arm length for estimation of stature
- Comparison of stature and upper arm length between boys and girls in urban and rural areas

**Material and methods:** A cross sectional study was conducted among 360 students of School located in urban area and rural area of Mangalore between the age group of 10-19 years with the approval of the institutional ethical committee during the period of May 2014 to July 2014. Children with Congenital defects on the hand, any spinal disorder, previous history of fracture in hands, bony involvement due to Rickets, Osteomalacia, Rheumatoid arthritis etc were excluded. Data was collected by measuring stature using Stadiometer, upper arm length using sliding calliper and. and analysed with SPSS v.16.0.

**Result:** Stature and upper arm length significantly and positively correlate with each other (p<0.001) in both males and females. Linear regression equations were derived for estimation of stature reliably and accurately that would be of immense value in identification. The regression equation derived in this study can be used accurately for estimation of stature in diverse population group.

**Conclusions:** In this study we found a significance correlation between stature and upper arm length. This has applicability and will be a very useful tool in the field of Forensic Anthropology.

**Keywords:** Forensic anthropology, Stature, Upper arm length

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**Introduction**

Forensic Anthropology is the application of anthropological knowledge in criminal investigation and to the legal process. Every human being has their basic rights to keep their identity during life as well as after death. Over the past century physical anthropologists (those who study human remains) have developed methods to evaluate bones to figure out things about people who lived in the past. These techniques help them to answer questions about the remains they are
studying. Forensic anthropological techniques can be used in the recovery and analysis of human remains. A forensic analysis assesses the age, sex, stature. With the help of this study, we can assist in the identification of deceased individuals whose remains are decomposed, burned, mutilated or otherwise unrecognizable. When natural disasters, plane crashes and explosions occur, there will often be a large number of unknown victims requiring identification, the determination of stature, age and sex from skeletal remains and badly decomposed or otherwise unidentified human remains is important in both legal and humanitarian contexts. There are various studies which have shown arguable evidences regarding stature variation among residents of urban and rural area. Living in the different environment with distinct eating habits can even lead to difference in growth pattern and stature.

METHODS AND MATERIALS

A cross sectional study was conducted in urban area and rural area of Mangalore with the approval of institutional ethical committee during the period of May 2014 to July 2014 among 360 school students using correlation coefficient (r) as 0.66 at 5% level of significance with power 90%, the sample size was 360. All the healthy boys and girls from the age group of 10-19 years were included, Simple random sampling was adopted to select the students from urban and rural area individuals having Congenital defects on the hand, any spinal disorder, previous history of fracture in hands, bony involvement due to rickets, osteomalacia, rheumatoid arthritis etc were excluded from the study. Data was collected by measuring stature using stadiometer where participants were made to stand in erect posture on the board of stadiometer without any footwear with their feet on close contact and arms hanging by the side, the trunk braced along the vertical board and eyes looking straight ahead and face adjusted in Frankfurt plane. The measurement was taken as maximum distance from floor to vertex of the head by bringing the horizontal sliding bar to vertex. Upper arm length was measured using sliding calliper where subjects were made to stand upright with the weight evenly distributed on both feet, the right arm bent 90º at the elbow, the end of the spine extending from the acromion process was marked, zero end of the measuring tape was held at this mark and extended down the posterior surface of the arm to the tip of the olecranon process. The measurements were taken on the right arm only and all the units were recorded in centimetre unit. Diurnal variation was avoided by taking all the measurement at same time period, to reduce subjective error readings were taken thrice and data was analysed using the SPSS version 16 software. Descriptive statistics were reported as mean (SD) for continuous variables and frequency (percentage) for categorical variables. Pearson’s Chi-square test was used to find association between two continuous variables. Regression analysis was used to estimate stature by measuring upper arm length. A p value < 0.05 was considered as statistically significant.

RESULT

Out of total 360 children, the study population was divided into two strata- rural (184) and urban (184) and further into two sub-strata – boys (92) and girls (92)

Table 1: Mean ± SD of Stature and upper arm length (UAL) in male and female (in centimeters)

<table>
<thead>
<tr>
<th>GENDER</th>
<th>STATURE</th>
<th>UAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>MALE</td>
<td>159.11</td>
<td>14.57</td>
</tr>
<tr>
<td>FEMALE</td>
<td>155.01</td>
<td>9.26</td>
</tr>
</tbody>
</table>

Table 1 indicates that the variation in mean value of stature and upper arm length in males was 159.11±14.57 and 31.22±3.86 respectively while in females mean value of stature was found to be 155.01±9.26 and upper arm length was 31.07±2.60.

Table 2: Mean ± SD of Stature and upper arm length (UAL) in rural and urban area (in centimetres)

<table>
<thead>
<tr>
<th>AREA</th>
<th>STATURE</th>
<th>UAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>URBAN</td>
<td>157.87</td>
<td>10.63</td>
</tr>
<tr>
<td>RURAL</td>
<td>156.25</td>
<td>14.86</td>
</tr>
</tbody>
</table>

Table 2 shows that in urban area mean value of stature was found to be 157.87±10.63 and mean value of upper arm length was 31.07±2.381 while in rural area
findings for mean value of stature was 156.25±14.86 and for upper arm length was 31.22±4.00.

### Table 3: Correlation between stature and upper arm length

<table>
<thead>
<tr>
<th>UPPER ARM LENGTH</th>
<th>STATURE</th>
<th>r value</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>MALE</td>
<td>0.883</td>
<td>&lt;0.001</td>
<td></td>
</tr>
<tr>
<td>FEMALE</td>
<td>0.885</td>
<td>&lt;0.001</td>
<td></td>
</tr>
</tbody>
</table>

Table 3 indicates that there was a strong correlation between upper arm length and stature in both males and females with r value of 0.883 and 0.885 respectively which was found to be statistically significant (<0.001).

The linear Regression formulae from upper arm length among males was found to be

\[ S = 55.085 + 3.332x \text{UAL} \]

The linear Regression formulae from upper arm length among females was found to be

\[ S = 57.183 + 3.148x \text{UAL} \]

**DISCUSSION**

Estimation of stature is a vital requirement in post mortem examination of dead bodies especially when they are un-identified and badly decomposed, mutilated or skeletonised to overcome this problem, new methods are being developed for estimation of stature using regression formulae.

In the present study it was found that the variation in dimensions of stature in males was 159.11±14.57 while in females mean value of stature was found to be 155.01±9.26 but the findings in the study conducted by Kaur M et al shows that the mean value of stature in North Indian males was 175.98±6.76 and in North Indian females the mean value of stature was 160.91±5.75, similar results was also seen in the study conducted by Krishan K et al among male participants in Chandigarh which showed that Gujjar males have an average stature of 172.54 cm. Study conducted by A Oladunni E in Southern Nigeria showed that male had an average height of 172.47cm and an adult female has an average height of 161.72cm which was different from the findings of present study.

In this study, mean upper arm length in males was 31.22±3.86 and in females it was 31.07±2.60 almost similar findings were observed in the study conducted by Akhlaghi M where mean arm length was 36.2±2.1 cm in males and 33.5±2.2 cm in females but in the study done by Amit K et al mean upper arm length in males and females was 46.799±2.24 cm and 41.9825±1.77 cm respectively. The mean stature in urban area was found to be 157.87±10.63 and mean upper arm length was 31.07±2.381 while in rural area mean stature was 156.25±14.86 and mean upper arm length was 31.22±4.00 which shows that there was no statistical significant association between stature and upper arm length with urban or rural area (p>0.001, p=0.215 while in the study conducted by Bielicki and Eiben et al reported that in Europe, children who were living in urban areas had greater size than children in rural area.

There was a strong correlation between upper arm length and stature in both males and females with r value of 0.883 and 0.885 respectively which was found to be statistically significant (<0.001) whereas in study conducted by Krishan K et al among male participants in Chandigarh ‘r’ value was 0.740 , study conducted by Kaur M et al ‘r’ value for males and females was found to be 0.660 and 0.474 respectively, study by Ahmed AA9 showed ‘r’ value for males as 0.698, and for females as 0.643 and Shende MR17 found that the correlation coefficient obtained in the present study was 0.416 for males and 0.367 for females.

The linear regression equations derived from upper arm length for estimation of stature showed a statistically significant relationship (p<0.001) in both males and females as found to be 55.085 + 3.332x UAL in males and 57.183 + 3.148x UAL in females . The regression formula derived from this study shows that in males, 1 unit increase of upper arm length results 3.332 unit increase of stature and in females, 1 unit increase of upper arm length causes 3.148 unit increase of stature. Ahmed AA11 found regression formula for estimation of stature from upper arm length for males as 95.80 + 2.51x UAL and for females it was 89.49 + 2.45x UAL.

**CONCLUSION**

Stature and upper arm length significantly and positively correlate with each other (p<0.001) in both males and females. Linear regression equations were derived for estimation of stature reliably and accurately.
that would be of immense value in identification. The regression equation derived in this study can be used accurately for estimation of stature in diverse population group.

**Source of funding:** Self

**Conflict of Interest:** Nil

**REFERENCE**

1. ABFA- American board of forensic anthropology. Available at: http://www.theabfa.org/ . accessed on 08-08-2015


Autopsy Study of Violent Asphyxial Deaths with Critical Analysis of Deaths due to Ligature Strangulation: A Two-Year Retrospective Study From Pune Region

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ABSTRACT

Mechanical asphyxia means flow of air into the body is interfered through some physical impediments. Violent deaths resulting chiefly from asphyxia includes death due to hanging, strangulation, suffocation and drowning. The purpose of this study was to analyze recent trends related to violent asphyxial deaths with critical analysis of deaths due to ligature strangulation in the Pune region of Maharashtra and to compare them with other studies. In the present study, 11984 medicolegal autopsies conducted between January 2014 to December 2015 at B.J. Government Medical College and Sassoon General Hospital, Pune, Maharashtra, India were analyzed retrospectively; in that in total 863 (7.2%) were asphyxial deaths with males (69.06%) were more commonly affected than females. Highest number of deceased belonged to age group of 21 to 30 years. Hanging was most common type of asphyxial death, followed by Drowning and Ligature strangulation. As deaths due to ligature strangulation were further analyzed, majority were homicidal deaths (92%) with males affected more than females and revenge was most common motive followed by sudden grave provocation and monetary issues. In postmortem findings in deaths due to ligature strangulation; Hematoma within neck muscles and posterior pharyngeal wall was uniform finding while congestion of face, Subconjunctival hemorrhages and hemorrhages in subcutaneous plane were present in majority of cases.

Keywords: Ligature strangulation, Violent Asphyxial Deaths, Hanging, Pune region.

INTRODUCTION

Mechanical asphyxia means flow of air into the body is interfered through some physical impediments1. Violent deaths resulting chiefly from asphyxia includes death due to hanging, strangulation, suffocation and drowning2.

Hanging is form of asphyxia caused by suspension of body by a ligature which encircles neck, the constricting force being weight of the body; while Strangulation is constriction of neck without suspending body and Drowning is form of asphyxia due to aspiration of fluid into air passages. Violent asphyxial deaths have contributed considerably to unnatural homicidal, suicidal and accidental deaths.3

It is essential to diagnose and differentiate between different asphyxial deaths, especially between hanging and strangulation by ligature. In addition to the cause of death, the careful examination can also help the investigator to arrive at a conclusion about manner of death.4

Gonzale’s scientific research paper, relying on European references from the 19th century about examination of strangulation victims is considered as best till date5. Pattern of neck injuries distinguishes strangulation from other types of blunt injuries including hanging, traumatic blow to the neck, and artifacts of decomposition6,7. The purpose of this study was to analyze recent trends related to violent asphyxial deaths with critical analysis of deaths due to ligature strangulation in the Pune region of Maharashtra and to compare them with other studies.
MATERIAL AND METHOD

In the present study, the medicolegal autopsies conducted between January 2014 to December 2015 at B.J. Government Medical College and Sassoon General Hospital, Pune, Maharashtra were analyzed retrospectively. Necessary information for the study was gathered from Police inquest report, hospital treatment records and discussion with the relatives, friends, and neighbors of the victims. The cases were studied to know the incidence of asphyxial deaths with respect to age group, sex, type of asphyxial deaths and deaths due to ligature strangulation were further studied in detail with respect to age group, sex, motives and postmortem findings.

OBSERVATIONS AND DISCUSSION

During the study period total 11984 medicolegal autopsies were conducted at B.J. Government Medical College and Sassoon General Hospital, Pune, in that in total 863 were asphyxial deaths i.e. 7.2%; these findings are more or less consistent with studies conducted by Patel A et al4 (5.63%), Amandeep Singh et al8 (5.26%), Bhagora L et al9 (10.7%), but does not with Srinivasa Reddy P et al10 (19.14 %) and Azmak D11 (15.7%), this might be due to higher sample size in present study (Chart 1).

In the present study, highest number of deceased belonged to age group of 21 to 30 years, followed by 11 to 20 years and 31 to 40 years (Table 1). These findings are consistent with studies conducted by Patel A et al4, Amandeep Singh et al8, Bhagora L et al9, Srinivasa Reddy P et al10, Azmak D11, Kulshrestha P et al12 and Zanjad N et al13 as this young adult age group is most active group of population and more exposed to external environment and stress and strain of life.

Table 1: Age and Sex wise distribution of asphyxial deaths

<table>
<thead>
<tr>
<th>Age group of deceased</th>
<th>Asphyxial deaths</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 10 years</td>
<td>41</td>
<td>26</td>
<td>15</td>
</tr>
<tr>
<td>11 to 20 years</td>
<td>204</td>
<td>115</td>
<td>89</td>
</tr>
<tr>
<td>21 to 30 years</td>
<td>308</td>
<td>215</td>
<td>93</td>
</tr>
<tr>
<td>31 to 40 years</td>
<td>164</td>
<td>136</td>
<td>28</td>
</tr>
<tr>
<td>41 to 50 years</td>
<td>82</td>
<td>59</td>
<td>23</td>
</tr>
<tr>
<td>51 to 60 years</td>
<td>55</td>
<td>37</td>
<td>16</td>
</tr>
<tr>
<td>More than 60 years</td>
<td>11</td>
<td>8</td>
<td>3</td>
</tr>
<tr>
<td>Total deaths</td>
<td>863</td>
<td>596 (69%)</td>
<td>267 (31%)</td>
</tr>
</tbody>
</table>

Table 2: Types of Asphyxial deaths in medicolegal autopsies.

<table>
<thead>
<tr>
<th>Types of Asphyxial deaths</th>
<th>Total deaths</th>
<th>Percentage (n = 863)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hanging</td>
<td>552</td>
<td>63.96 %</td>
</tr>
<tr>
<td>Drowning</td>
<td>251</td>
<td>29.08 %</td>
</tr>
<tr>
<td>Ligature Strangulation</td>
<td>36</td>
<td>4.17 %</td>
</tr>
<tr>
<td>Smothering</td>
<td>09</td>
<td>1.04 %</td>
</tr>
<tr>
<td>Throttling</td>
<td>08</td>
<td>0.92 %</td>
</tr>
<tr>
<td>Choking</td>
<td>06</td>
<td>0.70 %</td>
</tr>
<tr>
<td>Traumatic asphyxia</td>
<td>01</td>
<td>0.12 %</td>
</tr>
<tr>
<td>Total asphyxial deaths</td>
<td>863</td>
<td>100 %</td>
</tr>
</tbody>
</table>
In the present study, Hanging was most common type of asphyxial death with 63.96% of cases, followed by Drowning with 29.08% of cases and Ligature Strangulation accounted for 4.17 % of asphyxial deaths (Table 2). Drowning was found to be commonest asphyxial death by study conducted by Amandeep Singh et al 8 and Zanjad N et al13; while studies conducted by Patel A et al4, Bhagora L et al9, Srinivasa Reddy P et al10, Azmak D11 and Kulshrestha P et al12 showed findings consistent with present study. The difference with studies conducted by Amandeep Singh et al 8 and Zanjad N et al13 might be due to geographical variation as mentioned in these studies that their study regions had nearby water sources like rivers n canals.

**Special analysis of deaths due to ligature strangulation:**

<table>
<thead>
<tr>
<th>Manner of Asphyxial deaths due to ligature strangulation</th>
<th>Asphyxial deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Homicidal</td>
<td>33 (92%)</td>
</tr>
<tr>
<td>Accidental</td>
<td>3 (8%)</td>
</tr>
<tr>
<td>Total</td>
<td>36</td>
</tr>
</tbody>
</table>

In present study majority cases 92% were homicidal deaths while remaining 8% were accidental in nature. These findings are consistent with literature mentioned by many authors 1,2,3 And Rayamane AP et al 14, Khalil ZH et al 15.

In the present study, males (77%) were more commonly affected than females (23%) (Table 4); similar male preponderance in deaths due to ligature strangulation was observed by Rayamane AP et al 14, Khalil ZH et al 15, while studies conducted by Patel A et al 4 and Amandeep Singh et al 8 showed female preponderance, this difference might be due to larger sample size in present study.

In the present study, Revenge was most common motive followed by sudden grave provocation and monetary issues while jealousy and relationship breakdown was present in significant number as events leading to deaths due to ligature strangulation (Chart 2). These findings are consistent with literature mentioned by Helinä Häkkänen 16 and Dr. Basappa S. Hugar et al 17.

In the present study, postmortem findings in deaths due to ligature strangulation; Hematoma within neck muscles and posterior pharyngeal wall was uniform finding while congestion of face, Subconjunctival hemorrhages and hemorrhages in subcutaneous plane were present in significant number of cases (Chart 3). These findings are consistent with studies conducted by Rayamane AP et al 14 Khalil ZH et al 15 and Helinä Häkkänen 16.
SUMMARY AND CONCLUSION

The present study can be summarized and concluded as, asphyxial deaths are presented in significant number in day to day medicolegal autopsies. Among asphyxial deaths, Hanging is most common type of asphyxial death followed by Drowning while deaths due to ligature strangulation present in significant number. Highest number of asphyxial deaths belonged to age group of 11 to 40 years with male preponderance. Among deaths due to ligature strangulation; majority were homicidal deaths with males affected more than females. Highest number of deceased belonged to age group of 21 to 30 years i.e. most active young adult age group of population. Revenge was most common motive followed by sudden grave provocation and monetary issues in deaths due to ligature strangulation. In postmortem findings in deaths due to ligature strangulation; Hematoma within neck muscles and posterior pharyngeal wall was uniform finding while congestion of face, Subconjunctival hemorrhages and hemorrhages in subcutaneous plane were present in majority of cases. This analysis will provide a better understanding of epidemiology and burden of violent asphyxial deaths and that due to the ligature strangulation in particular in the society and will help to formulate comprehensive programmes and strategies to prevent same.

Source of funding: none

Ethical clearance: none.

Conflict of interest: nil

REFERENCES

ABSTRACT

In ancient times, people considered fire one of the basic elements of the universe, along with water, air, and earth. Fire can be a friendly, comforting thing, a source of heat and light, as anyone who has ever sat by a campfire in the dark of the night knows. Yet fire can also be dangerous and deadly, racing and leaping like a living thing to consume all in its path. Death due to burns was one of the commonest unnatural deaths found in society. A retrospective study of cases from January 2011 to December 2012 of death due to burns was conducted in the Department of Forensic Medicine and Toxicology, Government Medical College, Amritsar. The objective of the study was to understand various demographic aspects of deaths due to burns so as to suggest some remedial measures.

Keywords: Burns, Demography, Kitchen Accidents, Septicemia, Body surface area

INTRODUCTION

Among all discoveries made by men, only a few, such as cultivation of soil, speech and writing, have borne such eventful developments as are finding out how to make fire. Manufacturing, transportation, practically all phases of modern industrial life, sprang from the discovery of fire and its tremendous force. Whereas it took a man a long, long time to understand, appreciate, and reproduce these occurrences, it took him no time at all to realize that fire can hurt and hurt badly. Burns are injuries produced by application of dry heat, such as radiant heat, flame or any other heated solid substance like metal or glass to the surface of the body. Burns is the 4th most common type of trauma in the world, subsequent traffic accidents, falls, and interpersonal violence. The present study attempts to study various factors related burn deaths in Amritsar region.

Injuries are an increasingly recognized public health problem, substantially affecting nearly every population and every geographical zone in the world. Burns have always been considered as one of the most destructive injuries, causing not only morbidity and mortality but also major economic and psychological impacts and long-term somatic sequel as well. Apart from high numbers of deaths, the pain, suffering and agony of burn survivors are immeasurable. Burn is often a catastrophic event in the life of an individual. Incidence of burns is high in India. According to WHO it is estimated that each year over 300,000 people die from fire related burns. The vast majority (over 95%) of fire related burns occur in low- and middle-income countries. The data published by the Government of India, Ministry of Home Affairs, indicates that death by fire contributes to 7–9% of all intentional deaths. The reasons for this are multi-fold, such as dowry problems, rigidly defined role of women in the family, interpersonal conflicts in a joint family, overcrowding and use of a small, open cooking stove.

MATERIAL AND METHOD

A retrospective study was done on burn deaths in Amritsar region, from January 2011 to December 2012, which were autopsied at Forensic Medicine & Toxicology department of Government Medical College, Amritsar, India. A medico-legal autopsy is mandatory in India for all unnatural deaths including those due...
to burns irrespective of the burns being accidental, suicidal or homicidal. An in-depth examination of the epidemiological features and medico-legal aspects of these burn deaths was performed in an effort to more clearly understand the dynamics surrounding these deaths. Retrospective data were collected from the autopsy reports of the, case sheets from the hospital and the inquest reports from police. The data collected was thoroughly cleaned and entered into MS-Excel spread sheets, analysed, tabulated and compared with other various studies to analyse the trends. The study is approved from the Ethical Committee of the department.

**OBSERVATIONS**

During the study period, the medico legal profile of 136 burn cases were taken. Out of total, 60 burn deaths were reported in year 2011 with maximum cases in June (10) and minimum in March and November (1) and 76 burn deaths were reported in year 2012 with maximum cases (11) in month of February and May and minimum in September and November (2). Most of the victims belongs to the Sikh community comprise 59.5% cases, followed by Hindu community comprise 36.7% cases, 4 cases were from Christian community and only one case belongs to Muslim community was reported. Police inquest was done under section 174CrPC in 95 cases, 13 cases U/S302 IPC, 4 cases U/S 304A IPC, 5 cases U/S 304B IPC, 13 cases U/S 306 IPC and 6 cases U/S 309IPC.

Kerosene stove was the cause of fire in 68 (50%) cases and kerosene oil was the cause in 16.9% cases, while gas was involved in 1 case and anghiti in 9 cases and chullha in 13 (19.5%). Fire due to electricity was responsible for 7 deaths while petrol was responsible for 1 case. 18 died due to burn injuries as a result of fire in open wheat fields and 8 died due to other sources of fire like fire in patakha factory, fire due to some unknown source etc. 59.5% victims were from rural background. The most of the victims(55) sustained burns on >90% of total body surface area comprising 40.4% cases, followed by 51-70% of total body surface area comprising 33% cases.3 cases got burns upto 30%, 16 cases sustained burns 31-50% and 29 cases sustained burns on 71-90% of total body surface area.

<table>
<thead>
<tr>
<th>Age group</th>
<th>No. of cases (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-10 yrs</td>
<td>4(2.9%)</td>
</tr>
<tr>
<td>11-20yrs</td>
<td>30(22%)</td>
</tr>
<tr>
<td>21-30yrs</td>
<td>47(34.5%)</td>
</tr>
<tr>
<td>31-40yrs</td>
<td>29(21.32%)</td>
</tr>
<tr>
<td>41-50yrs</td>
<td>16(11.76%)</td>
</tr>
<tr>
<td>51-60yrs</td>
<td>6(4.4%)</td>
</tr>
<tr>
<td>61-70yrs</td>
<td>2(1.47%)</td>
</tr>
<tr>
<td>71-80yrs</td>
<td>2(1.47%)</td>
</tr>
<tr>
<td>Total</td>
<td>136</td>
</tr>
</tbody>
</table>

As for the age of the victims, the most of the victims were between 21-30 years of age comprising 34.5%, followed by 11-20 years age group comprising 22% cases. Very few cases were reported in the age group <10 years (2.4%) and age group >60 years (1.47%).

<table>
<thead>
<tr>
<th>Year 2011</th>
<th>Year 2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td>19</td>
<td>41</td>
</tr>
<tr>
<td>60</td>
<td>76</td>
</tr>
</tbody>
</table>

In present study most of the victims were female comprising 89 cases, 41 cases in 2011 and 48 cases in 2012 and male victim comprising 47% cases, 19 deaths in 2011 and 28 deaths in 2012 out of 136 cases studied.

<table>
<thead>
<tr>
<th>Year 2011</th>
<th>Year 2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male(19)</td>
<td>Female (41)</td>
</tr>
<tr>
<td>Married</td>
<td>Unmarried</td>
</tr>
<tr>
<td>14</td>
<td>5</td>
</tr>
</tbody>
</table>

Most of the victims (48.5%) were married females.
Table 4: Survival period in case of burn injuries

<table>
<thead>
<tr>
<th>Survival period</th>
<th>No. of cases (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;24hrs</td>
<td>65(47.7%)</td>
</tr>
<tr>
<td>1-5days</td>
<td>39(28.6%)</td>
</tr>
<tr>
<td>6-10days</td>
<td>21(15.4%)</td>
</tr>
<tr>
<td>11-15days</td>
<td>4(2.9%)</td>
</tr>
<tr>
<td>16-20days</td>
<td>5(3.6%)</td>
</tr>
<tr>
<td>21-30days</td>
<td>1(0.7%)</td>
</tr>
<tr>
<td>&gt;1month</td>
<td>1(0.7%)</td>
</tr>
</tbody>
</table>

In present study, highest number of victims died within 24 hours comprising 26.7% cases and followed by 28.6% cases who survived upto 5 days.

Table 5: Cause of death

<table>
<thead>
<tr>
<th>Cause of death</th>
<th>No. of cases (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Burn shock</td>
<td>109(80%)</td>
</tr>
<tr>
<td>Septicemia</td>
<td>21(15.4%)</td>
</tr>
<tr>
<td>Head injury</td>
<td>6(4.4%)</td>
</tr>
<tr>
<td>Total</td>
<td>136</td>
</tr>
</tbody>
</table>

In our study, burn victims who were admitted and treated survived beyond 3-4 days and died due to septicemia comprise 15.4% cases and in 80% cases cause of death was shock and 4.4% died due to head injury.

Table 6: Distribution of cases according to manner of death

<table>
<thead>
<tr>
<th>Manner of death</th>
<th>No. of cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accident</td>
<td>90(66%)</td>
</tr>
<tr>
<td>Suicide</td>
<td>20(14.7%)</td>
</tr>
<tr>
<td>Homicide</td>
<td>26(19.1%)</td>
</tr>
<tr>
<td>Total</td>
<td>136</td>
</tr>
</tbody>
</table>

As per history given to the police and the treating doctors and the doctors conducting the postmortem examination, 90 cases of deaths due to burns were accidental in nature, 20 were suicidal and 26 were homicidal. Gender-wise, there was not much difference in the deaths alleged to be accidental, between the 2 genders (1: 1.5). However, in case of suicidal & homicidal burns, females far outnumbered males.

DISCUSSION

In the present study, total 136 cases of burn injury were studied, which were brought to morgue for post mortem examination. Most of the victims are between 21-30 years of age group, which is similar to the findings of the other study.\textsuperscript{13-16}The age group 21-30 years is the young adult group and majority of victims were married housewives females. Incidence is more in this group, as most female being housewives and indulged in cooking work, do not take safety measure due to lack of knowledge. Half of the deaths due to burns were accounted for by married females, while married males comprised only \(\frac{1}{4}\) th of the cases. On the whole, married victims accounted for 75% deaths, predominantly females.

In one of the previous studies by the author\textsuperscript{17}, females accounted for 68% of the cases, the most common age group for males was the 31 – 40 years and for the females, it was 21 – 25 years and nineteen percent of the victims sustained burn injuries to 41- 50% of Total Body Surface Area (TBSA).

Burns are the only unnatural cause of death in India in which females outnumber males by a large margin.\textsuperscript{18} In the present study, females accounted for 65.4% of the victims. Similar findings, suggesting ‘female dominance’ was observed in studies in Delhi\textsuperscript{19}, Maharashtra\textsuperscript{20}, Kanpur\textsuperscript{21}, Haryana\textsuperscript{22}, Manipal\textsuperscript{23}, West Bengal\textsuperscript{24}, Assam\textsuperscript{25} and even Pakistan\textsuperscript{26}, our erstwhile neighbor. This is in contrast to the figures from Imphal\textsuperscript{27}.

Kamran Soltani et al\textsuperscript{28} observed the highest incidence of burns in the age group of 16-25 years.

In our study, most of the victims were female and belong to Sikh community and middle socio-economic class, which is similar to the results of other studies.\textsuperscript{13-16}

Most of the injuries are accidental in nature, which is similar to the findings of other studies.\textsuperscript{13-16} It is always difficult to ascertain the nature of burn as accidental, suicidal or homicidal. Most of victims met with accidental burn injury as they do not follow safety measure and precautions prior to lightening the fire due to lack of knowledge and negligence.

In present study, most of victims had burn injury involves >90% of total body surface area, which is similar to the findings of other studies.\textsuperscript{13,14,16} So once it got fire it is difficult to remove the clothes resulting in higher percentage of burns over body. It is also found that limited and congested living place could not allow them to reach out to help result in more damage.

In our study, most of victims died due to burn shock, which is not consistent with other studies.\textsuperscript{15}
Septicaemia as a cause of death reflected that deaths in burn cases occurred due to secondary infections. Sepsis is the most important factor in death occurring in 4-5 days or longer after burning. Shock is also found as a cause of death in burn cases within 1-2 days. Most of the burns were epidermal to dermo-epidermal in nature, which were agonising resulting in neurogenic shock. Hypovolemic shock is also prevalent in first 24-72 hours due to increased capillary permeability with loss of fluid. The causes of death due to burns are primary shock, secondary shock, suffocation, toxaemia, sepsis, hypokalaemia, acute tubular necrosis, pulmonary embolism.

Dasgupta and Tripathi\(^2\) reported that out of 87 burnt married females autopsied, 95% belonged to Hindu religion. Only 3.5% were Muslims and 1% came from Sikh community. They found that largest number of burn deaths were due to match-stick flame (36%) followed by cooking with wood (29%), stoves (18%), angithi (12%) and kerosene lamps (6%). In their study, 85% cases of burnt wives were between the age of 16-30 years and the rest 15% were beyond the age of 30 years.

Sharma et al.\(^1\) reported 248 (85%) of the female burn fatalities belonging to lower socioeconomic group. The high incidence of victims among rural areas is due to the reason that majority of poor Indian population belongs to rural parts having limited and unsafe cooking measures. Also in most of the parts of the India the cooking practice is by using wood and kerosene oil. The housewives work in the kitchen with the hazard of being exposed to the open fire.

**CONCLUSION**

Before conducting autopsy in burn case, the autopsy surgeon must be well aware of marital status, socioeconomic status, occupation and history of incidence of burns. An approach of prejudice due to history given by police or relatives can’t yield good results. So autopsy surgeon should rely on its own observations during autopsy. There is no substitute for thorough external and internal examination. Hence, autopsies in burn cases have to be complete in every technical respect. Sample collection in burn cases is very important particularly in unconscious and brought dead cases.

**SUGGESTIONS**

1. The investigating/ law enforcing agencies should look beyond just labeling these incidents as mere kitchen agencies. In his study in Manipal\(^3\), Rao found that in 22% of cases of alleged “stove burst”, no kerosene stove was found and that the family was using cooking gas.

2. Strict implementation of the Anti-dowry Act would go a long way in bringing down the incidence of these ‘accidents’.

3. Mass and effective education programs by various sources of multi-media – short films, docu dramas, radio and television advertisements, etc are a must.

4. Following the safety instructions like putting the lights off while going out, wearing tight and cotton clothes while cooking, not leaving a fire source unattended etc. will definitely help to reduce the incidence of burn injuries.

5. As the saying goes… prevention is better than cure and effective prevention requires a good understanding of the major risk factors.

**Funding:** None.

**Conflict of interest:** None declared

**Ethical Clearance:** Approved from ethical committee of the department.

**REFERENCES**

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Study of Awareness and perception of ‘PCPNDT Act, 1994’ among the Junior Residents in a Medical College in Rajkot-A Questionnaire Study

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1Assistant Professor, 2Tutor, 3Resident, Dept. of Forensic Medicine, P.D.U. Government Medical College, Rajkot (Gujarat)

ABSTRACT

Background: Pre conception and Pre-natal Diagnostic Technique Act was amended in year 2003 which provides for the prohibition of sex selection before & after conception & for regulation of prenatal diagnostic techniques appropriately as mentioned above & for prevention of their misuse. With advancement of technology doctors are probably misusing their power. Junior residents are future doctors in whom knowledge has to be imparted since the impact is life-long. Hence this study was conducted keeping in mind the aim & objective to study the Attitude and perception regarding PCPNDT Act in junior residents.

Material and Methods: A Cross sectional study of Attitude and perception regarding PCPNDT Act in 100 junior residents is carried out at P. D. U. Government Medical College, Rajkot (Gujarat) during the period of October 2016 to December 2016.

Results: The knowledge of PCPNDT Act was found to be low among junior residents. Majority of junior resident (98%) have heard about PCPNDT Act. Majority of junior resident (97%) were aware about the declining sex ratio in India. Only 21% junior residents have knowledge about punishment of offence under PCPNDT Act. Majority of junior residents (75%) didn’t have knowledge about registration of USG machine under PCPNDT Act. 54% junior residents didn’t have knowledge about notice of prohibition sex selection to be displayed outside the hospital. 56% didn’t have knowledge regarding declaration from pregnant lady before undergoing USG.

Keywords: PCPNDT Act, Sex ratio, female feticide, Sex determination.

INTRODUCTION

The Pre conception and Pre-Natal Diagnostic Techniques (Regulation and Prevention of Misuse) Act, 1994 was enacted by the Indian Parliament to provide for the regulation of the use of pre-natal diagnostic techniques for the purpose of detecting generic or metabolic disorders or chromosomal abnormalities or certain congenital malformations or sex linked disorders and for the prevention of the misuse of such techniques for the purpose of pre-natal sex determination leading to female feticide.1 Pre conception and Pre-natal

MATERIAL AND METHODS

A present cross-sectional study was undertaken to study awareness and perception of Pre-Conception and Pre-Natal diagnostic Technique Act amongst junior residents working at P. D. U. Govt. Medical Collage, Rajkot during October – December 2016. A self-
administered close questionnaires having 10 questions related to various aspects of PCPNDT Act were administered to all junior residents. The information was collected by distributing questionnaires during above mentioned period and collected back immediately. The data was analysed using Microsoft Excel.

RESULTS

The present study was conducted at P. D. U. Government Medical College and Hospital, Rajkot. Study sample was included junior residents (66 male & 34 female) who were posted P. D. U. Government Medical College and Hospital in which total 100 opinions were collected.

Table 1: Awareness about objectives of pcpndt act

<table>
<thead>
<tr>
<th>Questions</th>
<th>Male (n=66)</th>
<th>Female (n=34)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Aware n (%)</td>
<td>Not aware n (%)</td>
</tr>
<tr>
<td>Have you heard about PCPNDT Act</td>
<td>65 (98.48%)</td>
<td>1 (1.5%)</td>
</tr>
<tr>
<td>Knowledge of prevailing sex ratio in India</td>
<td>21 (31.81%)</td>
<td>45 (68.18%)</td>
</tr>
<tr>
<td>Knowledge of declining sex ratio in India</td>
<td>63 (95.45%)</td>
<td>3 (4.54%)</td>
</tr>
</tbody>
</table>

Table 2 showed that, Most of the junior residents, 50 male (75.75%) and 25 female (73.52%) didn’t have knowledge about registration of USG machine under PCPNDT Act, while 16 male (24.24%) and 09 (26.47%) female have knowledge that it is compulsory to register USG machine under PCPNDT Act. Most of the junior residents, 34 male (51.51%) and 20 female (58.82%) didn’t have knowledge to display notice regarding prohibition of sex selection in hospital, while 32 male (48.48%) and 14 (41.17%) female have knowledge that it is compulsory to display notice regarding prohibition of sex selection in hospital. Most of the junior residents, 35 male (53.03%) and 21 female (61.76%) didn’t have knowledge to take declaration from pregnant lady before undergoing USG, while 31 male (46.96%) and 13 (38.23%) female have knowledge that it is compulsory to take declaration from pregnant lady before undergoing USG. Most of the junior residents, 52 male (78.78%) and 27 female (79.41%) didn’t have knowledge of punishment under PCPNDT Act, while 14 male (21.12%) and 07 (20.58%) female have knowledge of punishment under PCPNDT Act.

Table 2: Awareness about various provisions of pcpndt act

<table>
<thead>
<tr>
<th>Questions</th>
<th>Male (n=66)</th>
<th>Female (n=34)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Aware n (%)</td>
<td>Not aware n (%)</td>
</tr>
<tr>
<td>Knowledge of registration of USG machine under PCPNDT Act</td>
<td>16 (24.24%)</td>
<td>50 (75.75%)</td>
</tr>
<tr>
<td>Knowledge to display notice regarding prohibition of sex determination in hospital</td>
<td>32 (48.48%)</td>
<td>34 (51.51%)</td>
</tr>
<tr>
<td>Knowledge to take declaration from pregnant lady before undergoing USG</td>
<td>31 (46.96%)</td>
<td>35 (53.03%)</td>
</tr>
<tr>
<td>Knowledge of punishment under PCPNDT Act</td>
<td>14 (21.12%)</td>
<td>52 (78.78%)</td>
</tr>
</tbody>
</table>
Table 3 shows Majority of junior residents (46.96% male & 58.82% female) were of the opinion that creating awareness among the medical fraternity and the community, about the declining sex-ratio, is an effective measure in reversing the skewed sex-ratio in India. As shown in Table 5, while 28 (28.78% male & 26.47% female) junior residents suggested that strict implementation of law is necessary to deal with the declining sex ratio. 13 (15.15% male & 8.82% female) junior residents suggested that more rigorous punishment necessary to deal with the declining sex ratio. But 08 (9.09% male & 5.88% female) students suggested that raising women’s status in society, is more helpful.

**Table-3 Suggestions to improve adverse sex ratio**

<table>
<thead>
<tr>
<th>Answers</th>
<th>Male N (%)</th>
<th>Female N (%)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Strict implementation of Act</td>
<td>19 (28.78%)</td>
<td>09 (26.47%)</td>
<td>28</td>
</tr>
<tr>
<td>(b) More rigorous punishment</td>
<td>10 (15.15%)</td>
<td>03 (8.82%)</td>
<td>13</td>
</tr>
<tr>
<td>(c) Creating awareness</td>
<td>31 (46.96%)</td>
<td>20 (58.82%)</td>
<td>51</td>
</tr>
<tr>
<td>(d) Raising women’s status in society</td>
<td>06 (9.09%)</td>
<td>02 (5.88%)</td>
<td>08</td>
</tr>
</tbody>
</table>

Table 4 shows Most of the junior residents (93.93% male & 97.05% female) were agree that sex determination should be punished. While only 5 junior residents (6.06% male & 2.94% female) were against the punishment of sex determination.

**Table 4: Opinion about punishment of sex determination**

<table>
<thead>
<tr>
<th>Should sex determination be punished?</th>
<th>Male N (%)</th>
<th>Female N (%)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Yes</td>
<td>62 (93.93%)</td>
<td>33 (97.05%)</td>
<td></td>
</tr>
<tr>
<td>(b) No</td>
<td>04 (6.06%)</td>
<td>01 (2.94%)</td>
<td></td>
</tr>
</tbody>
</table>

Table 5 shows Most of the junior residents (30.3% male & 52.94% female) considered that relative is responsible for sex determination. 34 junior residents (37.87% male & 26.47% female) considered that doctor is responsible for sex determination. While 22 junior residents (24.24% male & 17.64% female) considered that husband is responsible for sex determination. Only 03 junior residents (3.03% male & 2.94% female) considered that pregnant lady is responsible for sex determination, while 3 male junior residents were not able to say anything.

**Table 5: Opinion about person responsible for sex determination**

<table>
<thead>
<tr>
<th>Answers</th>
<th>Male N (%)</th>
<th>Female N (%)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Doctor</td>
<td>25 (37.87%)</td>
<td>09 (26.47%)</td>
<td>34</td>
</tr>
<tr>
<td>Pregnant lady</td>
<td>02 (3.03%)</td>
<td>01 (2.94%)</td>
<td>03</td>
</tr>
<tr>
<td>Husband</td>
<td>16 (24.24%)</td>
<td>06 (17.64%)</td>
<td>22</td>
</tr>
<tr>
<td>Relatives</td>
<td>20 (30.3%)</td>
<td>18 (52.94%)</td>
<td>38</td>
</tr>
<tr>
<td>Can’t say</td>
<td>03 (4.54%)</td>
<td>00 (0%)</td>
<td>03</td>
</tr>
</tbody>
</table>

**DISCUSSION**

The situation regarding male child preference in India is alarming, which has frequently led to the neglect and death of millions of females through feticide, infanticide and sex selective abortions. The present study was about awareness and perception among junior residents regarding adverse sex ratio and PCPNDT Act in India.

In study of Polo LB at al² Fifty six (74.7%) students reported to be aware of PCPNDT Act. The awareness was better among female (85.4%) as compared to male students (61.8%). While Sindhu T K et al⁶ reported that only 56.5% students had ever heard of PNDT Act. While in present study 98% junior resident were aware of Pre-Conception and Pre-Natal Diagnostic Technique (PCPNDT) Act. The awareness was similar in both sex.

In study of Polo LB at al² only 45.3% students were aware about the declining sex ratio. The awareness was higher among males (47.1%) than females (43.9%).

While in present study 97% junior resident were aware about the declining sex ratio. Which may be due to more academic and practical exposure of junior residents in hospital as compare to students. The awareness was higher among females (100%) than males (95.45%) in present study. Which is almost similar to finding of Avachat S et al in western Maharashtra, where among 79 interns, 40.7% of male and 84.37% of female interns were aware of female feticide and declining sex ratio. Similarly in a study conducted by Subitha et al, at a teaching institute in Mumbai, among hundred (III MBBS Part I) students, 98% knew about prevailing sex ratio.
In study of Polo LB at al² more than half of the students (56.0%) correctly reported about the punishment for sex determination. The correct response was higher among female students (61.0%) as compared to male students (50.0%). While in present study only 21% junior resident correctly reported about the punishment for sex determination. The correct response was higher among male junior resident (21.12%) as compared to female junior resident (20.58%).

In Subitha et al¹ 86% knew that registration of USG machine is mandatory & 14 % were not aware. While in present study Majority of junior residents (75%) didn’t have knowledge about registration of USG machine under PCPNDT Act, only 25% junior residents have knowledge that it is compulsory to register USG machine under PCPNDT Act.

In Subitha et al¹ 92% had knowledge about notice of prohibition sex selection to be displayed outside the clinic but out of that only 26% could correctly explain the matter to be written in the notice. While in present study 54% junior residents didn’t have knowledge about notice to be displayed outside the clinic.

In Subitha et al¹ 61% were not had Knowledge regarding declaration while undergoing USG by the pregnant lady. While 28 who had knowledge regarding declaration only 46% could answer it correctly. In present study 56% didn’t have knowledge regarding declaration from pregnant lady before undergoing USG.

In study of Polo LB at al² Majority of the participants (73.3%) reported that prenatal sex determination is a punishable offence, while 26.7% participants had no idea about the punishment. While in present study 95% junior resident reported that prenatal sex determination should be a punishable offence. While only 5 junior residents were against the punishment of sex determination. Which is similar to the finding of Subitha et al.

In Subitha et al¹ More than half (59%) answered that doctor, pregnant lady & relatives should be held responsible for sex determination. In present study Most of the junior residents (38%) considered that relative is responsible for sex determination, while 34% junior residents considered that doctor is responsible for sex determination. While 22 junior residents considered that husband is responsible for sex determination.

As per Dhaduk KM at al⁴ Almost all (97%) of the doctors affirmed that there is demand for gender determination of the foetus by patients. This is quite shocking and points toward the mindset of society toward a girl child. The observations highlight the need for sensitization of the society towards the hazards of adverse gender ratios and changing their attitudes towards girl children.

In study of Polo LB at al² All the (100%) medical students were of the opinion that creating awareness among the medical fraternity and the community, about the declining sex-ratio, is an effective measure in reversing the skewed sex-ratio in India. While 66 (88.0%) students suggested that strict implementation of law and more rigorous punishment is necessary to deal with the declining sex ratio. Similarly, in a study by Avachat S et al,⁷ majority of the interns (77.2%) stated that creating awareness about declining sex ratio is an effective measure while (62.2%) opined strict implementation of law is necessary to deal with this issue. Only 46.7% held the view that PCPNDT Act alone is not a sufficient tool for reducing female feticide by Sindhu TK et al.⁶

While in present study Majority of junior residents (46.96% male & 58.82% female) were of the opinion that creating awareness among the medical fraternity and the community, about the declining sex-ratio, is an effective measure in reversing the skewed sex-ratio in India. While 56 (88.0% male & 26.47% female) junior residents suggested that strict implementation of law is necessary to deal with the declining sex ratio. Only 28 (28.78% male & 26.47% female) junior residents suggested that more rigorous punishment necessary to deal with the declining sex ratio. But 08 (9.09% male & 5.88% female) students suggested that raising women’s status in society, is more helpful.

As per all studies, creating awareness among the medical fraternity and the community, about the declining sex-ratio, is an effective measure in reversing the skewed sex-ratio in India.

**CONCLUSION**

- The knowledge of PCPNDT Act was found to be low among both male and female junior residents. Therefore, medical professionals need to update their knowledge and understanding on PCPNDT Act and its amendments to be on a legally safer side. Compulsory continued medical education (CME) programs on PCPNDT Act should be arranged frequently and Orientation programs
regarding PCPNDT Act to all PG students are must after taking admission to Post Graduate course. Creating awareness among the medical fraternity and the community, about the declining sex-ratio, is an effective measure in reversing the skewed sex-ratio in India.

**Conflict of Interest:** None

**Source of Funding:** Self

**Ethical Clearance:** Ethical clearance is taken from institutional ethics committee (Reg. No. ECR/635/INST/GJ 2014) of P.D.U. Medical College, Rajkot.

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Autopsy Study of Cranio-Cerebral Injuries in Vehicular Accidents

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ABSTRACT

Head injury is one of the most important regional injuries known to human beings since time immemorial. Head injury is a morbid state, resulting from gross or subtle structural changes in the scalp, skull and or the contents of the skull, produced by mechanical forces. Vehicular accidents can be defined as, ‘An event that occurs on a way or street open to public traffic; resulting in one or more persons being injured or killed, where at least one moving vehicle is involved. They involve high human suffering and socioeconomic costs in terms of premature deaths, injuries, loss of productivity, and so on.

Keywords: Head injury, Vehicular accidents, skull.

INTRODUCTION

Cranio-cerebral injuries (also known as head injuries), one of the most important regional injuries, were known to human beings since time immemorial. (¹) The term accident has been defined as an occurrence in the sequence of events which usually produce unintended injury, death or property damage. (²)

Accident is unplanned event occurring suddenly, unexpectedly and inadvertently in unforeseen circumstances. Accidents, now a day’s one of the most serious problems related to health. A Vehicular accident can be defined as, ‘An event that occurs on a way or street open to public traffic; resulting in one or more persons being injured or killed, where at least one moving vehicle is involved. Thus vehicular accident is a collision between vehicles; between vehicles and pedestrians; between vehicles and animals; or between vehicles and geographical or architectural obstacles.’ Vehicular accidents are a human tragedy. They involve high human suffering and socioeconomic costs in terms of premature deaths, injuries, loss of productivity, and so on. (³)

Head injury is a morbid state, resulting from gross or subtle structural changes in the scalp, skull and or the contents of the skull, produced by mechanical forces. The application of blunt force to the head may result in injury to the contents of the skull, either alone or with a fracture of the skull. The extent and degree of an injury to the skull and its contents is not necessarily proportional to the amount of force applied to the head.

Even in developing countries like India where a huge population available as customers, numerous foreign vehicle companies are selling their vehicles in India leading to more number of users and proportionate increase in numbers of victims. It leads to a huge medical, social and economic bearing of the country as it involves especially younger and adolescents group population which is the main productive year group of any country’s population.

AIMS AND OBJECTIVES

1. To study distribution of pattern of head injury cases and its characteristics like type of injuries on head and body and its location.

2. To recommend measures to reduce incidence of vehicular accidents.

MATERIAL AND METHODS

Present study, was conducted at mortuary of tertiary care government hospital in Mumbai Region from
period 1 January 2014 to 31 December 2015. Cases of vehicular accident having head injury were included in study. Ethical clearance was obtained from the institutional ethical committee. The data was compiled, tabulated and analysed statistically.

**OBSERVATION AND RESULTS**

We found that maximum victims having injury to head and other body parts. Association of injury to other body parts and head was found in 162(67.5%) victims, while only head injury was found in 78(32.5%) victims.

**Table 1: Head injury association with other body part injury**

<table>
<thead>
<tr>
<th>Item</th>
<th>No of cases</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Head injury + body injury</td>
<td>162</td>
<td>67.5</td>
</tr>
<tr>
<td>Only head injury</td>
<td>78</td>
<td>32.5</td>
</tr>
<tr>
<td>Total</td>
<td>240</td>
<td>100</td>
</tr>
</tbody>
</table>

During study of distribution of injuries to other body parts, most common association was found with face either alone with head injury or with involvement of other body part with head injury. Maximum 83 (51.23%) victims had injuries over face, followed by involvement of upper limb injuries which is seen in 68 (41.9%) victims.

**Table 2: Distribution of extra cranial injuries**

<table>
<thead>
<tr>
<th>Associated affected body part</th>
<th>No of cases</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Face</td>
<td>83</td>
<td>51.23</td>
</tr>
<tr>
<td>Anterior trunk</td>
<td>30</td>
<td>18.5</td>
</tr>
<tr>
<td>Back</td>
<td>15</td>
<td>9.2</td>
</tr>
<tr>
<td>Upper limb</td>
<td>68</td>
<td>41.9</td>
</tr>
<tr>
<td>Lower limb</td>
<td>17</td>
<td>10.49</td>
</tr>
<tr>
<td>Genitalia &amp; perineum</td>
<td>3</td>
<td>1.8</td>
</tr>
</tbody>
</table>

Different types of extra cranial injuries found in the study group. These were found alone or along with combination with other injuries. Most common injury noted is abrasion found in 136(56.67%) followed by contusion and laceration in 92(38.33%) and 82(34.17%) victims respectively.

**Table 3: Types of extra cranial injuries**

<table>
<thead>
<tr>
<th>Type of injuries associated on other body parts</th>
<th>Total</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abrasion</td>
<td>136</td>
<td>56.67</td>
</tr>
<tr>
<td>Contusion</td>
<td>92</td>
<td>38.33</td>
</tr>
<tr>
<td>Laceration</td>
<td>82</td>
<td>34.17</td>
</tr>
<tr>
<td>Incised injury</td>
<td>8</td>
<td>3.33</td>
</tr>
<tr>
<td>Stab injury</td>
<td>2</td>
<td>0.83</td>
</tr>
<tr>
<td>Crushing injury</td>
<td>6</td>
<td>2.5</td>
</tr>
<tr>
<td>Fractures</td>
<td>34</td>
<td>14.17</td>
</tr>
<tr>
<td>No injuries</td>
<td>78</td>
<td>32.5</td>
</tr>
</tbody>
</table>

After sustaining head injury the different kinds of intra cranial haemorrhages were observed in the study group. They may be found either individually or in combination with each other. But subarachnoid haemorrhage either singly or in combination with others was found in 180 (75%) in head injury cases. Subdural haemorrhage was next common haemorrhage found in 162 (67.5%) cases.

**Table 4: Types of intracranial haemorrhage observed**

<table>
<thead>
<tr>
<th>Type of haemorrhage</th>
<th>No of cases</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extradural</td>
<td>30</td>
<td>12.5</td>
</tr>
<tr>
<td>Subdural</td>
<td>162</td>
<td>67.5</td>
</tr>
<tr>
<td>Subarachnoid</td>
<td>180</td>
<td>75</td>
</tr>
<tr>
<td>Intracerebral</td>
<td>42</td>
<td>17.5</td>
</tr>
<tr>
<td>Intraventricular</td>
<td>26</td>
<td>10.8</td>
</tr>
<tr>
<td>Basal</td>
<td>12</td>
<td>5</td>
</tr>
</tbody>
</table>

When frequency of different types of fracture was noted in victims of head injury; most common type of fracture observed among head injury victims was linear fracture in 104(43.33%) victims. Second most common was comminuted fracture found in 56(23.33%) victims.

**Table 5: Frequency of different types of fractures**

<table>
<thead>
<tr>
<th>Type of fracture</th>
<th>Total</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linear / fissure</td>
<td>104</td>
<td>43.33</td>
</tr>
<tr>
<td>Comminuted</td>
<td>56</td>
<td>23.33</td>
</tr>
<tr>
<td>Depressed</td>
<td>22</td>
<td>9.16</td>
</tr>
<tr>
<td>Gutter</td>
<td>2</td>
<td>0.83</td>
</tr>
<tr>
<td>Ring</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
Among total 240 victims of head injury, 146 were involved in two wheeler accidents, 12 were involved in four wheeler accidents, 64 victims were from railway accident and 12 were pedestrian.

Table 6: Shows type of case/accident among victims

<table>
<thead>
<tr>
<th>Type of case/accident</th>
<th>Number of victims</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two wheeler</td>
<td>146</td>
<td>60.8</td>
</tr>
<tr>
<td>Four wheeler</td>
<td>12</td>
<td>5</td>
</tr>
<tr>
<td>Railway accident</td>
<td>64</td>
<td>26.66</td>
</tr>
<tr>
<td>Pedestrian</td>
<td>18</td>
<td>7.5</td>
</tr>
<tr>
<td>Total</td>
<td>240</td>
<td>100</td>
</tr>
</tbody>
</table>

Out of those 146 two wheeler victims included both rider and pillion rider. The evidence of Helmets used was recorded in 54 (36.98%) of the victims while 92 (63.01%) did not use it. None of the pillion riders were wearing helmets at the time of accidents.

Table 7: Helmet use among two wheeler driver or pillion driver

<table>
<thead>
<tr>
<th>Use of helmet among two wheeler driver or pillion driver</th>
<th>Number of Cases</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>54</td>
<td>36.98</td>
</tr>
<tr>
<td>No</td>
<td>92</td>
<td>63.01</td>
</tr>
<tr>
<td>Total</td>
<td>146</td>
<td>100</td>
</tr>
</tbody>
</table>

Among victims of four wheeler accidents, use of seat belts was not observed in 10(83.33%) victims. Status of 2 (16.66%) victims was not known.

Table 8: Seat belt usage in four wheeler users

<table>
<thead>
<tr>
<th>Use of seat belt in four wheeler driver or passenger</th>
<th>Number of cases</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>No</td>
<td>10</td>
<td>83.33</td>
</tr>
<tr>
<td>Not known</td>
<td>2</td>
<td>16.66</td>
</tr>
<tr>
<td>Total</td>
<td>12</td>
<td>100</td>
</tr>
</tbody>
</table>

DISCUSSION

Vehicular accidents are one of the leading causes of deaths, hospitalizations, disabilities and socio economic losses in India, especially in metropolitan cities with liberalized economic reforms, industrialization, migration and changing values of the large, middle class young and middle age sections of the society. The motorization phenomena in India has been rapid and marked since last decade.

In our study involvement of other body part along with head injury is common, similar finding found in study by Shobhna et al (4). As most of the victims are from two wheeler accidents, victims had involvement of other body parts after fall was more common.

In our study face was most common extra cranial site, which is similar in study conducted by Harnam Singh et al (2), Oberoi S et al (5), but study conducted by Tandale R. et al (6) contrast our study where upper limbs was common site. Due to anatomical approximation of face to cranium increases the association.

In our study abrasion was most common associated injury either single or in combination with other injuries. Similar findings were observed in study conducted by Oberoi et al (5). However study conducted by Shobhna et al (6) laceration was most common associated injury. Whenever there is a vehicular accident there is blunt force acting on the victim so it causes injuries like abrasion, contusion, lacertions.

In our study, most common type of haemorrhage was subarachnoid (either alone or with combination) which is similar to study conducted by Wankhede et al (7) while study by Ravikumar et al (8) and Arvind kumar et al (9) contrasts our finding where subdural haemorrhage was most common.

Regarding fracture of skull bone, we found that linear fracture was most common, similar findings were observed in studies conducted by Menon et al (10), Wankhede et al (7), Shobhna et al (4). Type of fracture occurring after vehicular accident depends on various factors e.g. speed, safety measures used, ground over which fall occurs. In major accidents combination of fractures is observed.

In our study, majority of two wheeler riders were not using helmets, similar findings were observed in
the studies conducted by Sauter et al\textsuperscript{[11]}, Zarger et al\textsuperscript{[12]}, Sirathanout J et al\textsuperscript{[13]}. Result itself says, if safety measure like use of helmet not used the chances of mortality increases.

In our study, seat belt was not used by most of the victims; similar results were seen in study conducted by Gururaj et al\textsuperscript{[15]}.

**CONCLUSION**

(a) When site of injury is considered, maximum 162(67.5\%) victims showed injury to head and other body parts, while only head injury was involved in 78(32.5\%) victims.

(b) During study of distribution of injuries to other body parts, most common association was found with face in (51.23\%) victims.

(c) Most common associated injury noted was abrasion found in (56.67\%) victims

(d) Subarachnoid hemorrhage either singly or in combination with others was most common hemorrhage found in (75\%) victims.

(e) Most common type of fracture observed was linear fracture in (43.33\%) victims.

(f) Among the total 240 victims of head injury, 92 (63.01\%) were without helmet at the time of accident.

(g) Out of total 12 car driver 10 (83.33\%) drivers did not used seat belt.

**RECOMMENDATIONS ON MEASURES AGAINST VEHICULAR ACCIDENTS**

The first recorded pedestrian accident was in Britain in 1896, where a man was killed by a car travelling at 4 miles/hour\textsuperscript{[16]}. In present scenario, the number of vehicles and speed of new vehicles increased multiple times. This comparison is enough to throw light on rate of increase in road traffic accidents. To prevent this, a multidimensional approach is the need of the hour.

**Road:** This includes maintaining existing roads, improving road surface, removing obstacles, constructing guards, rails, proper signs and widening or narrow sections of roads. There should be good road lighting and segregation of slow moving vehicles, pedestrians from highways and use of Zebra crossing, sub ways for pedestrians.

**Vehicles:** Vehicles design to improve visibility and protection in event of crash, restraining devices as seat belts compulsorily present and proper maintenance of vehicle and regular inspection of vehicles.

**Road Users:** should be properly trained by authorised centres, medically fit and mentally alert, issuing licenses after strict testing of driving skills, medical fitness and periodic review of driving skills specially annual medical examination of drivers above 50 years of age. There should be strict traffic laws regarding use of helmet plus awareness should be implemented from school level so burden can be reduced.

There is no Panacea that will prevent road traffic accidents, what is required is an organized team work by people in many disciplines like education, engineering, medical, law enforcement agencies for effective prevention of road accidents.

**Conflict of interest:** None.

**Source of funding:** Nil.

**Ethical clearance:** obtained from the institutional ethical committee.

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Causes and Prevailing factors of Sudden Natural Deaths—
An Autopsy Study Conducted in
North Coastal Area, Andhra Pradesh

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ABSTRACT

A sudden death is not necessarily unexpected and unexpected death is not necessarily sudden, but very often the two are in combination, these sudden deaths are most probably due to transformation of man to more sedentary stressful life due to advancement in lifestyle and modern technology leading to increase in risk factors for sudden death. Unfortunately, forensic autopsy is too often thought of only in reference to violent or unnatural deaths. The present prospective study was aimed to know the effectiveness of post-mortem examination to find out the cause of death. Most of the natural deaths are due to cardiovascular diseases the leading mode of death in all communities throughout the world which are sudden, unexpected and not diagnosed or witnessed. But legally certification of death is mandatory in our country, hence cause of death can be arrived by doing medico legal autopsy in such circumstances. Studies conducted at one place can’t be considered as standard to other with respect to etiology because the environment and the circumstances are not identical.

Keywords: sudden natural death, medico legal autopsy, Lifestyle, foul play

INTRODUCTION

The official WHO definition of sudden death is someone who dies within 24 hours from the onset of terminal symptoms but in forensic sense, most of such people die within minutes or even in seconds of the onset of symptoms. Sudden cardiac death (SCD) is an unexpected death due to cardiac causes that occurs in a short time period (generally within 1 hour of symptom onset) in a person with known or unknown cardiac disease. When a natural death is very rapid, virtually instantaneous the cause is invariably cardiac origin. Indeed if a person collapses and dies or someone nearby runs to assist him, this can only be cardiac arrest as virtually no other mode of death operates so quickly.

The medico legal autopsy is conducted in cases of sudden and unexpected death, including apparently accidental death, primarily to establish the cause of death; this examination will very frequently demonstrate natural diseases the presence of which will raise a number of questions like

1. If death is associated with an accident
2. If death is not associated with an accident
3. If the disease is connected with trauma, homicide or crime implicated in the cause of death

It is evident that if these questions are answered accurately much more may be achieved than the establishment of a cause of death. Medico legal autopsy will assist legal authorities and satisfy the bereaved relatives perhaps by helping them to obtain insurance, compensation benefits and to eliminate suspicion or foul play as well as to exclude death from violence or poisoning etc. the end of justice can be properly served.

A most important medico legal problem has been possible association of effort (Physical / emotional or both) with sudden death. This is especially significant...
with cardiovascular origin, where the influence of emotion or excitement in precipitating sudden death in the presence of a criminal offence may vary much affect the nature of a prosecution.13

After thorough autopsy, available photographs, naked-eye observations along with information from inquest may thus be confirmed or refuted, evidence of unsuspected disease or poisoning may be obtained, and the danger of the acceptance of the obvious cause by avoiding with the salutary demonstration of the fact that a double pathology is into a rarity.5

Studies conducted at one place can’t be considered as standard to other with respect to etiology because the environment and the circumstances are not identical.

MATERIALS AND METHODS

This study has been carried out from October 2004 to September 2005 after clearance from the ethical committee of Andhra Medical College/King George Hospital, Visakhapatnam.

The present study was conducted in the Department of Forensic Medicine, Andhra Medical College, and Visakhapatnam from October 2004 to September 2005 i.e., 12 months, during which the total postmortem cases were 1215, out of which total number of natural deaths was 52.

The records maintained for each case in this department are 1. Post mortem requisition given by Investigating Officer along with the inquests 2. Treatment records from hospital if treated 3. History from blood relatives and friends 4. Observation of the circumstances at the scene by visiting the scene of offence 5. Photographs taken from the scene of offence 6. Findings in the Post mortem examination certificates. In cases of deaths due to poisoning, chemical analysis reports from the Forensic Science Laboratory were taken into consideration.6

The materials used are inquest Reports, inpatient Case sheets, perusal of police papers, data from district crime records bureau (DCRB), Visakhapatnam, Records from Medical Records Section of Andhra Medical College, Visakhapatnam, Post mortem Reports of all cases, Information collected from the Investigation Officer, Relatives and friends of the deceased accompanying dead bodies.

The factors taken to enumerate the study are the incidence of causes of sudden natural deaths, weights of heart causing sudden cardiac deaths, incidence of diseased or healthy cases among sudden natural deaths, period of survival in sudden natural deaths and organic and infectious causes in sudden natural death.

In addition to routine regular autopsy, thorough examination of heart & great vessels was done in deaths due to cardiac origin. The pericardial sac is incised and its contents are examined. The heart is washed, weighed and surface is inspected for any discoloration, rupture, scarring, hemorrhages etc. for evidence of infarction4.

The heart is held at the apex and the great vessels are cut as far as possible from the base of heart. The heart is opened along the direction of blood flow using enterotome. The atrial and ventricular chambers are looked for thrombus & dilatation, walls for hemorrhages, rupture or scarring. The thickness of left and right ventricular walls are measured using a scale6. The valves are inspected and palpated and conditions of the valves like size of orifice, calcification, vegetations etc. over the cusps are noted. The coronary arteries are dissected cross sectional using a scalpel at every 3mm distance1.

OBSERVATIONS AND RESULTS

The majority of these are natural deaths. But very often natural deaths form the basis of medico legal investigation, if they have occurred suddenly and unexpectedly in apparently healthy persons and under the suspicious conditions leads query to relatives of deceased. The situation may become very knotty where the trauma per se is not fatal and pathological lesion found at autopsy may have been compatible with continued life like chronic heart disease and these can create difficulties in determining the cause of death. In such cases it is not usually possible to certify the cause of death only on external examination of the body. In all such cases an autopsy is imperative to obviate the possibility of cause of death.

In this study from Graph No-1 showing incidence of sudden natural deaths were 52 cases, out of the 1215 postmortems conducted most deaths 31 cases (59.6%) were due to cardiac origin; respiratory causes were 11 cases (21.15%); nervous system causes were 4 cases (7.69%); miscellaneous causes4 cases (7.69%);
gastrointestinal and genitourinary were one each case (1.92%). The incidence is compared with sudden natural deaths due to cardiovascular disease, by this study with studies of Aligbe et al 31%, Amakin et al 23%, S.Harish 57.3%, Kagne et al 23.17%, R.K Sharma 60%, Palson and Gee 61%, Taylor 57% and Granmason 72.7%. The incidence of sudden natural deaths due to cardiovascular disease in the present study agrees with R.K Sharma, Taylor and S.Harish studies. The incidence is high compared to studies of Aligbe et al and Amakin et al. The incidence is low when compared with studies of Granmason, Palson and Gee. The difference could be due to place and preventable medical care.

In this study from Graph No-2 showing 31 cases of deaths due to cardiac origin out of total 52 cases of sudden natural deaths, heart weight ranged from 225 – 600 gm, only one case (3.23%) of the heart weight was normal. 13 (41.67%) cases weighed ranging between 301 – 400 gm. 12 (38.71%) cases ranging from 401 to 500 gm and 4 (12.90%) cases ranging from 501 to 600 gm.

Graph No-3 showing incidence of previous diseased/healthy cases among sudden natural deaths, out which for 24 (46.15%) cases health profile was not known, 6 (11.54%) cases were healthy and remaining 22 (42.3%) cases were diseased.

Graph No-4 showing organic and infectious causes of sudden death of which 33 (63.46%) cases had organic lesion, 16 (30.77%) cases were infectious, one (1.92%) case was functional and in two (3.85%) cases both functional & organic.

Graph No-5 showing period of survival of which majority were found dead 16 cases (31.37%); died immediately & within an hour following the onset of acute signs and symptoms were 9 cases each (34.6%); 4 (7.69%) cases survived for 2-6 hours; 3 cases (5.76%) for 7-12 hours; 2 cases (3.92%) survived for 13-24 hours and only 9 cases survived more than 24 hrs.

**DISCUSSION AND SUGGESTIONS**

The present study indicated that a considerable number of cases among total medico legal postmortems diagnosed to be due to sudden natural causes of death. The importance lies in the fact that while doing medico legal postmortem examination we have to bear in mind that in certain percentage of cases death could be due to natural causes. We have to obtain all available information i.e. information revealed on police investigation, inquest report, hospital case sheet, records etc. and then we have to conduct a thorough postmortem examination before coming to a conclusion regarding the cause of death of the deceased.

1. Graph No-1 It is observed that the cardiovascular causes are more prevalent in sudden natural deaths. And male gender is more prevalent, the age group is being 41-60 years, it is advisable to go for thorough investigations after the age of 40 years for males so that we can take much care to prevent the sudden natural deaths. The mere presence of injuries will not always indicate the death due to trauma, as sudden cardiac death is also a definite possibility as seen in four cases associated with injuries during present study. In this way we can rule out the role of any foul play or death occurring due to accident, poisoning, assault or any other means and help the justice.

Most of the sudden cardiac deaths were in the age range of 41-50 years (38.71%) with marked preponderance of males. This may be due to paternalistic nature of our environment with more men being involved in outdoor activities. Male gender is more prevalent in the incidence of sudden natural deaths as males need to face more pressure and stressful situations to combat with the family and their work related problems. There is much chance of catecholamine actions in the body. Relaxation techniques, yoga may help the male to overcome these problems.
2. Graph No-2 showing 31 cases of deaths due to cardiac origin out of total 52 cases of sudden natural deaths. Weight of the heart is very important for every individual, however the increase in the heart weight is a candidate for sudden death, which may or may not be associated with coronary artery disease, the reason being irritability and instability from hypoxia, so that sudden stress can suddenly cause arrhythmias and death. Hence periodic cardiac health checkups are very important including echo, ventricular mass index to prevent the sudden cardiac deaths.

3. Graph No-3 Sudden natural deaths occur even without history of disease. In this study 30 cases (57.69%) were either healthy or history of disease not known reveals sudden unexpected nature of sudden death.

4. Graph No-4 showing 33(63.46%) cases having organic lesions, 16 (30.77%) cases were infectious as causes of sudden natural death, which can be preventable by personal health care & regular checkups.

Organic and infectious causes in sudden natural deaths

5. Graph No-5 showing 34 cases (66%) found dead, died immediately or within one hour, 4 (7.69%) cases survived for 2-6 hours; 3 cases (5.76%) for 7-12 hours; 2 cases (3.92%) for 13-24 hours and only 9 cases survived more than one day indicating sudden natural deaths.

Diagram showing period of survival in sudden natural deaths

CONCLUSION

By this study it is clear that deaths due to cardiovascular disease (59.6%) form major part of sudden natural deaths. In this study, most of the cases 16 (31.37%) were found dead which were not witnessed indicating sudden and unexpectedness of sudden deaths. In some cases symptoms were neither severe nor typical of any disease; therefore patient may not visit the doctor.

By this study 30 (96.77%) cases out of 31 cases deaths due to cardiovascular origin showing increase in heart weight, is a candidate for sudden death.
Prevention of sudden natural deaths requires the prevention of initial and recurrent ischemic heart disease. This is best accomplished by a comprehensive multi factorial risk factor intervention by periodic checkups, lifestyle, stress management skills through yoga, counseling of diet and exercise.

In some cases stress functions as a catalyst that, in fact, leads to death by directly compounding the existing health complications, such as heart disease. Whether it is work-related or a death in the family, stress can be the result of a variety of events in one’s life. For some cases it is extremely difficult to determine if the contributing cause of death is stress related. That being said, it is imperative that a forensic expert possess the ability and knowledge to determine if stress is a contributing cause to death and to rule-out other possibilities.

Ethical Clearance: This study has been carried out in the year 2005, after permission from the ethical committee of Andhra Medical College/ King George Hospital, Visakhapatnam, Andhra Pradesh

Source of funding: Self

Conflict of Interest: Nil

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Radiological Development of Mandibular Third Molar as An Indicator of Chronological Age in a South Indian Population

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ABSTRACT

Background: Forensic age estimation and its medicolegal implications are gaining lot of importance mainly to determine the age of undocumented youths and to differentiate juvenile from adults. Radiographic evaluation of third molars in terms of its stages of development, its position and extent of mineralization provides an important tool for age estimation, especially in middle teens and early twenties. Hence, this study was designed to assess the reliability of lower third molar development as an indicator for chronological age estimation in young adults of South Indian Population.

Material and methods: The study sample comprised of OPG’s (orthopantamographs) of 188 subjects from a restricted geographic area and known chronological age and gender. Radiographs were evaluated using Demerjian’s method to assess the various stages of mandibular right and left third molar development. Data obtained were subjected to statistical analysis. Regression analysis was performed to obtain formula for dental age calculation.

Results: Study revealed strong correlation between Demirjian’s third molar developmental stages and chronological age. Our study also showed that accuracy of age estimation is enhanced when bilateral third molar is evaluated and used for age estimation. The probability of an individual being adult at developmental stage G is still remains uncertain, however at developmental stage H it is almost assured.

Conclusion: Several research groups have evaluated the reliability of third molars in age estimation but consensus on the usefulness of these teeth in forensic view has not been reached. The present study has discussed the utility of 3rd molar calcification stage in differentiating between juvenile and adolescent. Demirjian’s stage H can be used as cut off point for determining the majority/minority status of the individual.

Keywords: Third molar, Demirjian’s stage, calcification, age estimation, adolescent.

INTRODUCTION

Forensic age estimation of living subjects has become an increasing focus of interest in modern society. When persons under court investigation are unable to produce birth certificates or identification documents proving their accurate age, it is the task of the forensic expert to estimate their age based on an analysis of biological signs of development. Age assessment is required in numerous circumstances like, asylum seekers of unknown age, young people accused of criminal activities, and convicted criminals whose age is claimed to be less than 18 years prior to sentencing. Forensic age estimation should comprise a physical examination, signs of sexual maturation, eliminating the possibility of potentially age-relevant development disorders, left
hand wrist X-ray examination, and a detailed dental examination on OPG’s. Dental development process correlates with different morphological stages of mineralization that can be observed with radiographic techniques. This is less influenced by external factors like malnutrition, diseases and mental stress compared to other measurable criteria of maturity. Dental developments is slower and delayed compared with skeletal development, nevertheless follows a known, regular pattern. Hence biological age can reasonably be assessed. It is also non-invasive, reproducible, easily exploitable and economical technique.

Figure 1: Schematic and radiographic images of mandibular third molar development as shown by Demirjian.
MATERIAL AND METHODS

A cross-sectional study was carried out to assess chronological age based on the stages of lower third molar development. OPG’s of subjects aged between 14-25yrs, taken for the purpose of orthodontic treatment were collected from the Orthodontic clinic in and around Mangalore and from the Department of Oral medicine and radiology. Subjects with history of trauma to facial bones, extraction, orthodontic treatment, developmental and systemic disorders were excluded. The appearance of ossification centre and the tooth development stages slightly varies depending on ethnicity, socioeconomical conditions and genetical influence. Hence subjects were selected from a restricted geographical area.

185 OPG’s were evaluated out of which 107 OPG’s belonged to female and 79 were of male population. These OPG’s were compared with a series of standard images of mandibular third molar development (A – H stages of formation) as defined by Demirjian et al. The first four stages (A-D) show crown formation from the beginning of cusp calcification to completed crown, and the second four (E-H) shows root formation from initial radicular bifurcation to apical closing. To match the mathematical models the stages are converted to numbers (from 2-9). For improved accuracy stage 0 and stage 1 is added where stage 0 represents absence of bud and stage 1 indicated presence of crypt with radiolucent bud within it. The information obtained and derived are analysed using SPSS (statistical Package for Social Sciences), 11.5 version.

A- Cusp tips are mineralized but have not yet coalesced, B-Mineralized cusps are united, C-The crown is about half formed & the pulp chamber is evident, D-Crown formation is complete to the dentinoenamel junction, E-Inter-radicular bifurcation has begun, length is less than the crown length, F-Root length is as great as crown length & roots have funnel shaped endings. G-Root walls are parallel but apices remain open, H-Closed apical ends & uniform periodontal ligament around the root.

RESULTS

Our results for the age range between 14 and 16 years showed a prevalence of stages C to E in both sexes. Stages E to G were prevalent in the 17 and 18 year age groups. By the age of 18, stage G was slightly predominant (63%). At 19 years of age stage G was observed in 75% of the people though some were still in stage F. At the age of 20 although some were in H stage, G was markedly predominant (>80%). Between ages 21 and 23 stage H was preponderant though some remained in stage G. By 24, 25 years of age stage H was seen exclusively.

Among males lower left third molar developmental stage G and stage H showed a mean of 20.15 and 22.92 with SD (standard deviation) of 1.496 and 1.768. And among female population stage G and stage H showed a mean of 19.47 and 22.56 with SD of 1.558 and 1.433 respectively (Table 1). Stages G and Stage H showed a mean of 20.25 and 23 with SD of 1.743 and 1.650 among male and Stage G and Stage H showed a mean of 19.44 and 22.56 with SD of 1.576 and 1.433 among female population based on development of lower left third molar respectively. (Table 2) when overall considered, the age could be calculated near accurately with SD of ± 3.2years (Table 3)

Gender specific regression equation was derived to determine the age for right and left third molars alone and also bilaterally combined.

Age in years (Males) = 7.486 + 1.897 x (Stage of Lower left third molar)
Age in years (Females) = 7.820 + 1.771 x (Stage of Lower left third molar)
Age in years (Males) = 7.637 + 1.868 x (Stage of Lower right third molar)
Age in years (Females) = 7.086 + 1.868 x (Stage of Lower right third molar)
Age in years (Males) = 7.418+ [1.243 x (Stage of right third molar) + 0.660 x (Stage of left third molar)]
Age in years (Females) = 7.138 + [1.623 x (Stage of right third molar) + 0.239 x (Stage of left third molar)]

Pearson correlations provided the relationship between the third molar development and chronological age. It showed a strong positive correlation between stages of lower right third molar development and chronological age in both the sexes, Males( r²)=0.747, Females( r²)= 0.699. Positive correlation was observed between stages of lower left third molar development and age in both the sexes, r²= 0.734 and r²= 0.683
respectively. Age estimation seemed to be more accurate when bilateral third molar development was considered compared to unilateral alone. (Table 4) According to our study in male population, if the stage of lower left and right third molar is G and H, the probability of the age being more than 18 years will be 85% and 100% respectively. Contrary to this in Female population, if the stage of lower left third molar is G and H, the probability of age being more than 18 years will be 75% and 100%. Accordingly 78% and 100% probability of age being more than 18 years in females, if the stage of lower right third molar is G and H respectively. (Table 5)

Table 1: Gender distribution of Mean ages based on development of Lower right Third Molar

<table>
<thead>
<tr>
<th>Gender</th>
<th>Stage of Lower right 3rd Molar</th>
<th>No. of Samples</th>
<th>Mean</th>
<th>Median</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>C</td>
<td>3</td>
<td>14.67</td>
<td>15.00</td>
<td>.577</td>
</tr>
<tr>
<td></td>
<td>D</td>
<td>8</td>
<td>15.38</td>
<td>15.00</td>
<td>.744</td>
</tr>
<tr>
<td></td>
<td>E</td>
<td>4</td>
<td>16.50</td>
<td>17.00</td>
<td>1.915</td>
</tr>
<tr>
<td></td>
<td>F</td>
<td>4</td>
<td>17.25</td>
<td>17.00</td>
<td>1.258</td>
</tr>
<tr>
<td></td>
<td>G</td>
<td>20</td>
<td>20.15</td>
<td>20.00</td>
<td>1.496</td>
</tr>
<tr>
<td></td>
<td>H</td>
<td>39</td>
<td>22.92</td>
<td>23.00</td>
<td>1.768</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>78</td>
<td>20.50</td>
<td>21.00</td>
<td>3.286</td>
</tr>
<tr>
<td>Female</td>
<td>C</td>
<td>1</td>
<td>14.00</td>
<td>14.00</td>
<td>1.059</td>
</tr>
<tr>
<td></td>
<td>D</td>
<td>10</td>
<td>15.30</td>
<td>15.50</td>
<td>1.059</td>
</tr>
<tr>
<td></td>
<td>E</td>
<td>11</td>
<td>16.45</td>
<td>15.00</td>
<td>2.505</td>
</tr>
<tr>
<td></td>
<td>F</td>
<td>8</td>
<td>17.50</td>
<td>17.50</td>
<td>1.915</td>
</tr>
<tr>
<td></td>
<td>G</td>
<td>36</td>
<td>19.47</td>
<td>20.00</td>
<td>1.558</td>
</tr>
<tr>
<td></td>
<td>H</td>
<td>41</td>
<td>22.56</td>
<td>22.00</td>
<td>1.433</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>107</td>
<td>19.76</td>
<td>20.00</td>
<td>3.021</td>
</tr>
</tbody>
</table>

Table 2: Gender distribution of Mean ages based on development of Lower Left Third Molar

<table>
<thead>
<tr>
<th>Gender</th>
<th>Stage of Lower left 3rd Molar</th>
<th>No. of Samples</th>
<th>Mean</th>
<th>Median</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>C</td>
<td>3</td>
<td>14.67</td>
<td>15.00</td>
<td>.577</td>
</tr>
<tr>
<td></td>
<td>D</td>
<td>7</td>
<td>15.43</td>
<td>15.00</td>
<td>.787</td>
</tr>
<tr>
<td></td>
<td>E</td>
<td>4</td>
<td>16.00</td>
<td>16.00</td>
<td>1.826</td>
</tr>
<tr>
<td></td>
<td>F</td>
<td>7</td>
<td>18.14</td>
<td>18.00</td>
<td>2.116</td>
</tr>
<tr>
<td></td>
<td>G</td>
<td>20</td>
<td>20.25</td>
<td>20.00</td>
<td>1.743</td>
</tr>
<tr>
<td></td>
<td>H</td>
<td>37</td>
<td>23.00</td>
<td>23.00</td>
<td>1.650</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>78</td>
<td>20.50</td>
<td>21.00</td>
<td>3.286</td>
</tr>
<tr>
<td>Female</td>
<td>C</td>
<td>1</td>
<td>14.00</td>
<td>14.00</td>
<td>1.059</td>
</tr>
<tr>
<td></td>
<td>D</td>
<td>12</td>
<td>15.67</td>
<td>15.50</td>
<td>1.670</td>
</tr>
<tr>
<td></td>
<td>E</td>
<td>12</td>
<td>16.50</td>
<td>16.00</td>
<td>2.236</td>
</tr>
<tr>
<td></td>
<td>F</td>
<td>5</td>
<td>17.80</td>
<td>18.00</td>
<td>1.304</td>
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<tr>
<td></td>
<td>G</td>
<td>36</td>
<td>19.44</td>
<td>20.00</td>
<td>1.576</td>
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<tr>
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<td>H</td>
<td>41</td>
<td>22.56</td>
<td>22.00</td>
<td>1.433</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>107</td>
<td>19.76</td>
<td>20.00</td>
<td>3.021</td>
</tr>
</tbody>
</table>
### Table 3: Gender wise prediction of age based on Stage of development of Third Molar

<table>
<thead>
<tr>
<th>Gender</th>
<th>Statistic</th>
<th>Actual age</th>
<th>Predicted age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>Mean</td>
<td>20.50</td>
<td>20.5025</td>
</tr>
<tr>
<td></td>
<td>Median</td>
<td>21.00</td>
<td>21.6905</td>
</tr>
<tr>
<td></td>
<td>SD</td>
<td>3.286</td>
<td>2.85042</td>
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<tr>
<td>Female</td>
<td>Mean</td>
<td>19.76</td>
<td>19.7606</td>
</tr>
<tr>
<td></td>
<td>Median</td>
<td>20.00</td>
<td>20.1720</td>
</tr>
<tr>
<td></td>
<td>SD</td>
<td>3.021</td>
<td>2.52828</td>
</tr>
</tbody>
</table>

### Table 4: Gender wise correlation of age based on Stage of Lower Right and Lower left third molar

<table>
<thead>
<tr>
<th>Gender</th>
<th>r</th>
<th>R²</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>0.867</td>
<td>0.752</td>
<td>1.658</td>
</tr>
<tr>
<td>Female</td>
<td>0.837</td>
<td>0.700</td>
<td>1.671</td>
</tr>
</tbody>
</table>

### Table 5: Probabilities of male and female subject > 18 years based on stage of lower left and right third molar

<table>
<thead>
<tr>
<th>Gender</th>
<th>Stage of Lower left third molar</th>
<th>Stage of Lower right third molar</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>G</td>
<td>H</td>
<td>G</td>
</tr>
<tr>
<td>Male</td>
<td>85%</td>
<td>100%</td>
<td>85%</td>
</tr>
<tr>
<td>Female</td>
<td>75%</td>
<td>100%</td>
<td>78%</td>
</tr>
</tbody>
</table>

### DISCUSSION

Dental age estimation in children is more accurate since many teeth develop simultaneously. After the age of fourteen, as most of the teeth are already developed, age estimation becomes more difficult. The only teeth still growing at this age are the third molars. Though third molars are one of the most variable tooth in the dentition, after mid adolescence virtually no other biological indicators are available for age estimation accurately. Hence, they can be considered for juvenile versus adult status in legal consequences. Formerly numerous studies have been done on different population to validate the third molar development assessment for age estimation. However, variation in tooth development process between different populations necessitates population-specific studies.

Age estimation based on dental methods has their own limitations in terms of great variation in tooth position, morphology, and time of formation. There are also differences between the observers and different methodology used for age estimation. Earlier several methods have been proposed for the assessment of the third molar development such as Gleiser and Hunt, Demirjian, Gustofson and Koch, Harrison and Kullman. Validity of these for the estimation of age is evaluated by Olze et al and they concluded that Demirjians method is most accurate for the age estimation.

According to Sisman and others the mean age of some of the Demirjians development stages were earlier for males than females. However, other researchers found no significant difference in calcification stages between male and female subjects. The present study revealed that females attained most of the Demirjians developmental stages slightly earlier than males. (Table 1,2) Similar result was found by Rai et al and the reason for such a finding could be due to small difference in dental growth of female subjects which is probably due to the smaller size of the tooth, as discussed previously by Junior F et al.

In current study we considered only mandibular third molars since developmental stages of maxillary third molars is more difficult to identify in orthopantomographs due to superimposition of anatomical structures and higher chances of image distortion. JOSE C et al assessed accuracy of age estimation using mandibular and maxillary third molars by Demirjian’s technique on Mexican and Colombian population and suggested that the threshold cut off point for adulthood is Demirjians’s H stage since Stage G is usually borderline between juvenile and adult. We found that only 75% of the subjects attained Demirjians stage G by the age of 19 years and by 20 years of age more than 80% of the subjects were still at stage G. For stage H, the present study found a mean age of 22 years old, while in Brazillins, it was 19 years and in Germans, Japanese, Africans and Turkish subjects the mean age for stage H is higher than 21 years old.

According to Mincer et al, if root development of third molar is complete (Demirjian’s Stage H) there was 90-92% probability of subject being at least 18 years old. Other studies showed that probabilities varied in different populations and other ethnic groups, for Europeans 97-99%, Hispanics 85-92% and for Japanese 98-99%. Present study showed that the probability of an individual being adult (<18yrs) is more than 80.75% if
the third molar development is in G stage, and its 100% if an individual is in Demirjian’s developmental stage H. Most of the previous studies have also supported this view that if an individual is in Demirjian’s stage H, the investigator can be reasonably confident that he/she is at least 18 years old.11,12,23,25

CONCLUSION

Third molar calcification stage is one of the few tools which is available to assess the age when development is nearing completion and it can reliably be assumed that individuals with molar developmental stages will correlate with Demirjian’s stages of tooth development in both the gender. Accuracy level is much higher when both right and left side third molars are evaluated simultaneously and used for age estimation. Demirjian’s stage H can be used as cut off point for determining the majority/minority status of the individual. Though considerable variability of third molar tooth undermines its usage as lone developmental marker, it could be beneficial to narrow down the age range in the absence of other alternatives. This study requires further extension using larger and population specific sample.

Research funding: None

Conflict of interest: None declared

Ethical Clearance: Not required as the above study was retrospective analysis of ortho pantomograms

REFERENCES


Study of Fingerprint in Relation to Gender and ABO Blood Group

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¹Associate Professor, ²Assistant Professor, ³Professor & head
Department of Forensic Medicine, GMER Medical College, Paddock Road, Near Majewadi Gate-Junagadh(Gujarat)

ABSTRACT

Fingerprints are of great evidential value in crime investigations and are universally accepted as reliable evidence in court of law. It is considered one of the best tool for identification. Fingerprint is based on principle of individuality and genotypically determined, remain unchanged from birth till death, neither can be duplicated. ABO blood grouping is the universal and common method for the determination of blood grouping. Total 244 students(137 male+107 Female) of 1st and 2nd MBBS of GMERS Medical College, Junagadh-Gujarat belonging to age group of 17 to 25 years were included in this study to correlate the fingerprint with ABO and Rh blood group of an individual. Fingerprint pattern distribution loops is highest among all digits followed by Whorl while arches are rare. There is also an association found between distribution of fingerprint patterns, gender and blood groups.

Keywords: Identification, Fingerprint Patterns, Blood group

INTRODUCTION

Identification has paramount importance in the practice of Forensic Medicine. Identification is defined as determination of the individuality of a person based on certain physical characteristics which are unique to that individual¹. Various identification data used are fingerprinting, handwriting, bite marks, DNA fingerprinting etc. Fingerprints are constant and individualistic and form the most reliable criteria for identification. Fingerprint is one of the oldest, reliable and mature biometric technologies and is considered one of the best, cheapest and legitimate proofs of identification²,³.

Fingerprint patterns are genotypically determined and remain unchanged from birth till death⁴. To establish the absolute identity among the above characters fingerprint is one of the most important tool easily available, because it has been estimated that chances of two persons having identical fingerprints is about one in sixty four thousand million population of the world⁵.

Fingerprints are impressions of patterns formed by the papillary/epidermal ridges of fingerprints⁴. The characteristic patterns of epidermal ridges are differentiated in their definitive forms during third and fourth month of foetal life⁶. Pattern of these papillary ridges remain unchanged in an individual throughout life⁷.

Herschel used fingerprints for personal identification in India⁸. Galton classified the types of fingerprints depending upon their primary pattern as loops, whorl and arches⁹.

In present work we have tried to analyze the relationship of fingerprints with different blood groups and gender.

MATERIAL AND METHODS

This study was conducted in the Department of Forensic Medicine, GMERS Medical College, Junagadh(Gujarat). Total 244 Medical students (137 Male & 107 Female) were selected randomly for
the study. Students with permanent scars on their fingers or thumbs, with any hand deformity due to injury, birth defect or disease, extra webbed or bandaged fingers were excluded from the study. Informed written consent was obtained prior to starting study procedure.

For taking Dermatoglyphics, Ink Method suggested by Cummins was used. Each subject was asked to wash his/her hands thoroughly with soap and water and dry them by using a towel. He/She was then asked to press his/her fingertip on the stamp pad and then to the paper to transfer the fingerprint impression. The same method was repeated for all the finger of both hands. In this way, the plain fingerprints of all the ten digits were taken separately on the respective blocks on the same sheet of paper. Care was taken to avoid sliding of fingers to prevent smudging of the print after the fingerprints were acquired. Blood grouping was done using slide method. Details like age, gender were entered in the proforma. Fingerprint patterns were studied with the help of a magnifying lens and were identified as: Loops, Whorls and Arches based on the appearances of ridge lines according to Henry’s system of classification. The distribution of dermatoglyphic fingerprint patterns in both hands of individuals and its relationship with gender and different ABO and Rh blood groups was evaluated and analyzed statistically.

**FINDINGS**

### Table 1: Henry’s Classification

<table>
<thead>
<tr>
<th>Finger</th>
<th>Lt. Little</th>
<th>Lt. Ring</th>
<th>Lt. Middle</th>
<th>Lt. Index</th>
<th>Lt. Thumb</th>
<th>Rt. Thumb</th>
<th>Rt. Index</th>
<th>Rt. Middle</th>
<th>Rt. Ring</th>
<th>Rt. Little</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>10</td>
<td>9</td>
<td>8</td>
<td>7</td>
<td>6</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

### Table 2: Blood Group According to Rh Factor

<table>
<thead>
<tr>
<th>Rh factor</th>
<th>A(%)</th>
<th>B(%)</th>
<th>AB(%)</th>
<th>O(%)</th>
<th>Total(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rh +ve</td>
<td>50(20.08)</td>
<td>84(34.42)</td>
<td>18(7.38)</td>
<td>74(30.33)</td>
<td>225(92.21)</td>
</tr>
<tr>
<td>Rh -ve</td>
<td>05(2.05)</td>
<td>06(2.46)</td>
<td>02(0.82)</td>
<td>06(2.46)</td>
<td>19(7.79)</td>
</tr>
<tr>
<td>Total</td>
<td>54(22.13)</td>
<td>90(36.88)</td>
<td>20(8.20)</td>
<td>80(32.79)</td>
<td>244(100)</td>
</tr>
</tbody>
</table>

### Table 3: Gender Distribution of Primary Fingerprint Pattern In All Fingers and Thumbs of Both Hands

<table>
<thead>
<tr>
<th>Fingerprint Pattern</th>
<th>Male (n=137x10)</th>
<th>Female (n=107x10)</th>
<th>Total (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loop</td>
<td>754 (55.04)</td>
<td>699 (65.33)</td>
<td>1453 (59.55)</td>
</tr>
<tr>
<td>Whorl</td>
<td>492 (35.91)</td>
<td>299 (27.94)</td>
<td>791 (32.42)</td>
</tr>
<tr>
<td>Arch</td>
<td>83 (6.06)</td>
<td>33 (3.08)</td>
<td>116 (4.75)</td>
</tr>
<tr>
<td>Composite</td>
<td>41 (2.99)</td>
<td>39 (3.64)</td>
<td>80 (3.28)</td>
</tr>
<tr>
<td>Total</td>
<td>1370</td>
<td>1070</td>
<td>2440 (100)</td>
</tr>
</tbody>
</table>

### Table 4: Frequency distribution of digital patterns

<table>
<thead>
<tr>
<th>Pattern</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loop</td>
<td>147 (60.24)</td>
<td>151 (61.88)</td>
<td>170 (69.67)</td>
<td>152 (62.29)</td>
<td>152 (62.29)</td>
<td>128 (52.46)</td>
<td>130 (53.28)</td>
<td>150 (61.47)</td>
<td>133 (54.51)</td>
<td>140 (57.38)</td>
</tr>
<tr>
<td>Whorl</td>
<td>79 (32.38)</td>
<td>72 (29.51)</td>
<td>56 (22.95)</td>
<td>90 (36.89)</td>
<td>80 (32.79)</td>
<td>78 (31.97)</td>
<td>69 (28.28)</td>
<td>72 (29.51)</td>
<td>104 (42.62)</td>
<td>91 (37.29)</td>
</tr>
<tr>
<td>Arch</td>
<td>00 (00)</td>
<td>18 (7.38)</td>
<td>14 (5.74)</td>
<td>00 (00)</td>
<td>01 (0.41)</td>
<td>26 (10.65)</td>
<td>38 (15.57)</td>
<td>19 (7.79)</td>
<td>00 (00)</td>
<td>00 (00)</td>
</tr>
<tr>
<td>Composite</td>
<td>18 (7.38)</td>
<td>03 (1.23)</td>
<td>04 (1.64)</td>
<td>02 (0.82)</td>
<td>11 (4.50)</td>
<td>12 (4.92)</td>
<td>07 (2.87)</td>
<td>03 (1.23)</td>
<td>07 (2.87)</td>
<td>13 (5.32)</td>
</tr>
</tbody>
</table>
CONCLUSION AND DISCUSSION

The present study reveals that most frequently observed fingerprint pattern is loop followed by whorl and arch in both gender. Similar ridge pattern was observed in studies conducted in different regions of India by Gangadhar MR et al., Venkatesh Maled et al., Deepa Deopa et al. Studies conducted in Southern Nigeria, Libya, Kenya and Tanzania revealed similar fingerprint ridge pattern. Study Conducted in New Zealand revealed different results more whorls (55.6%) than loops(43.6%) in males and much higher frequency of whorls (65.6%) and lower frequency of loops(33.7%) in females.

In present study highest subjects belonged to blood group B(36.88%) followed by group O, A and AB. Majority of subjects (225) were Rh positive while only 25 were Rh negative. Same findings have been observed by Deepa Deopa et al and Mehta AA. Our findings doesn’t coincide with the study conducted by Venkatesh Maledet al which revealedO as predominant blood group and AB as least common blood group.

In our study highest percentage of loops showed in blood group O & B, and lowest in blood group AB. In the study of Mehta AA & Mehta AA observed highest percentage of loops was highest in O blood group and lowest in AB blood group. While Deepa Deopa et al observed highest percentage of loops in blood group O and B and Lowest in blood group A. Kshirsagar SV et al observed higher percentage of Whorl in O blood group while lowest in AB blood group.

In Our study Arches were highest in A negative and Ab negative blood groups and lowest in B and O blood groups respectively. Contrary to findings of Deepa Deopaet al who observed highest arches in A, B, O positive blood groups and lowest in AB blood group. While Mehta AA and Mehta AA observed highest percentage of Arches in AB blood group and lowest in B blood group. On the basis of gender in our study frequency of Loops was found higher in females than males while whorls were more frequent in males as compared to females. Similar findings observed by Deepa Deopa et al.

We can conclude that in fingerprint pattern distribution loops is highest among all digits followed by Whorl while arches are rare. In right and left hand digital pattern is mostly similar. There is also an association found between distribution of fingerprint patterns, gender and blood groups.


Source of funding: Self

Conflict of Interest: Nil

REFERENCES


Knowledge and Practice of Bio Medical Waste Management in a Tertiary Care Teaching Hospital

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ABSTRACT

Bio Medical Waste management has received highest priority in hospitals, after introduction of the act “Bio Medical waste management and Handling rules 1998” by The Ministry of Environment and Forest. 0.33 million tones of Bio medical waste is being generated annually in India. Hospital acquired infections are increasing due to improper waste management practice. A cross sectional study on knowledge and practice of Bio Medical waste management was conducted at a tertiary care teaching hospital from 1st June to 31st August 2016. Interestingly the practice of Bio Medical waste management was good in spite of the knowledge levels not being up to the mark in lower cadre staff. Majority of the doctors, nurses and other paramedical staff have adequate knowledge on bio medical waste management. Except a few lower cadre staff, remaining health care personnel are well versed with universal work precautions. The practice of segregation, storage and transportation of biomedical waste was according to the prescribed guidelines.

Keywords: Bio Medical waste(BMW) management. Knowledge. Practice. Tertiary care hospital.

INTRODUCTION

Bio medical waste comprises waste generated in the hospitals during diagnosis, immunization, treatment and research activities. Bio medical waste is potentially hazardous. Common generators of biomedical waste include hospitals, health clinics, nursing homes, medical research labs, offices of physicians, dentists, veterinarians, home health care and funeral homes. The waste generation rate ranges from 0.5 to 2.0 kg per bed per day. The most high risk group are the people who come in contact with the hospital environment on a daily basis which includes doctors, medical students, nurses, paramedical staff, sanitary staff, laboratory personnel and patients and their attendants. Biomedical waste is different from the household waste and also differs from other type of hazardous waste such as radioactive, chemical or industrial waste. Medical facilities also generate waste like chemical and radioactive materials, which are hazardous though not infectious still require proper disposal. Hospital acquired infections usually spread from biomedical waste are very dangerous and contagious. Infectious diseases like Tuberculosis, diarrheal diseases, lung infections, hepatitis, HIV and various other communicable diseases can spread due to improper management of biomedical waste.

Millions of people are affected by health care associated infections worldwide. WHO survey states that 8.7% patients worldwide had hospital acquired infections. WHO statistics reveals that in every 100 hospitalized patients at any given point of time 7 patients in developed countries and 10 in developing countries are acquiring nosocomial infections. The magnitude of problem in India is as high as in other developing country. Urinary tract infections and post operative infections usually comprise the most common health care acquired infections. Health care acquired infections are preventable by efficient practice of biomedical waste management.

Legal aspects: Bio Medical waste (Management and Handling) rules 2016

- Short title and commencement.- (1) these rules may be called the Bio-Medical Waste Management Rules, 2016.
- Authorization means permission granted by the prescribed authority.
- Authorized person means an occupier or operator authorized by the prescribed authority.
- Bio-medical waste means any waste, which is generated during diagnosis, treatment, immunization and in research activities.
Bio-medical waste treatment facility means any facility wherein treatment and disposal of bio-medical waste is carried out.

Occupier means a person who has control over that institution.

Operator of a bio-medical waste disposal means a person who owns or operates a facility for the collection, storage, transport, treatment and disposal of bio-medical waste.

Authorization: Every occupier of an institution handling bio-medical waste shall make an application in Form 1 to the prescribed authority for grant of authorization.

Advisory committee: The Government of every State/Union Territory shall constitute an advisory committee. The State Pollution Control Board shall be represented. The committee shall advise the Government about matters related to the implementation of these rules.

Annual report: Every occupier/operator shall submit an annual report to the prescribed authority in Form 11 by 31 January every year.

Maintenance of records: Every authorized person shall maintain records related to the generation, collection, reception, storage, transportation, treatment and disposal of bio-medical waste in accordance with these rules and any guidelines issued.

Accident reporting: Any accidental injury while handling the bio medical waste is to be recorded and reported immediately to the authority.

As per the Bio-medical Waste management rules, it shall be the duty of every occupier Health Care Facility & operator of Common Bio-Medical Waste Treatment Facility to take all the steps to ensure that the Bio-Medical waste is properly handled and disposed off without any adverse effect to human health and the environment.

### Segregation of biomedical waste

<table>
<thead>
<tr>
<th>Category</th>
<th>Type of Waste</th>
<th>Type of Bag or Container to be Used</th>
<th>Treatment and Disposal options</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yellow</td>
<td>(a) <strong>Human Anatomical Waste</strong>: Human tissues, organs, body parts and fetus below the viability period.</td>
<td>Yellow colored non-chlorinated plastic bags</td>
<td>Incineration or deep burial.</td>
</tr>
<tr>
<td></td>
<td>(b) <strong>Animal Anatomical Waste</strong>: Experimental animal carcasses, body parts, organs, tissues, including the waste generated from animals used in experiments or testing in veterinary hospitals or colleges or animal houses.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(c) <strong>Soiled Waste</strong>: Items contaminated with blood, body fluids like dressings, plaster casts, cotton swabs and bags containing residual or discarded blood and blood components.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(d) <strong>Expired or Discarded Medicines</strong>: Pharmaceutical waste like antibiotics, cytotoxic drugs including all items contaminated with cytotoxic drugs along with glass or plastic ampoules, vials etc.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(e) <strong>Chemical Waste</strong>: Chemicals used in production of biological and used or discarded disinfectants.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(f) Discarded linen, mattresses, beddings contaminated with blood or body fluid.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(g) Microbiology, Biotechnology and other clinical laboratory waste: Blood bags, Laboratory cultures, stocks or specimens of microorganisms, live or attenuated vaccines, human and animal cell cultures used in research, dishes and devices used for cultures.</td>
<td>Autoclave safe plastic bags or containers</td>
<td></td>
</tr>
</tbody>
</table>
Red
(a) **Contaminated Waste (Recyclable)**
Wastes generated from disposable items such as tubing, bottles, intravenous tubes, catheters, urine bags, syringes and gloves.
Red colored non-chlorinated plastic bags or containers
Autoclaving or micro-waving followed by shredding and recycling.

White (Translucent)
Waste sharps including Metals:
Needles, syringes with fixed needles, needles from needle tip cutter or burner, scalpels, blades or any other contaminated sharp object that may cause puncture and cuts. This includes both used, discarded and contaminated metal sharps
Puncture proof, Leak proof, tamper proof containers
Autoclaving or Dry Heat Sterilization followed by shredding and dispose by concrete waste sharp pit.

Blue (a)
**Glassware:** Broken or discarded and contaminated glass including medicine vials and ampoules except those contaminated with cytotoxic wastes.
Cardboard boxes with blue colored marking
Disinfection or autoclaving or microwaving and then sent for recycling.

(b) **Metallic Body Implants**
Disposal by deep burial is permitted only in rural or remote areas where there is no access to common biomedical waste treatment facility. This will be carried out with prior approval from the prescribed authority and as per the Standards specified in Schedule-III.

- Bio-medical waste shall not be mixed with other wastes.
- Bio-medical waste shall be segregated into containers/bags at the point of generation according to their color codes.
- Biomedical waste shall be transported only in such a vehicle that is authorized for the particular purpose by the competent authority as specified by the government.
- No untreated bio-medical waste shall be kept stored beyond a period of 48 hours.
- Instruments used in the hospital can be reused after thorough washing and disinfecting with 10% sodium hypo chlorite solution.
- Mutilation or shredding of contaminated plastic must be conducted to a proper extent so as to prevent unauthorized reuse.
- There will be no chemical pretreatment before incineration, except for microbiological, lab and highly infectious waste.
- The waste should be transported from the bins to the storage point, once the bins are filled up to three quarters of the bin

- Syringes should be mutilated, needles should be cut and both should be disposed into leak proof and puncture proof containers.
- Bio-medical waste generated in households during healthcare activities should be segregated as per the rules and handed over in separate bags or containers to municipal waste collectors. Urban Local Bodies should have tie up with the common bio-medical waste treatment and disposal facility to pickup this waste from the Material Recovery Facility (MRF) or from the house hold directly, for final disposal in the manner as prescribed in this Schedule.

**Precautions:**
- All the generators of bio--medical waste should adopt universal work precautions and appropriate safety measures while conducting therapeutic and diagnostic activities and also while handling the bio-medical waste.
- No one should handle Bio Medical waste with their bare hands. Those who handle BMW must wear gloves, head cap, mask, goggles and body apron.
- Workers should be protected by vaccination against Tetanus and Hepatitis B, Hepatitis C and other vaccine preventable diseases.

**Punishment:** Whoever fails to comply with any of the provisions of the act or rules shall be punishable with an imprisonment for a term up to five years or with a fine up to one lakh rupees or both, (EPA Act 1986).

**Aim of the study:** The aim of the study is to assess the knowledge and observe methods of practice of
biomedical waste management among doctors, nurses, technicians and sanitary staff.

To identify any lacunae in the existing practice and guide them towards improvement of hospital waste management programme.

MATERIALS AND METHODS

A cross sectional study on knowledge and practice of Bio Medical waste management in a tertiary care hospital was conducted from 1st June to 31st August 2016 after obtaining permission from the hospital authority. We observed the existing method of practice regarding collection, storage and disposal of Bio medical waste in the hospital.

We also assessed the knowledge of BMW management among hospital staff which includes doctors, nurses, technicians and sanitary staff who handle bio medical waste, by using the following questionnaire. The purpose of the study was explained to all the participants. The name of the hospital and names of the participants have been kept anonymous.

The questionnaire used for doctors, nurses and technicians:

- Do you know the definition of bio medical waste.
- What are the types of bio medical waste.
- How to segregate and store bio medical waste.
- How is bio medical waste transported.
- Disposal of bio medical waste.
- Awareness on usage of needle cutter.
- Method of disinfection of recyclable BMW.
- Knowledge of universal work precautions.
- Can you recognize the Bio hazard symbol.
- Aware of BMW management Act , Rules and Punishment.
- Any training received for BMW management.

Questionnaire for sanitary staff:

- What constitutes BMW.
- What are the colors bins used for BMW management.
- How to segregate BMW.
- Maximum time limit for the disposal of BMW.
- How to transport BMW from the site of generation to the final site of disposal.
- Awareness on hazards of BMW.
- Precautions to be taken while handling BMW.
- Any training received for BMW management.

The following observation were made on the practice of BMW management in various departments of the hospital:

- Availability of bins.
- Proper segregation of BMW.
- Whether bins were kept in a proper place.
- What was the condition of the colour bin.
- Availability of needle cutter.
- Availability of disinfectant solution.
- Any unusual observation.

The above information was recorded into a data sheet and evaluated scientifically as per the existing guidelines.

RESULTS AND DISCUSSION

A Cross sectional study on assessment of knowledge and practice of BMW management was conducted in a tertiary care teaching hospital. The following observations were found.

1. 82% of the doctors, nurses and technicians know the complete definition of BMW.

2. In our study we observed that 94% of the doctors, 92% of the nurses were aware of the various colors of the bins specified in the BMW Management Act.

3. Segregation of BMW is to be done according to its categories and color code mentioned in the act. We found that 94% of the doctors, nurses and technical staff have sufficient knowledge.

4. As per the act BMW can be stored up to a maximum of 48 hours. The waste should be disposed as soon as 3 quarters of the bin is filled.
The doctors, nurses and technicians comply with this rule mentioned in the act.

5. Transportation of BMW from the point of segregation to the final disposal site should be carried out by a vehicle specially designed for the purpose. The vehicle must have closed containers and the bio-hazard symbol should be clearly visible on all the sides of the vehicle. When we questioned the participants, 75% of the doctors and 70% of the nurses and technicians have adequate knowledge concerning this procedure.

6. Disposal of BMW is to be carried out according to the color coded segregation. The waste in the yellow bin should be incinerated, waste collected in the red/blue bin should be disinfected and could be recycled, whereas waste collected in transparent puncture proof container should be disposed off into a needle pit. Our assessment revealed that 85% of the doctors and 70% of the nurses had appreciable knowledge.

7. The disposable syringes should be destroyed after their use by with the help of a needle cutter. 90% of the doctors and 99% of the nurses and technicians comply with this procedure.

8. Disinfectant solution (10% sodium hypochlorite solution) should be freshly prepared and used to disinfect the contaminated instruments and materials. 75% of the doctors and 70% of the nurses and technicians were aware of this procedure.

9. Every hospital staff member while handling BMW must follow universal work precautions to minimize the risk of infections. In our study 95% of the doctors, nurses and technicians had sufficient knowledge.

10. Bio-hazard symbol must be displayed on all the containers used for BMW management. 88% of the doctors and 64% of the nurses and technicians could recognize the symbol.

11. Our study revealed that 75% of the doctors and 70% of nurses and technicians had knowledge of the rules and regulations of BMW management act.

12. BMW management is mandatory in every health care system. Anybody who does not comply with the rules prescribed in the act is liable for punishment. Only 50% of the doctors and 40% of the nurses, technicians were aware of this rule.

13. Every hospital staff member must be trained for the management of BMW. In our study 70% of the doctors and 35% of the nurses had not undergone any training.

14. For sanitary staff:

80% of the staff were well aware of what constitutes BMW. 85% of the staff were familiar with the color coding procedure. 70% of the staff had sufficient knowledge on segregation of BMW. 75% of staff were aware of timely disposal of BMW. 88% of the staff had knowledge on how to transport of BMW. 50% of the staff were well aware of the universal work precautions while handling BMW. Only 60% of sanitary staff underwent training for BMW management.

We also conducted a detailed study on practice of BMW management in various departments of the institution and found the following results:

- Bins according to the colour code were available in all the departments.
- 90% of the departments had segregated BMW according to the act.
- Bins were kept in a proper place in all the departments and with minimum accessibility to the attendants of the patients.
- Needle cutters were available in all the departments.
- 80% of the departments were using disinfection solution (10% sodium hypochlorite) for disinfecting the instruments.
- 50% of sanitary staff were not following universal work precautions, some were handling BMW without gloves.
- We also observed that the transportation of BMW from the point of segregation to the point of storage was according to the act.

**CONCLUSION**

Bio medical waste management is an attitude and knowledge related programme. In our study we observed that the main culprit for poor management of
the programme is the lack of knowledge and awareness among the sanitary staff. Though doctors and nurses are well trained but the practice is not up to mark due to lack of team work among the handlers. For effective implementation, periodical training programmes, focusing on practical aspects should be conducted for the Health care personnel and sanitary staff of the hospital.

Conflict of Interest: Nil.

source of the funds: self.

Ethical clearance: No ethical issues were encountered during this study. We have obtained permission from the hospital authority before commencement of the study.

REFERENCE


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5. GOVERNMENT OF INDIA MINISTRY OF ENVIRONMENT, FOREST AND CLIMATE CHANGE. New Delhi. NOTIFICATION dated 28th March, 2016. Published in the Gazette of India, Extraordinary, Part II, Section 3, Sub-section (i).
A Study on Poisoning Cases at a Tertiary Care Hospital

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ABSTRACT

Morbidity and mortality as a result of poisoning is an increasing problem worldwide even though these are mostly preventable, if a basic treatment facility is available with immediate accessibility.

Objectives: To determine the socio demographic profile of the poisoning cases reported and to find out the pattern of poisoning cases at a tertiary hospital.

Methodology: A Hospital based prospective study was conducted at Katuri Medical College & Hospital, Guntur. Patient data relevant to the study was recorded in a suitably designed patient proforma. The collected data was analysed using descriptive statistical analysis.

Results: Majority (32.7%) of poisoning cases were found in the age group (21-30 years). Most of the patients were from rural region (76%). Occupation wise farmers were more exposed (47.1%) and then house wives (19.2%). In the study, the maximum numbers of poisoning cases reported were due to agricultural poisons (59.6%) which include organophosphorous and insecticides. The number of suicidal poisoning cases (89.4%) was more when compared to accidental poisoning (10.6%).

Conclusion: This study shows that the maximum number of victims were in between 21-30 years with male predominance. Suicidal by oral route is the most common manner of poisoning. Farmers were the major risk group in our study.

Keywords: Poisoning, Deaths, Organophosphorous, Suicidal.

INTRODUCTION

Poison is a substance, which if introduced into living body, or brought into contact with any part thereof, will produce ill health or death, by its constitutional or local effects or both¹. Poisoning is a common medico-social problem now days all over the world. It consumes not only the valuable health service resources but also causes considerable morbidity and mortality². It is estimated that up to half a million people die each year as a result of poisoning, due to pesticides and natural toxins. Modern toxicology is a multidisciplinary science and forensic toxicology is required to determine any exogenous chemical agent present in biological specimens made available in connection with medico-legal investigations³.

WHO estimated that approximately 3 million pesticide poisoning occurs worldwide and cause more than 2,20,0000 deaths per year. Developing countries like India and Sri Lanka report alarming rates of toxicity and death⁴. It is estimated that more than 50,000 people die every year from toxic exposure in India⁵. Considering the cost and outcomes of the poisoning cases reported to the hospitals, it is found necessary to establish a Poison Information Centre (PIC) which should be networked with other poison information centers in India and with other countries, by which identifying the poisons and managing the cases will become more efficient⁶. A detailed knowledge about the pattern of poisoning cases in a particular area is not only important for early diagnosis and prompt treatment but also is essential for introducing the new and evaluating the old preventive measures⁷.
MATERIAL AND METHODS

The study was conducted at Katuri Medical College & Hospital, Guntur. A prospective study was done on patients admitted to the hospital. The study was conducted for a period of 10 months from January 2016 – October 2016. Cases admitted in the hospital that satisfied the relevant criteria for the study were included. Food poisoning cases and animal bites were excluded from the study. The demographics such as name, age, sex, address, educational status, and occupation of the patient, and type of poisoning, manner of administration, reason etc were studied.

RESULTS AND DISCUSSION

Evolution in fields like agriculture, industry etc has made wide and easy availability of various poisonous substances.

Pattern of poisoning in any region depends on availability of poisons, socio economic status of the population, religious and cultural influences, occupation prevalent in the region and likewise.

All the demographic variables of the present study were shown in the table – 1.

Table 1: Socio demographic profile of the individual

<table>
<thead>
<tr>
<th>Variable</th>
<th>No. of cases</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 – 10</td>
<td>2</td>
<td>1.9</td>
</tr>
<tr>
<td>11 – 20</td>
<td>23</td>
<td>22.1</td>
</tr>
<tr>
<td>21 – 30</td>
<td>34</td>
<td>32.7</td>
</tr>
<tr>
<td>31 – 40</td>
<td>28</td>
<td>26.9</td>
</tr>
<tr>
<td>41 – 50</td>
<td>11</td>
<td>10.6</td>
</tr>
<tr>
<td>&gt;50</td>
<td>6</td>
<td>5.8</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>68</td>
<td>65.4</td>
</tr>
<tr>
<td>Female</td>
<td>36</td>
<td>34.6</td>
</tr>
<tr>
<td>Educational status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Illiterate</td>
<td>39</td>
<td>37.5</td>
</tr>
<tr>
<td>Schooling</td>
<td>48</td>
<td>44.23</td>
</tr>
<tr>
<td>Graduates</td>
<td>19</td>
<td>18.27</td>
</tr>
<tr>
<td>Occupation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Farmer</td>
<td>49</td>
<td>47.1</td>
</tr>
<tr>
<td>House wife</td>
<td>20</td>
<td>19.2</td>
</tr>
</tbody>
</table>

The majority (32.7%) of poisoning cases were found in the age group between 21-30 years. It is because this age group was most active, physically, mentally, socially and hence more prone to stress during life.

Our study shows a male predominance (68 males and 36 females) which shows the stress among the males.

Rural cases were more (76%) than the urban (24%). This could be due to the presence of hospital in rural area.

With reference to education, 81.7% of people were in the group of illiterate and low educational standards when compared to 18.3% of graduate level which may be due to the fact that they are under continuous financial crisis.

Farmers (47.1%) were the majority of victims of poisoning in our study than other occupation, which is explained by the easy availability of agricultural poisons. House wives (19.2%) were next to farmers which may due to the heated arguments in the family and added domestic violence leading to ingestion of poison.

Figure – 1 depicts the Family conflicts (49%) and financial problems (34.6%) as the major reason or motive that lead to poisoning when compared to love failure (11.5%) and other unspecified causes (4.8%).

According to our study, most of the cases (93) were suicidal in manner, in comparison to accidental (11) and no homicidal cases were admitted during the study period which shows the importance of psychological counseling to overcome the stress of life (table - 2).
Table 2: Manner of Poisoning

<table>
<thead>
<tr>
<th>Manner</th>
<th>No. of cases</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suicidal</td>
<td>93</td>
<td>89.4</td>
</tr>
<tr>
<td>Accidental</td>
<td>11</td>
<td>10.6</td>
</tr>
<tr>
<td>Homicidal</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Out of 104 cases brought to emergency dept., most of the cases (62) were agricultural poisons because of their easy access when compared to remaining poisoning cases of our study (figure - 2).

CONCLUSION

The incidence of poisoning is rising and further likely to rise more in the future because of the uncontrolled growth of human population and ours being an agro based economy. Through decades poisoning remains as a manner of killing oneself. Hence the pattern and magnitude of poisoning are multidimensional and demand multi-sectoral approach to overcome this problem. Agricultural poisoning is the most common in Guntur region. Hence education amongst the agricultural workers about the harmful and deleterious effects of agricultural poisons and up gradation of the primary health centre facilities to render immediate management, which is an important step, in reducing both mortality and morbidity. Public education against domestic violence and timely psychosocial management of the vulnerable cases through N.G.O’s, Government authorities and community based mental health programs may help to reduce the stress of individuals at various levels thereby morbidity and mortality.

Conflict of interest: nil

Source of funding: self

Ethical clearance: obtained from Ethical Committee, Katuri Medical College & Hospital, Guntur

REFERENCES


Causes and Manner of Deaths in Domestic Violence in and around Guntur City, Andhra Pradesh

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ABSTRACT
Domestic violence is an issue affecting people of all ages, races, genders, and sexual orientations. Violence against men and same-sex domestic violence are often considered less of a threat to society and to the people involved, but it is important to understand that male-on-female violence, female-on-male violence, and same-sex violence all involve serious consequences to the victim’s and batterer’s short- and long-term health. This paper determines whether men or women suffer from more long-term health problems caused by domestic violence by comparing the currently published statistics on the prevalence of domestic violence in heterosexual and homosexual relationships, and analyzing the results of existing studies on the short- and long-term health effects of domestic violence. The findings indicate that although men and women sustain many of the same injuries, women suffer from more long-term health problems caused by domestic violence.

Keywords: domestic violence, intimate partner violence

INTRODUCTION
Domestic relations are nothing but family relations. So, the domestic violence is nothing but any act causing disturbance in the family relations. The family includes parents, grandparents and children. Violence among these people is inhuman. Most cruel and sustained violence on one or more members or some others of the same family occurs frequently in the family environment. Acts of cruelty on children, wife, husband, old and disabled are antagonising to the family concept and civilized human society, because, in these cases violence strikes the basic nature of sweet and intimate relationship.1

Synonyms for domestic violence include partner violence, relationship violence, and intimate partner abuse, spouse abuse, domestic abuse, and wife abuse, wife beating, and battering. Domestic violence is also described as “pattern of interaction” in which one intimate partner is forced to change his or her behavior in response to the abuse or threats of the other partner.2

Domestic violence is considered to have occurred when one intimate partner uses physical violence, coercion, threats, intimidation, isolation, and/or emotional, sexual, and economic abuses over the other intimate partner to maintain power and control.2

The term domestic violence includes elaborately all forms of actual abuse or threat of abuse of physical, sexual, verbal, emotional and economic nature that can harm, cause injury to, endanger the health, safety, life or wellbeing, either mental or physical of the aggrieved person.

The US Office on Violence against Women (VOW) defines domestic violence as a “pattern of abusive behavior in any relationship that is used by one partner to gain or maintain power and control over another intimate partner.”

Domestic violence in India is endemic and widespread predominantly against women. Around 70% of women in India are victims to domestic violence according to ministry for women and child development. National Crime Records Bureau reveal that a crime
against a women is committed every three minutes, a women is raped every 29 minutes, a dowry death occurs every 77 minutes and one case of cruelty committed by either the husband or relative of the victim occurs every nine minutes.3

Domestic violence affects people of all races, religions, age groups, sexual orientations, and socioeconomic levels.4 Victims/ persons of domestic violence are mostly women and they usually belong to one of the following three categories:

1. Single and legally divorced, recently widowed, recently separated, recently sought an order of protection, addicted to alcohol or other drugs, pregnant, having excessively jealous or possessive partners.

2. Witnessed or experienced physical or sexual abuse as children.

3. Have partners who have witnessed or experienced physical or sexual abuse as children.

MATERIALS AND METHODS

This study has been carried out in the year 2012, after from the ethical committee of Guntur Medical College/ General Hospital.

The present study was conducted in the Department of Forensic Medicine, Guntur Medical College, Guntur from January 2012 to December 2012 i.e., 12 months, total postmortem cases were 1448. An attempt was made to work on cases with history of domestic violence that came to our department i.e., 51 cases out of 1448 cases. The statistics of these cases were analyzed with available data in our department, crime scene visits and by psychological autopsy.

The records maintained for each case in this department are post mortem requisition given by Investigating Officer in their inquests, treatment records from hospital if treated, history from blood relatives and friends, observation of the circumstances at the scene by visiting the scene of offence, photographs taken from the scene of offence and findings in the Post mortem Examination certificates. In cases of deaths due to poisoning, chemical analysis reports from the Forensic Science Laboratory were taken into consideration.

The materials used are inquest Reports, inpatient Case sheets, per usual of police papers, data from district crime records bureau (DCRB), Guntur, Records from Medical Record Section of Guntur General Hospital, Post mortem Reports of all cases, Information collected from the Investigation Officer, Relatives and friends of the deceased accompanying dead bodies.

The factors taken to enumerate the study are, distribution of domestic violence cases among the employed and unemployed groups, different causes of death like dowry, harassment by husband and relatives, alcohol consumption followed by violence and extra marital affair, manner of death, cause of death in domestic violence deaths and different types of poisoning in domestic violence deaths.

OBSERVATIONS AND RESULTS

Domestic violence includes harassment, maltreatment, brutality or cruelty and even the threat of assault - intimidation. It includes physical injury, as well as “willfully or knowingly placing or attempting to place a spouse in fear of injury and compelling the spouse by force or threat to engage in any conduct or act, sexual or otherwise, from which the spouse has a right to abstain”. Confining or detaining the spouse against one’s will or damaging property are also considered as acts of violence.5 Domestic violence includes not only inter-spousal violence, but also violence perpetrated by other family members. Generally, an important part of the power relationship between spouses and their families relates to dowry and its ramifications6

In this study from Figure No. 1, regarding the employment status of domestic violence deaths, 38 cases (74.5%) were in the non-working individuals where as
it is less i.e., 13 cases (25.4%) in working individuals. It indicates that the financially dependent individuals are more prone to domestic violence, harassment, abetment to commit suicide and homicides. According to studies, women who are educated are less likely than those who are not to return to an abusive partner. It was hypothesized that higher education can contribute to the presence of social networks (Schutte, Malouff, & Doyle, 1988).

Figure No. 2 indicates, the common cause of violence is Alcohol consumption followed by Violence i.e., 14 cases (27.4%). The next common causes of violence are Harassment by husband and relatives includes 13 cases (25.4%), dowry related issues includes 10 cases (19.6%), extra marital affairs includes 6 cases (11.7%) and others include 8 cases (15.6%). A combination of alcohol consumption followed by Violence, Harassment by husband and relatives, dowry related issues and extra marital affairs constitute 43 cases (84.1%) of the cases, which indicate that male dominance is the underlying factor. In a 1995-1996 PubMed study conducted in Northern India, wife abuse appears to be fairly common throughout the region as a whole. 22% of the 6632 adult men surveyed reported sexually abusing their wife without physical force in at least one instance and 7% reported sexual abuse with physical force. Abuse was most common among men who also had extramarital affairs, and among those who had Sexually Transmit Disease (STD) symptoms. Abusive sexual behaviours were also found to be correlated with an elevated rate of unplanned pregnancies.

Figure No. 3 indicates, out of 51 deaths, the manner of death is suicidal in nature in 40 deaths (78.4%) whereas 11 deaths (21.5%) are homicides. In most of the deaths the unbearable violence by husband on consumption of alcohol and harassment by husband and his relatives, dowry related leading to abetment of suicide by the victim. Statistics from the United States Department of Justice estimate that 40 per cent of female homicide victims were killed by an intimate partner in 1993, increasing to 45 per cent in 2007. An estimated 6 per cent of male homicide victims were killed by an intimate partner in 1993, decreasing to 5 per cent in 2007.

Figure No. 3

Table 1: Cause of Death in Domestic Violence

<table>
<thead>
<tr>
<th>Cause of Death</th>
<th>No. Of Cases</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Burns</td>
<td>25</td>
<td>49.0 %</td>
</tr>
<tr>
<td>Poisoning</td>
<td>13</td>
<td>25.4 %</td>
</tr>
<tr>
<td>Hanging</td>
<td>10</td>
<td>19.6 %</td>
</tr>
<tr>
<td>Others</td>
<td>03</td>
<td>5.9 %</td>
</tr>
</tbody>
</table>
Table No. 1 of my study shows that, out of 51 deaths, the cause of death in most of the cases is burns i.e., 25 deaths (49%), followed by poisoning in 13 deaths (25.4%). The cause of death due to hanging is seen in 10 deaths (19.6%). Three deaths (5.9%) are due to other injuries. In India, most common form of suicides in females is flame burns popularly known as “kitchen burns”. Dikshit P.C (2010) states that dowry death is also known as bride burning. For burning a bride, fire accelerant such as kerosene and petrol can be used by the husband and in-laws. In India, hanging is among the top 5 methods of choice for committing suicide, the other preferred methods being poisoning, drowning, burning, and jumping from a tall structure or in front of a train. Dr. Narayan Reddy K.S (2013) states that in some cases newly married girls are abused, harassed, cruelly treated and tortured by the husband, in-laws and their relatives for or in connection with any demand for dowry. In extreme cases, the woman is killed by burning or some other method.

Table 2: Different Types of Poisoning in Domestic Violence Deaths

<table>
<thead>
<tr>
<th>Poisoning</th>
<th>No. Of Cases</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organophosphorous</td>
<td>05</td>
<td>9.8 %</td>
</tr>
<tr>
<td>Organochlorate</td>
<td>03</td>
<td>5.8 %</td>
</tr>
<tr>
<td>Paraquat</td>
<td>03</td>
<td>5.8 %</td>
</tr>
<tr>
<td>Gammexane</td>
<td>01</td>
<td>1.9 %</td>
</tr>
<tr>
<td>Carbamate</td>
<td>01</td>
<td>1.9 %</td>
</tr>
</tbody>
</table>

In my study, Table No. 2 shows that, out of 51 deaths, 13 (25.4%) deaths are caused by poisoning. In poisoning cases 05 deaths (9.8%) are due to Organophosphorous poisoning, 03 deaths (5.8%) are due to Organochlorate and Parquet poisoning, 01 death (1.9%) each in Gammexane and Carbamate poisoning.

DISCUSSION AND SUGGESTIONS

Lack of education and awareness are the most common reasons for violence against women. Children who are subjected to abuse are likely to behave similarly as adults. Socio-economic status, substance and alcohol abuse also leads to violence against women in India. Sometimes children who witness one parent abusing the other tend to abuse later in life. Awareness about gender equality and women’s rights should be instilled in boys and girls from a very early age in order to bring a change in the mindset of future generations.

Suggestions:

i. Special women police stations staffed with multidisciplinary female teams quipped to respond to the different needs of victim, have been set up in several countries, are an attempt to make police stations accessible for women.

ii. The judiciary must become more gender sensitive.

iii. Curriculum that teaches non-violence, human rights and gender issues should be included in elementary and secondary school, universities, colleges and other training institutes. Teaching about women contributors in history class, promoting girl participants in sports are some important steps in promoting gender equality.

iv. The judiciary must strongly reinforce the message that violence against women is a serious crime and the abuser will be held accountable.

v. The police must be well positioned to provide assistance to victims.

vi. NGO’s like women organizations which work in partnership with government must be promoted because they provide education and awareness programs. The range of their services must be strengthened.

vii. Strategies must be formed at pre- complaint and complaint level.

CONCLUSION

The Indian society is build up with the relationship between the human beings among the families and it is often associated with love, support and bonding among members. Though these characteristics are often present, it has become evident through recent researches that the home is also frequently the site of violent human relationships. Domestic violence persists in all regions of the world as a pervasive violation of human rights and a major impediment to achieve gender equality.

By comparing the data of the present study of 2012 with that of the previous studies, the incidence of domestic violence cases are gradually increasing in number day by day.
Unemployed females were predominantly affected than the women who are financially stable.

Married women were most predominantly affected than the unmarried women.

Our study showed a greater percentage of domestic violence cases in the moderately literate group of people compared to the illiterate group.

The victim was mostly harassed by both the spouse and in-laws compared to others.

Alcohol consumption played prime role in domestic violence deaths followed by dowry harassment and extramarital affair.

Both physical and psychological violence are predominant in domestic violence deaths.

Manner of the death is mostly suicidal in nature followed by homicides.

Cause of death in majority of cases was due to Burns followed by poisoning and hanging.

The burns are mixed flame burns and second degree in nature involving dermo-epidermal layers of skin using combustive fuel.

In deaths affected by poisoning, organophosphorous poisoning are common.

**Ethical Clearance:** This study has been carried out in the year 2012, after from the ethical committee of Guntur Medical College/ General Hospital, Guntur, Andhra Pradesh

**Source of funding:** Self

**Conflict of Interest:** Nil

**REFERENCES**


A Study of Chest Injuries in Medico-legal Autopsies*
An Autopsy Based Prospective Study at RIMS, Ranchi

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ABSTRACT

Injuries are a health concern in every country around the world, causing over five million deaths per year. Study of Chest Injuries in Medico-legal Autopsies was a prospective study which, carried out in the department of forensic medicine and toxicology, RIMS, Ranchi for period of one year from August 2012 to July 2013. In these study 340 victims died due to chest injuries. The objective of the present study was to analyse the severe chest injuries during autopsy and find out the measures for the prevention. It was noted that males (84.71%) outnumbered the females (15.29%). Majority of victims were in the age group of 31-45 years (39.41%). Most of the deceased died by heavy vehicles (62.15%). Trauma to thorax occurs in about 60% of multi-trauma patients and is 2-3 times more common than intra abdominal visceral injuries. Thoracic trauma is associated with a high morbidity and mortality, after the head and spinal injuries.

Keywords: Road traffic accident, Medico-legal autopsies, Chest injuries, Vital organs.

INTRODUCTION

Accident is an event, occurring suddenly, unexpectedly and inadvertently under unforeseen circumstances. In developed countries, in spite of recent advancement of technology and medical sciences death and deformities following road-traffic accident is yet to be controlled successfully rather incidences of road traffic accident (RTA) has been increasing at an alarming rate throughout the world. In India, according to the National Crime Record Bureau (2003-12), the incidence of accidental deaths has shown an increasing trend during the period 2003-2012 with an increase of 51.80% in the year 2012 as compared to 2002. Amongst the RTA direct impact by the vehicle is most frequent cause of blunt trauma to the chest1. Lungs were found injured in all the cases of fatal chest injuries2. Moreover, injuries to the chest and abdomen are commonly associated with injuries to other parts of the body, namely the head, spine, limbs etc. The results of this study could be useful for strategic planning in the control of road-traffic accidents in future.

MATERIAL AND METHODS

Materials for the present study comprised 340 cases of fatal blunt chest injuries brought to the mortuary of Rajendra Institute of Medical Sciences (RIMS), Ranchi for post-mortem examination from the period of August 2012 to July 2013. These cases were from various police stations of Ranchi district as well as from RIMS. All the information related to the cases was collected from relatives, friends and police officer accompanying the dead body and also from the inquest report. Data related to injuries, damage to internal organs and cause of death were collected during the post-mortem. Decomposed bodies were excluded from study.

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OBSERVATION AND RESULTS

Total 2392 autopsies were conducted during the period of study, out of which 340 cases had injuries to the chest. Majority of cases were in the 31-45 years of age group (39.41%). Only 27 persons had been found killed who were above 60 years of age and 37 persons below 15 years of age (Table No-1). The ratio of male to female is 5.54:1 (Table No-2). The maximum numbers of cases were due to heavy vehicles (62.15%) followed by the light vehicles (22.66%) (Table No-3). The pedestrians rank the highest (37.62%) followed by pillion 19.80% (Table No-4). Injury due to firearm was in only (11.77%) cases (Table No-5).

<table>
<thead>
<tr>
<th>Name of agents</th>
<th>Male</th>
<th>Female</th>
<th>No. of Cases</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heavy vehicles(Truck, Bus, Lorries)</td>
<td>89</td>
<td>21</td>
<td>110</td>
<td>62.15</td>
</tr>
<tr>
<td>Light vehicles(Car, Taxy, Jeep, Tempo, Auto-rickshaw)</td>
<td>27</td>
<td>13</td>
<td>40</td>
<td>20.60</td>
</tr>
<tr>
<td>Train</td>
<td>20</td>
<td>7</td>
<td>27</td>
<td>15.25</td>
</tr>
<tr>
<td>Total</td>
<td>136</td>
<td>41</td>
<td>177</td>
<td>100.00</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type of road users</th>
<th>Male</th>
<th>Female</th>
<th>No. of Cases</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pedestrians</td>
<td>57</td>
<td>19</td>
<td>76</td>
<td>37.62</td>
</tr>
<tr>
<td>Pillion</td>
<td>27</td>
<td>13</td>
<td>40</td>
<td>19.80</td>
</tr>
<tr>
<td>Cyclist</td>
<td>11</td>
<td>-</td>
<td>11</td>
<td>5.44</td>
</tr>
<tr>
<td>Bullock cart driver</td>
<td>5</td>
<td>-</td>
<td>5</td>
<td>2.48</td>
</tr>
<tr>
<td>Rickshaw puller</td>
<td>7</td>
<td>-</td>
<td>7</td>
<td>3.47</td>
</tr>
<tr>
<td>Driver of automobiles</td>
<td>21</td>
<td>8</td>
<td>29</td>
<td>14.36</td>
</tr>
<tr>
<td>Not known</td>
<td>23</td>
<td>11</td>
<td>34</td>
<td>16.83</td>
</tr>
<tr>
<td>Total</td>
<td>151</td>
<td>51</td>
<td>202</td>
<td>100.00</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Manner of death</th>
<th>No. of cases</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road traffic injuries</td>
<td>209</td>
<td>61.47</td>
</tr>
<tr>
<td>Railway traffic injuries</td>
<td>34</td>
<td>10.00</td>
</tr>
<tr>
<td>Fall from height</td>
<td>29</td>
<td>8.52</td>
</tr>
<tr>
<td>Fire-arm injuries</td>
<td>40</td>
<td>11.77</td>
</tr>
<tr>
<td>Stab injuries</td>
<td>9</td>
<td>2.65</td>
</tr>
<tr>
<td>Injuries by blunt weapon</td>
<td>13</td>
<td>3.82</td>
</tr>
<tr>
<td>Blast injuries</td>
<td>6</td>
<td>1.77</td>
</tr>
<tr>
<td>Total</td>
<td>340</td>
<td>100.00</td>
</tr>
</tbody>
</table>
DISCUSSION

Blunt injuries to the chest are responsible for a large numbers of casualties, road traffic accidents are responsible for most cases\(^2,3\), which is very much approximate with observation of present author. In this study majority of the victims are young adult male, mostly accidental and RTA is the main cause of death. This is similar to the observation made by other authors\(^4,5,6,7,8\). In accidental cases large number of accidents were due to heavy vehicles and the pedestrians have also been reported\(^9,9\). The high preponderance of male has also been reported by various other workers from different parts of the globe\(^10,11\). Amongst the RTA direct impact by the vehicle is most frequent cause of blunt trauma to the chest. This is also consistent with the observations made by the other experts\(^12\). Lungs were found injured in all the cases of fatal chest injuries. This is similar to the observations mentioned in standard text books\(^3,6,10,11,13,14,15\).

CONCLUSION

As evident from the study undertaken, majority of the accidents happened in the national highway. Lungs were involved in all the cases followed by heart, ascending aorta, pulmonary vessels and diaphragm. The most common cause was shock and haemorrhage. Season has been found to bear a significant and striking relationship with the incidence of fatal chest injuries. Majority of cases were in the 31-45 years of age group. Males were more prone than females. Majority of victims were from rural area. Non-penetrating injuries were found more than penetrating injuries. The incidences of accidental injuries were higher followed by homicidal injuries. The maximum numbers of cases were due to heavy vehicles. The pedestrians rank the highest followed by pillion. Large numbers of human lives can be saved if trauma centres are established along the National Highways equipped with well trained medical personnel's. It is also very important to increase public awareness about road safety.

Ethical clearance: Taken from ethical Committee

Source of funding: Institutions

Conflict of interest: Nil

REFERENCES

Demographic Study of Fatal Scorpion Sting Deaths among Medicolegal Postmortem Examination in Warangal

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ABSTRACT

There are around 1250 species of scorpions globally, only a minority of which can effectively sting, causes a large number of cases and significant mortality. In India there are 100 species. In Warangal area Mesobuthus tumulus (Indian red scorpion) and Heterometrus swammerdami (Indian black scorpion) sting deaths are common. Most of the scorpion sting deaths especially in children reported were due to delay in proper treatment, giving antivenom and the relatives of deceased allege against doctors that proper care is not given. Scorpion bite remains a public health problem in many developing countries. Furthermore, scorpions can be found outside their normal range of distribution, i.e., when they crawl into luggage, boxes, containers, or shoes and are unwittingly transported home via human travelers.

Keywords: Scorpion bite, pulmonary oedema, habitat of the victim, socioeconomic status

INTRODUCTION

The bites are always accidental. Scorpion bites are a common problem among people living in rural and agricultural areas, occupational hazard mainly in farmers, plantation workers, herders and laborers leading to significant morbidity and mortality with the most common site of such bites are on the hands and feet. The bites inflicted are frequently accidental as when scorpions are trodden upon or could result due to sleeping on floor and open style habitation. Further, in rural and suburban areas the peripheral health care facilities are not well equipped, shortage of emergency drugs, ventilators etc thus necessitating a trip to well equipped tertiary care hospitals, where treatment may be unaffordable due to limited purchasing power of antivenom by the rural victims. High mortality can be attributed to loss of crucial golden hour and lack of treatment.

MATERIALS AND METHOD

The present study is made on the dead bodies that are subjected to Post-mortem examinations death due to scorpion bite in the mortuary of Department of Forensic Medicine, Kakatiya Medical College, Warangal, from September 2008 to June 2010 a total period of 22 months.

Inquest report, First information report, history given by the relatives and from the neighbors, who attended the Mortuary at the time of Post-mortem examination, Hospital records etc. were collected from the Police, apart from the Post-mortem examination report from the Department of Forensic Medicine Kakatiya Medical College, Warangal, to get the data for analysis purpose and basing on the inquest, post mortem examination findings and Reports of Forensic Science Laboratory. The Bitten Scorpion was also found in some cases from the relatives who brought dead snake along with them. In some cases where they were admitted to the Hospital, the investigations done, treatment given, administration of the quantity of Ante Venom given and ultimate cause of death are taken and are correlated with the findings of Post-mortem examination.

The materials used are inquest reports, inpatient case sheets, perusal of police papers, records from Medical Records Section of Kakatiya Medical College/ MGM Hospital, Warangal, Post mortem reports of all cases and any other relevant information collected from the Investigating Officer.
As a part of the present study, many constraints were identified. In some cases the scorpion sting Marks were not visualized properly, Scorpion was neither seen by the relatives nor observed by the victim. All this information is incorporated in the present study.

The factors taken to enumerate the fatal scorpion bite study are Age & sex, Socio economic status, Educational status, Habitat of the victim, Area of biting on the body and postmortem examination of internal organs of the deceased.

**OBSERVATIONS AND RESULTS**

A total number of nineteen (19) cases died due to scorpion bite/sting envenomation were taken for the present study from the year September 2008 to June 2010.

**Graph—1 Age and sex distribution**

Graph—1 showing a total deaths of 19 due to scorpion bite of which 9 were males died (47%); and females 10 (53%). There was a small difference in sex distribution with female preponderance. Adults aged from 18 years to 59 years were died more in number i.e. 8 (42.2%) were due to scorpion bite. Next to them was adolescent age between 13 to 17 years were 6 (31.5%) cases, children between 1 to 12 years were 3 (15.8%) deaths and in old age (more than 60 years) 2 (10.5%) deaths occurred. There was no infant in the present study died of scorpion bite envenomation.

**Graph—2 Socioeconomic status**

Graph—2 showing most of the victims were from low and middle socioeconomic status. From middle income group accounted to 11 (57.9%) cases of scorpion bites. In the low income group, there were 8 deaths due to scorpion bite which amounts to 42.1%. There were no people from high income group.

**Graph—3 Internal features of Scorpion bite**

Graph—3 showing In all cases the viscera was congested and there were petechial hemorrhages spread on the parietal and the visceral surface of the organs and Epicardial haemorrhages seen in 8 persons (Scorpion bite, a sting to heart) during post mortem examination.

**Table 1: Educational status**

<table>
<thead>
<tr>
<th>Education status</th>
<th>Infants &lt;1 year</th>
<th>Children 1 to 12 years</th>
<th>Adolescent 13 to 17 years</th>
<th>Adults 18 to 59 years</th>
<th>Old age &gt;60 years</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Illiterate</td>
<td>Male 0 0</td>
<td>Female 1 1</td>
<td>Male 3 1</td>
<td>Male 1 1</td>
<td>Male 1 1</td>
<td>6 6</td>
</tr>
<tr>
<td>Primary</td>
<td>Male 0 0</td>
<td>Female 0 0</td>
<td>Male 1 0</td>
<td>Male 1 2</td>
<td>Male 0 0</td>
<td>1 4</td>
</tr>
<tr>
<td>Secondary</td>
<td>Male 0 0</td>
<td>Female 0 0</td>
<td>Male 1 0</td>
<td>Male 1 0</td>
<td>Male 0 0</td>
<td>2 0</td>
</tr>
<tr>
<td>Higher</td>
<td>Male 0 0</td>
<td>Female 0 0</td>
<td>Male 0 0</td>
<td>Male 0 0</td>
<td>Male 0 0</td>
<td>0 0</td>
</tr>
</tbody>
</table>

Table: 1 showing most of the people were illiterates, which scored 12 deaths due to scorpion bite, it amounted to 63.1% of total deaths. People having primary education were next to them, 5 cases (26.3%), and remaining 2 of the snake bite victims had secondary education i.e. 10.5%. No person who had higher education died in the present study.
Table 2: Habitat of the victim

<table>
<thead>
<tr>
<th>Habitat</th>
<th>&lt;1 year</th>
<th>1 to 12 years</th>
<th>13 to 17 year</th>
<th>18 to 59 years</th>
<th>&gt;60 years</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
<td>Male</td>
<td>Female</td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td>Rural</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Sub-urban</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Urban</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 2 regarding Habitat of the victim: most of the victims were from sub-urban areas (57.9%) cases. Next to them were from rural areas wherein (42.1%) deaths. No person from urban area died in the present study.

Table 3: Area of biting on the body

<table>
<thead>
<tr>
<th>Area of bite</th>
<th>Infants</th>
<th>Children</th>
<th>Adolescent</th>
<th>Adults</th>
<th>Old age &gt;60 years</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt;1 year</td>
<td>1 to 12 years</td>
<td>13 to 17 year</td>
<td>18 to 59 years</td>
<td>years</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
<td>Male</td>
<td>Female</td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td>Head and Neck</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Trunk</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Upper Limbs</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Lower Limbs</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 3 showing area of bite on the body: mostly on the upper limbs had in 9 people (47.3%); lower limbs in 7 people (36.8%); Head and neck region in 2 persons (10.5%); and over the trunk region in only one person (5.2%).

DISCUSSION AND SUGGESTIONS

The present study is conducted on the dead bodies died due to scorpion bite/sting subjected to post mortem examination in the Mortuary of Department of Forensic Medicine in Kakatiya Medical College/MGM Hospital, Warangal.

The number of deaths occurring due to scorpion bite/sting reflects only the tip of iceberg. Many people who received the scorpion bite envenomation might be treated and went home, the records of which are not available, as well as scorpion bite mark is single and also mostly occurs at nighttime which is not clearly recognizable. Hence the percentages mentioned here reflect only of the fatal cases.

Graph 1: Slight female preponderance is seen over the male with a ratio of 1.1: 1. This says that the movement of the population is common and equal among the both sexes, at least in the rural and semi-urban areas around Warangal.

Graph 2: All deaths were seen from the low socio economic status and middle income group. This reflects their inability and ignorance to go for treatment. This statement can be justified by observing that there are no deaths seen from higher socio economic group.

Graph 3: In all 19 cases, congestion of viscera, petechial haemorrhages on the parietal and visceral surface of the all organs observed and Epicardial haemorrhages seen in 8 cases (Scorpion bite, a sting to heart) during post mortem examination. Autopsy findings are nonspecific and include pulmonary and brain edema, local necrosis, disseminated intravascular coagulation and myocardial damage.

Table 1: Illiteracy is also another culprit which increases the ignorance of a man. This is once again reflected by the increased number of deaths in this group of people than the educated community.

Table 2: It was observed that people from rural and sub-urban areas were more victimised. This can be attributed to the habitat of the scorpions which are disturbed by the urbanisation. Naturally the movement of scorpions among the man kind is more common in rural and sub-urban areas than urban arrears.
Table 3: The common sites for scorpion sting were usually the peripheral parts\textsuperscript{9, 10} of the body such as hand and foot, as people do not take proper precautions to protect themselves from such bites. It does not mean that head & neck and trunk cannot receive the bites, but these areas were bitten in sleeping posture.

Post-mortem diagnosis of envenomation by a scorpion with or without a reliable history is a herculean task. The challenge is compounded when stinging occurs at night, with the history remaining unreliable. The autopsy diagnosis is further complicated when the inflicted wound is small, and the mark is obliterated by healing within few days. Though the number of cases examined during the study was small, the data suggest certain characteristic features. In the present study, pulmonary oedema\textsuperscript{10} was observed in all the cases. As the venom of a scorpion is a mixture of enzymes, most of the forensic science laboratories in India fail to diagnose the poisoning. The detection of scorpion venom in the tissue or blood is difficult\textsuperscript{15}. It can be ascertained to many factors as, bio-degradability of the venom in the tissue, improper preservation of the tissue, improper transportation of the specimen, prolonged period between preservation and testing or non-availability of the reagents (kit) to detect the venom in the tissues. In no one case of scorpion bite the venom was detected from the chemical examination of the viscera. Hence the opinion about the cause of death by scorpion bite envenomation is empirical, based on the post mortem examination findings, history and Inquest, by ruling out the other possibilities of death.

However all animal bites are taken as accidental, they cannot be considered to.

**CONCLUSION**

1. Low socio economic group and middle income group not having proper living facilities are the most vulnerable group for scorpion bite particularly in nights. Hence they should be educated /informed about the hazards of sleeping on the floor especially during nights.

2. Common and standard treatment protocol should be planned and the doctors working in the Primary Health Centres should be made aware of the latest treatment protocol by training them for saving the lives of victims.

3. Due to lack of proper education regarding the envenomous effects of the scorpion bite the people are consulting the chanters. Hence proper education must be given to the people of High Risk areas of Scorpion bite.

4. Evidence of venom at the site of bite was not detected in any case.

5. There was no mention made in any case about the suicidal or homicidal attacks by scorpion bite.

6. In all cases of deaths due to scorpion bite there is congestion of viscera, petechial haemorrhages on parietal and visceral surface of the all organs and pulmonary edema due to cardiac failure suggests the “though scorpion bite is on the skin externally, scorpion stings actually to the heart”\textsuperscript{12, 13}

**Ethical Clearance:** This study has been carried out in the year 2010, after permission from the ethical committee of Kakatiya Medical College, Warangal, Andhra Pradesh

**Source of funding:** Self

**Conflict of Interest:** Nil

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An Autopsy Study of Fatal Blunt Trauma of Chest with Emphasis on Two Wheelers Road Traffic Accidents

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ABSTRACT

This study was done on blunt chest trauma related deaths in the city of Bangalore, which focused on deaths due to Road traffic accidents among two-wheelers. Study includes 64 deaths, 49 deaths being because of RTA, apart from fall from height and assaults. 40% of people who died because of RTA were in the age limits of 21-30 years. 24.5% in the age of 31-40 years. Males predominated with rate of 83.7%. All the deaths were accidental, detected by autopsy and by investigation. 61% of deaths were among riders. Most accidents occurred on city roads i.e., 79.6% and on highways 14.2%. 62% of people survived till 6 hours after the accident. Maximum cases were brought dead to the hospital. Death was mostly due to blunt trauma to the trunk and combined regions. This study mainly aims at determining the survival period, two wheeler chest injuries and possible preventions for it.

Keywords: Blunt Trauma, Chest injuries, Road traffic accidents, Accident Prevention.

Abbreviations used: RTA – Road Traffic Accident.

INTRODUCTION

Urbanization and industrialization along with other changing trends of city life have added risk to the life of an individual. During 1990’s Road Traffic Accidents ranked 9th among the leading causes of death in the World. It is projected that, if the same trend continues it would become the 3rd leading cause by the year 2020.1 Trunk has vital organs like lungs, heart and blood vessels. Trauma to a body, when discussing about trunk, will not be limited to that, adjacent regions also will be involved in that incident. Trunk is the main region, anatomically, apart from head, to be considered in deaths related to trauma. Along with head, trunk is involved in road traffic accidents resulting in deaths. This study is done to evaluate the pattern of fatal chest injuries leading to death in RTA and assess them in relation to age-gender ratio, survival period and cause of death.

MATERIALS & METHOD

This study was carried out on the dead bodies brought for medico-legal autopsies to Forensic Medicine Department at Vydehi Institute of Medical Sciences and Research Centre, Bangalore after obtaining approval from Institutional Ethical Committee. Individuals who succumbed to fatal injuries by blunt force were included in the study and cases where sustenance of injuries not known and where injuries altered by putrefaction were excluded from the study.

A total of 64 cases over period of 2 years brought to our centre for medico-legal autopsy fulfilling the criteria were included in the study. Epidemiological data like

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age, gender, type of trauma, type of road users, and type of vehicle involved in the accident and other relevant data about the cases were collected from the eyewitnesses, relatives, accompanying persons, police, hospital records and inquest papers. Study results were entered into a master chart and data were analyzed by comparing to national and international results.

RESULTS

In this study, 86% (55 cases) were males and 14% (9 cases) were females. Majority were in the age group of 21-30 years (46.9%), followed by individuals between the age groups 31-40 (20.3%), 41-50 (12.5%), <10 (7.8%), 51-60 (6.3%) > 60 (3.15%) and 11-20 (3.1%) years.

Of the 64 cases, 49 individuals suffered injuries due to Road Traffic Accidents followed by fall from height (9 cases), wall collapse (3 cases), assault (2 cases) and industrial mishap (1 case). Survival period ranged from < 6 hours (73.7% cases), 6-12 hours (9.3%), 12-18 hours (1.6%), and 18-24 hours (1.6%) to > 24 hours (7.8%).

Chest alone sustained injuries in 2 cases (3.1%), Chest and adjacent part of head and neck in 17 cases (26.6%), Chest and adjacent part of abdomen in 8 cases (12.5%) and combined areas in 37 cases (57.8%). Skeletal injuries in the form of fractures of ribs (43.7%), sternum (7.8%) and clavicle (3.2%) were present associated with parenchymal injuries.

Thoracic organ injuries in the form of contusions and lacerations were present involving Lungs (39.1%), Heart (3.1%), Major vessels of chest (1.5%), Combined (more than one organ -56.3%) were present. By analysis of injuries cause death were ascertained as asphyxia (4.7%), hock & hemorrhage (87.5%), Coma (4.7%) and Septicaemia shock (3.1%).

DISCUSSION

The results of our study on the fatal chest injury due to blunt force were analyzed and compared with other studies conducted at various places in India and abroad. According to our study RTA was the commonest cause for blunt chest trauma which is in accordance with the study conducted by Robert M. Shorr2, Raju S Iyer3, A.L. Ghangale7, Meera TH12 and Pathak Manoj Kumar6. This could be as ribs are most exposed bone to trauma as they are spread over large area.

Maximum number of blunt chest injuries was present in male individuals aged 21–30 years, followed by age group 31–40 years. Similar results were observed in the previous studies conducted by Raju S Iyer3, A.L. Ghangale7, R.V. Kachre3, D.Harish9 and Pathak Manoj Kumar6, the reason could be that the young adults are prime earners of the family and remain outdoors during most of the day, risk taking behavior, driving at high speeds by the young. Male dominance is explained by the fact that, males are more exposed to hazards of road. Similar results were observed in studies conducted by Robert M. Shorr2, Serife Tuba Liman4, D.Harish9, and Ali1.

From the study population in RTA it was observed that motor cyclists accounted for 30 cases (61.2%), the major part of victims of blunt chest injury followed by pedestrians 10 cases (20.4%). Similar results were observed in the studies conducted by Ganveer GB10, Pathak Manoj6 and Srinivasulu Pothireddy11 on road traffic accidents.

We observed that victims had 28 cases (43.7%) rib fracture, followed by combined bony fractures 22 cases (34.4%) which is in accordance with the study conducted by Robert M. Shorr2, Raju S Iyer3, A.L. Ghangale7, Meera TH12 and Pathak Manoj Kumar6. This could be as ribs are most exposed bone to trauma as they are spread over large area.

It was observed that Shock and hemorrhage was seen in 56 cases (87.5%) followed by asphyxia and coma 03 cases (4.7%) but it is in contrast to study done by Meera TH12 and Archana Kual12 and in our study it was observed that combination of different parts of body involvement is maximum with 37 cases (57.8%), followed by Chest and adjacent parts of head and neck 17 cases (26.6%), and chest alone is involved in 2 cases (3.1%). In the study by Robert M. Shorr2, Ghangale7 and ArchanaKaul13 chest and adjacent parts of head and neck are involved in most cases.

CONCLUSION

The riders are educated about wearing a helmet to prevent head injuries but the chest also contains vital organs like heart and lungs and the injury to them can lead to rapid death. Road traffic accident victims particularly two-wheelers riders should be investigated for hidden chest injury in casualty which may turn out to be fatal at a later stage.
**Ethical clearance:** Institute Ethics Committee.

**Conflict of interests:** Nil

**Source of funding:** Self Funding.

**REFERENCES**


An Autopsy Study of Suicides in the Age Group of 20-40Yrs

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ABSTRACT
Death of a person in the middle age is not only a loss of family member but it also causes additional burden to the family in the form of financial or work force hindrance. Of late incidences of suicide are on the rise in the metropolitan cities and Bangalore is often termed as Suicide capital. This study was intended to know the socio-demography, methods and motive behind such acts so as to suggest preventive measures. A total of 110 cases of suicides were studied out of which 76 were in the age group 20-40yrs, 61% were males, and 79% committed suicide by hanging. Remedial family problems (32%) followed by chronic illness (18%), Depression (12%) were the major cause for such acts.

Keywords: Suicide, Hanging, Family problems, Depression.

INTRODUCTION
Suicide is widely prevalent worldwide. According to World Health Organisation, every year about 8,000,000 people die by suicide. It is the 2nd leading cause of death in developing countries between the age group 20-39 years. Hanging, Pesticide Poisoning and Firearms were the most frequent methods globally.

National Crime Records Bureau (NCRB) of India reports fewer suicide deaths (about 135 000 suicides in 2010) than estimated by WHO. Nowadays suicidal gesture, attempted suicide, completed suicide cases are common and we read or hear in media, newspapers. Increasing number of deaths by suicide is a public health problem in India today which is spreading rapidly.

Keeping the same aspect in consideration this study was conducted to assess the method of suicide employed in the young age group, to know the age sex ratio committing suicides and to determine motives behind the suicides.

MATERIALS AND METHOD
Data was collected from police inquest documents of cases in the deaths of individuals in age group 20-40years of suicides autopsied at the Department of Forensic Medicine & Toxicology, VIMS & RC, during one and half year. All cases of autopsies on suicidal deaths in the age group 20-40years conducted in VIMS&RC. Unknown Cases, Cases in which autopsies did not reveal cause of death and in cases where clear history was not available were excluded from the study.

OBSERVATIONS & RESULTS
Total suicides were 110 and in the age group 20-40years -76 cases (69.09%) rest of age groups -34(30.9%)
Family problems were the main reason of suicides in our study which accounted for 24(31.57%), followed by chronic illness-13(17.10%), depression-8(10.52%), failure in love-3(3.94%), psychiatric illness and failure in exam, each accounted for 1(1.31%) respectively, and not known-26(34.21%).

**DISCUSSION**

In this study the common age group was 21-40 years, males were more than females, and method used were hanging and poisoning which are similar to WHO & NCRB1 2. In the study by Santhosh C S and Nawaz B, out of 840 autopsies, 370 were suicides, the common age group was 21-30 years (144 cases). The number of suicides in the age group 21 – 40 years – 76(69.09%), males out numbered 46(60.53%), followed by females 30(39.47%), 20-30 years males- 32(42.1%), females-24(31.5%), and in 30-40years – males 14(18.42%), females-6(7.89%), total- 20(26.31%) which was similar to our study3. Shetty C K reported the consistent results during January 1992 to December 2012, Commonest age group involved was 19-30 years (males-316- 59.6%, females-194 – 39.6%)4. In a study done by Kumar S A et al during January-2008 to October-2012, most common age group was 20-30 years which correlates with our study5. Narayana KA &Vaidyam reported the most common age group being 21-30 years6. Macharia B N et al reported that the age groups being most involved was 21-30 years (40.1%)7. On methods adopted, the most common method was hanging, followed by poisoning, cut throat and jumping from height. Contrary to current study, Rastogi P and S R Kochar, in a study during 2004-2008 reported the common method as poisoning, followed by train run over8. Narayana KA & Macharia B N reported that hanging is the most common method chosen followed by poisoning which is similar to our study6,7.

**CONCLUSION**

Warning signs of Suicides are:

- Previous suicide attempt/s
- Mental disorder/s
- Chronic use of alcohol
- Financial loss
- Family history of suicide
Chronic disability in the form of intolerable pain

Sense of isolation and lack of social support from family / friend.

Most vulnerable in our study are age group 21 to 40 and then the male gender. Suicides can be prevented with proper and timely medical attention in the form of Psychiatric counselling.

**Ethical clearance:** Institute Ethics Committee.

**Conflict of interests:** Nil

**Source of funding:** Self Funding.

**REFERENCES**


2. National crime records bureau, 2014, part 2 chapter 2; 192-208


Estimation of Stature from Length of Great Toes among Diverse Population of Medical Students of MGM Medical College, Aurangabad

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ABSTRACT

Estimation of an individual’s stature is an important parameter in Forensic field. It is one of the important parameters for establishing identity of a person. In cases of mass disasters, only peripheral parts of the body are found and the task of forensic investigations is to establish stature of victim from measurement of those body parts. Stature can be estimated from skeletal remains of human body because relationship exists between stature and body parts. If forensic expert establishes stature of a victim from mutilated body part, it will shorten the time required for establishment of identity.

Present study was undertaken to find out regression equation for stature estimation from the measurements of lengths great toes bilaterally among 200 students (100 male and 100 female) diverse population of MGM Medical College, Aurangabad (MS). After obtaining an informed consent, data entered & readings were tabulated and the results were analyzed statistically using SPSS software version 20. It is found that the males have greater mean value for stature as compared to females. The stature is in direct relationship with great toe lengths in both the gender. There is difference between mean values of length of great toes in males and females bilaterally.

The regression equations derived were found to be statistically significant and correspond to the stature of an individual. Thus these regression equations can be used in future to calculate the stature of a person from lengths of great toes.

Keywords: Length of great toes, Stature, Anthropometry, Regression equation, diverse medical students

INTRODUCTION

The etymology of word identity is derived from Latin word “idem” which means—the same, i.e. identical. Identification of an individual means determination of individuality of a person based on certain physical characteristic features such as name, age, sex, religion, race, anthropometry(stature), fingerprints, footprints, DNA typing, congenital or acquired malformations etc. Of these features sex, age and stature are considered as primary characteristics of identification where as others are secondary. Stature is defined as a height of a body in standing position. From birth to adulthood, stature increases until a maximum is reached. It is well known fact that the stature is maximum after the age of puberty and then gradually declines with increase in age especially after 30 years.

The challenging need of identification of an individual arises in situations like, riots, floods and earthquakes and so many times, railway, motor vehicle and aircraft accidents, bomb explosions, in terrorist attacks (which are becoming more and more common now-a-days), tsunamis. In such conditions, only mutilated body parts, especially the peripheral body parts like hands or feet are available.

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So as to develop an anthropological profile of an individual, estimation of stature is an important component. The stature of an individual can be measured in living or dead and it can be correlated with lengths and breadths of body parts to deduce the regression equation. Such regression equations can be used for establishing stature in cases where only body parts of the body are available. It has been shown that dimensions of the lower extremity show greater association with stature than those of upper extremity. (Ozaslan et al 2003, Fessler et al 2005) 1, 2

Many researchers have worked to find out regression equations for stature estimation of an individual by measuring lengths of different body parts such as arms, phalanges, hands feet, etc and have developed regression equations. However most of these studies are applicable to a specific population residing in a specific geographical area.

In the present study, the participants come from different geographical parts (states) of India and different hereditary features, it is hoped that such a regression equation (formula) derived will be applicable to population of India in general in broad sense.

**AIMS AND OBJECTIVES**
- To measure the lengths of great toes (right and left).
- To measure the stature
- To evolve regression equation for stature estimation from measurements lengths of great toes (right and left)
- To assess the bisexual and bilateral difference for the different percutaneous measurements of lengths of great toes

**MATERIAL AND METHODS**

The study was carried out involving 200 (100 males and 100 females) subjects comprising of both male and female students of MGM Medical College, Aurangabad of age group between 18 to 23 years by simple random sampling method from August 2015 to October 2015.

**Inclusion Criteria:**
- Age group between 18 to 23 years
- Apparently healthy
- Only adults who have documentary evidence of age.
- Students of MGM Medical College Aurangabad

**Exclusion Criteria:**
- Students suffering from chronic illness & endocrinal disorders, individuals with deformities of foot, lower limb or vertebral Column.

**OBSERVATIONS**

<table>
<thead>
<tr>
<th>Table No. 1: Table Showing Distribution of Participants by Age &amp; Gender</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
</tr>
<tr>
<td>-----</td>
</tr>
<tr>
<td>18</td>
</tr>
<tr>
<td>19</td>
</tr>
<tr>
<td>20</td>
</tr>
<tr>
<td>21</td>
</tr>
<tr>
<td>22</td>
</tr>
<tr>
<td>23</td>
</tr>
<tr>
<td>Total</td>
</tr>
<tr>
<td>Mean ±SD</td>
</tr>
</tbody>
</table>

In the present study, there were 200 participants from age 18 to 23. Out of which 100 were male and 100 were females. In case of males the maximum participants were of age group 18 years and minimum were from age group 22 and 23 years. In case of females, the maximum cases were from age groups 18, 19 and 20 years and minimum from age group 22 and 23 years. Mean age of male participants was 19.49 ±1.49 and that of female participants was 19.49 ±1.21 and mean age of all participants was 19.49±1.34.

<table>
<thead>
<tr>
<th>Table No. 2: Table Showing Distribution of Participants by Stature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stature (cms)</td>
</tr>
<tr>
<td>----------------</td>
</tr>
<tr>
<td>Maximum</td>
</tr>
<tr>
<td>Minimum</td>
</tr>
<tr>
<td>Mean</td>
</tr>
<tr>
<td>SD</td>
</tr>
<tr>
<td>Z value</td>
</tr>
<tr>
<td>P value</td>
</tr>
</tbody>
</table>
The maximum stature of male participant was 197.30 cms and minimum stature was 155.00 and mean value of stature of male participants was 172.49. In case of female participants the maximum, minimum and mean values of stature were 176.00, 143.00 and 158.11 respectively. The mean value of stature of male participants was more than that of females. The P value was <0.001 i.e. significant.

In case of males, the maximum length of great toe was 8.6 cm and minimum length was 6 cm, mean length was 7.13 cm. In case of females, the maximum length of great toe was 7.6 cm and minimum length was 5.1 cm; mean length of right great toe was 6.37 cm. The Z value was 11.07 and P value was <0.0001 Significant.

**Table No. 3: Table Showing Comparison of Great Toe Length in Male & Females**

<table>
<thead>
<tr>
<th>Finding</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum</td>
<td>8.6</td>
<td>7.6</td>
</tr>
<tr>
<td>Minimum</td>
<td>6</td>
<td>5.1</td>
</tr>
<tr>
<td>Mean</td>
<td>7.13</td>
<td>6.37</td>
</tr>
<tr>
<td>SD</td>
<td>0.51</td>
<td>0.46</td>
</tr>
<tr>
<td>Z value</td>
<td>11.07</td>
<td></td>
</tr>
<tr>
<td>P value</td>
<td>&lt;0.001</td>
<td>Significant</td>
</tr>
</tbody>
</table>

**Table No. 4: Table Showing the Linear Regression Equation for Stature Estimation from Great Toe Length in Males in Various Age Groups**

<table>
<thead>
<tr>
<th>AGE</th>
<th>SIDE</th>
<th>EQUATION</th>
<th>SE</th>
<th>R</th>
<th>R²</th>
</tr>
</thead>
<tbody>
<tr>
<td>18</td>
<td>Right</td>
<td>S=65.04+15.18xRGL</td>
<td>5.67</td>
<td>0.76</td>
<td>0.58</td>
</tr>
<tr>
<td></td>
<td>Left</td>
<td>S=75.85+13.78xLGL</td>
<td>6.44</td>
<td>0.67</td>
<td>0.46</td>
</tr>
<tr>
<td>19</td>
<td>Right</td>
<td>S=125.90+6.48xRGL</td>
<td>6.81</td>
<td>0.44</td>
<td>0.19</td>
</tr>
<tr>
<td></td>
<td>Left</td>
<td>S=123.77+6.88xLGL</td>
<td>6.74</td>
<td>0.45</td>
<td>0.21</td>
</tr>
<tr>
<td>20</td>
<td>Right</td>
<td>S=141.07+4.40xRGL</td>
<td>6.65</td>
<td>0.39</td>
<td>0.15</td>
</tr>
<tr>
<td></td>
<td>Left</td>
<td>S=148.16+3.45xLGL</td>
<td>6.85</td>
<td>0.33</td>
<td>0.10</td>
</tr>
<tr>
<td>21</td>
<td>Right</td>
<td>S=188.85+2.53xRGL</td>
<td>8.22</td>
<td>0.08</td>
<td>0.00</td>
</tr>
<tr>
<td></td>
<td>Left</td>
<td>S=160.42+1.53xLGL</td>
<td>8.22</td>
<td>0.07</td>
<td>0.00</td>
</tr>
<tr>
<td>22</td>
<td>Right</td>
<td>S=172.68-0.48xRGL</td>
<td>7.57</td>
<td>0.02</td>
<td>0.00</td>
</tr>
<tr>
<td></td>
<td>Left</td>
<td>S=215.24-6.27xLGL</td>
<td>7.35</td>
<td>0.24</td>
<td>0.05</td>
</tr>
<tr>
<td>23</td>
<td>Right</td>
<td>S=136.44+5.08xRGL</td>
<td>6.08</td>
<td>0.43</td>
<td>0.19</td>
</tr>
<tr>
<td></td>
<td>Left</td>
<td>S=124.41+6.75xLGL</td>
<td>6.02</td>
<td>0.45</td>
<td>0.20</td>
</tr>
<tr>
<td>ALL</td>
<td>Right</td>
<td>S=122.70+6.94xRGL</td>
<td>6.75</td>
<td>0.46</td>
<td>0.21</td>
</tr>
<tr>
<td></td>
<td>Left</td>
<td>S=128.00+6.27xLGL</td>
<td>6.91</td>
<td>0.42</td>
<td>0.18</td>
</tr>
</tbody>
</table>

S = Stature, RGL & LGL = Right and Left great toe lengths, SE = Standard Error of the Estimate, R = Coefficient of multiple co-relation, R² = Coefficient of Determination

In case of male participants, the regression equation for stature estimation from length of right great toe was S=122.70+6.94xRGL, The SE, R and R² values for this equation were 6.75, 0.46 and 0.21 respectively. The regression equation for stature estimation from length of left great toe was S=128.00+6.27xLGL, the SE, R, R² values were 6.91, 0.42 and 0.18 respectively.

**Table No. 5: Table Showing the Linear Regression Equation for Stature Estimation from Great Toe Length in Females in Various Age Groups**

<table>
<thead>
<tr>
<th>AGE</th>
<th>SIDE</th>
<th>EQUATION</th>
<th>SE</th>
<th>R</th>
<th>R²</th>
</tr>
</thead>
<tbody>
<tr>
<td>18</td>
<td>Right</td>
<td>S=101.95+8.76xRGL</td>
<td>4.76</td>
<td>0.61</td>
<td>0.37</td>
</tr>
<tr>
<td></td>
<td>Left</td>
<td>S=102.49+8.81xLGL</td>
<td>4.87</td>
<td>0.58</td>
<td>0.34</td>
</tr>
<tr>
<td>19</td>
<td>Right</td>
<td>S=112.98+6.96xRGL</td>
<td>5.55</td>
<td>0.56</td>
<td>0.31</td>
</tr>
<tr>
<td></td>
<td>Left</td>
<td>S=107.91+7.95xLGL</td>
<td>5.32</td>
<td>0.60</td>
<td>0.37</td>
</tr>
<tr>
<td>20</td>
<td>Right</td>
<td>S=127.73+4.57xRGL</td>
<td>4.82</td>
<td>0.44</td>
<td>0.19</td>
</tr>
<tr>
<td></td>
<td>Left</td>
<td>S=119.95+5.86xLGL</td>
<td>4.63</td>
<td>0.51</td>
<td>0.26</td>
</tr>
</tbody>
</table>
In case of female participants, the regression equation for stature estimation from length of right great toe was \( S=116.26+6.50 \times RGL \), The SE, R and \( R^2 \) values for this equation were 5.14, 0.51 and 0.26 respectively. The regression equation for stature estimation from length of left great toe was \( S=112.19+7.26 \times LGL \), the SE, R, \( R^2 \) values were 5.03, 0.54 and 0.29 respectively.

**DISCUSSION**

The present study is aimed at estimation of stature from percutaneous measurement of length of great toes (right and left) by formulating linear and multiple regression equations. The measurements were subjected to statistical computation using SPSS software to derive regression formula for all the parameters.

**Age:** A study population of 200 subjects (100 male and 100 female) distributed in the age group of 18 to 23 were considered. Age-wise distribution of participants was as per Table No. 1.

A study on almost same age group of participants was conducted by Rani M et al (2011) in which participants of age group 18 to 22 years were studied to find out regression equation for stature estimation from measurement of foot length. However different researchers have conducted study on participants of different age groups.


We have considered the subjects in the age group between 18 to 25 years for our study, since the stature of a person attains maximum and remain constant after the age of 21 years.


Since the stature differs with gender as established by different studies worldwide, we considered it prudent to stratify our study population by gender as done by numerous other researchers.

**Stature:** In our study, stature in males as shown in Table No. 2 is ranging from 155-197.3 cms with the mean of 172.4 +/- 7.60. Similarly stature in females is ranging...
from 143 – 176 cms with the mean of 158.11+/-5.96 cms. It is observed that males have taller stature as compared to females. The fact that males are constitutionally taller than females as the age of puberty being 2-3 years later in them as compared to females gives them, additional time for growth. This explains that formula for one sex cannot be applied for other sex.

**Length of Great Toe: No previous linear regression equations for determination of stature from length of great toes are available for comparison with present study.** The regression equations derived in this regard during present study are as follows

**Males:**
S=122.70+6.94xRGL, S= stature, RGL= right great toe length
S=128.00+6.27xLGL, S= stature, LGL= left great toe length

**Females:**
S=116.26+6.50xRGL, S= stature, RGL= right great toe length
S=112.19+7.26xLGL, S= stature, LGL= left great toe length.

It may also be emphasized that all measurement exhibit high value of correlation in both gender and thus any of these lengths would offer a reliable correlation for stature estimation in both males and females

**Ethical clearance:** Taken from MGM’s Ethics Committee for Research on Human Subjects (MGM-ECRHS), December 2014

**Source of funding:** Self

**Conflict of Interest:** Nil

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Fatal Burns in a Semiurban District of Central India-
An Autopsy Study

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ABSTRACT

Background: Burns constitute a major cause of unnatural deaths encountered in Medico-legal Practice. The present study was performed with an aim to evaluate the magnitude and socio-cultural factors related to the problem of burns in Etawah district of Uttar Pradesh. Owning to preponderance of rural and semiurban population in this area there is lack of awareness regarding safe cooking practices and various other fire safety measures which thereby stresses the need of framing various prevention strategies specific for this region to reduce the incidence of burn fatalities.

Material and Method: A one year retrospective study was conducted from 1 April 2016 to 31 March 2017 on burn cases that were brought to the mortuary of the district. During this period, out of 1845 cases that were subjected to medico-legal autopsy, 230 cases of burn deaths were selected for the present study.

Observation: Out of 230 cases of burn mortalities 90% of the fatalities were due to thermal burns and 10% were due to electric burns. Gender analysis revealed preponderance of female victims 149(64.8%) over male victims 81(35.2%). The commonest age group affected was 21-30 years. Married males(74%) and married females(81.8%) outnumbered unmarried males and females. Highest incidence of burn mortalities were observed in month of November(13.9%). A significantly high mortality rate was noticed in the victims with >41 % burns and amongst them, the utmost mortality was reported in victims with > 81% of the burnt surface area. Septicaemia was observed as a major cause of death (57.82%) among all the cases.

Conclusion: The present study highlights the pattern of burn mortalities in Etawah region. We recommend organisation of awareness programmes for the residing population to promote fire safety education. For reducing or preventing ‘bride burning’ proper implementation of existing laws, along with newer stricter legislation to abolish dowry-related crime is required. Fire escape systems should be installed in home in urban settings. To ameliorate the care of people affected by burns all Hospitals should establish proper upgraded burn unit.

Keywords: burn mortalities, Septicaemia, bride burning, Pradhan Mantri ujjwala Yojana

INTRODUCTION

Death due to thermal and electrical burn injuries constitute a major cause of unnatural deaths encountered in medico-legal practice. Thermal burns occur mainly in home and workplace. Children and women are usually burned in domestic kitchens due to widespread use of floor level cooking arrangements, lack of appropriate safety measures while using liquified petroleum gas, accidental spillage from utensils containing hot liquids or from explosion of kerosine stoves. Men are most likely to suffer in the workplace due to fire and electrical burns. Fatal electrical injuries occur due to stepping on loose live wires lying on ground, use of faulty appliances and crude electric rods for boiling water, or while working on electric lines or poles.

Meanwhile, in dealing with deaths of women from burns in our country a unique category termed as ‘Dowry deaths’ is available which is not mentioned in other jurisdictions, when the deceased is female and has been
married for less than seven years (section 304B IPC). The seemingly high number of such deaths in the recent past, despite of all efforts of Indian Government to curb the menace of bride burning has raised significant concern.

Numerous studies have been conducted in various hospitals across the country regarding various aspects of burn but despite of very large no. of burn deaths in Etawah region no information is available. Hence the present study was performed to collect the regional epidemiological data with an aim to evaluate the magnitude of burn mortality and various socio-cultural factors leading to such fatalities. A significantly high reporting of burn fatalities in Etawah could be attributed to the presence of UPUMS, Saifai, a tertiary care hospital which caters to most of the emergencies in Etawah as well as referral cases from nearby districts of Auraiya, Etah, Mainpuri, Farukhabad, and Kannauj.

Owing to preponderance of rural and semiurban population in this area there is lack of awareness regarding safe cooking practices and various other fire safety measures which thereby stresses the need of framing various prevention strategies specific for our region to reduce the incidence of burn fatalities.

MATERIAL AND METHOD

A one year retrospective study was conducted on burn cases that were brought to the mortuary of Etawah district during the period from 1 April 2016 to 31st March 2017. During this time frame a total of 1845 medico-legal autopsies were conducted; out of which 230 cases of unnatural deaths were due to burns. The age and sex of the deceased, marital status, body surface area involved, survival period and cause of death along with additional information in cases of alleged dowry deaths were ascertained from the autopsy records. We had also tried to study the association of burn mortalities with the month of presentation.

OBSERVATIONS

The following observations were made

<table>
<thead>
<tr>
<th>Table 1: Distribution of cases based on type of burn</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of Burn</td>
</tr>
<tr>
<td>---------------</td>
</tr>
<tr>
<td>Thermal burn</td>
</tr>
<tr>
<td>Electric burn</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 2: Distribution of cases based on Age and Gender</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age group</td>
</tr>
<tr>
<td>-----------</td>
</tr>
<tr>
<td>&lt;10</td>
</tr>
<tr>
<td>11-20</td>
</tr>
<tr>
<td>21-30</td>
</tr>
<tr>
<td>31-40</td>
</tr>
<tr>
<td>41-50</td>
</tr>
<tr>
<td>51-60</td>
</tr>
<tr>
<td>61-70</td>
</tr>
<tr>
<td>&gt;70</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 3: Distribution of cases based on marital status of deceased</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marital status</td>
</tr>
<tr>
<td>----------------</td>
</tr>
<tr>
<td>Married</td>
</tr>
<tr>
<td>Unmarried</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 4: Distribution of cases based on month of sustaining injuries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Month</td>
</tr>
<tr>
<td>---------------------</td>
</tr>
<tr>
<td>April 2016</td>
</tr>
<tr>
<td>May 2016</td>
</tr>
<tr>
<td>June 2016</td>
</tr>
<tr>
<td>July 2016</td>
</tr>
<tr>
<td>Aug 2016</td>
</tr>
<tr>
<td>Sept 2016</td>
</tr>
<tr>
<td>Oct 2016</td>
</tr>
<tr>
<td>Nov 2016</td>
</tr>
<tr>
<td>Dec 2016</td>
</tr>
<tr>
<td>Jan2017</td>
</tr>
<tr>
<td>Feb 2017</td>
</tr>
<tr>
<td>Mar2017</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 5: Distribution of cases based on total body surface area involved</th>
</tr>
</thead>
<tbody>
<tr>
<td>TBSA</td>
</tr>
<tr>
<td>------</td>
</tr>
<tr>
<td>0-20%</td>
</tr>
<tr>
<td>21-40%</td>
</tr>
<tr>
<td>41-60%</td>
</tr>
<tr>
<td>61-80%</td>
</tr>
<tr>
<td>81-100%</td>
</tr>
</tbody>
</table>
Table 6: Distribution of cases according to the cause of death

<table>
<thead>
<tr>
<th>Cause of death</th>
<th>No. of cases</th>
<th>% of cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shock (Neurogenic and Hypovolemic)</td>
<td>84</td>
<td>36.5</td>
</tr>
<tr>
<td>Septicemia</td>
<td>146</td>
<td>63.4</td>
</tr>
</tbody>
</table>

DISCUSSION

We came across 230 cases of burn deaths which constituted 12.5% of total medico-legal autopsies performed during the study period. Among this 90% of the fatalities were due to thermal burns and 10% were due to electric burns. Contrastingly, Zopate Pravin R\(^1\) and Kumar V\(^2\) have reported very low mortality rates in electrical burns i.e. 3.9% and 2.5% respectively. In our study most of the electric burn victims were males (95.6%) which is in concordance with findings of Ghuliani et al\(^3\) who reported 90.9% of electrical burn fatalities in males, while Dandapat et al\(^4\) mentioned all electric burn mortalities only in males.

Gender analysis revealed preponderance of female victims 149(64.8%) over male victims 81(35.2%) which is in contrast to the usual injury pattern, where rates for the various injury mechanisms tend to be higher in males than females. The higher risk can be attributed to an obvious reason that household and kitchen responsibilities are mostly carried out by females in our society. Besides this the dress pattern i.e. use of clothes with flowing ends like saree and dupatta which are made of synthetic materials further contribute to such injuries as they are more prone to catch fire. These observations were in concordance with other studies from various regions of India\(^5,6,7\). Whereas a male predominance was observed by Memchoubi P et al\(^8\) in a Manipal based study and in other similar studies carried out in western countries\(^9,10\).

In this study it was noteworthy that the commonest age group affected was 21-30 years with an incidence of 33.04% in females and 11.73% in males. Consistent findings were reported by B L Chaudhary\(^11\) and Zopate Pravin R\(^1\). This seems to be more relevant in context of our society where adults in this age group are entrusted with responsibilities both at home and outside as they are considered more productive while the older adults are endowed with more of supervisory role of looking after young children rather than active work. The youngest patient in our study series was a 14 month old and the eldest was 105 year old. A significantly high rate of 16.9% was noticed in females in age group 11-20 years pointing towards early involvement of young females in household roles. Regarding the marital status, we found that married males (74%) and females (81.8%) outnumbered unmarried males and females. This was in compliance with Usama B. Ghaffar\(^7\) who mentioned a rate of 60.8% in married males and 82.7% in married females in his study.

We came across 62 cases alleged of dowry death out of which 10(16%) cases were below 20 years of age, 30(48.4%) cases constituted 21-25 age group, 20(32.2%) cases were in 26-30 age group and only 2(3%) cases were above 30 years. Such a high incidence of 27% not only point towards the deep rooted social evil prevalent in our society but also the poor implementation of laws pertaining to dowry prohibition and violence against women. At the same time we should keep in mind the probability of misuse of IPC section 304(b). There is no presumption that every suicide committed by a married woman in her in-laws' house or at her parents' house has to be because she was suffering harassment at the hands of her husband or her in-laws.

Highest incidence of burn mortalities were observed in month of November (13.9%) which can be attributed to firecracker accidents during customary celebration of Diwali festival, followed by large no. of cases in month of May (13.5%) and April (10.86%). This is in accordance with the findings of Dhillon S and Sekhon S\(^12\) who reported high number of cases in summers. 10.43% cases were noticed in month of January, the probable explanation is use of open wood fire and angithi for warmth during this period which increases the risk of accidental injuries.

In the present study, a significantly high mortality rate was noticed in the victims with >41% burns and amongst them, the utmost mortality was reported in victims with > 81% of the burnt surface area, thus demonstrating that such an extent of the burn is usually incompatible with the life. This was in accordance with the findings of Kumar V\(^13\) and Mangal HM\(^14\). Septicaemia was observed as a major cause of death (57.82%) in the present study which is in accordance with the findings of Zanjad NP\(^15\) and Singh D\(^16\). This is in contrast to findings of Mazumbder A\(^17\) who has mentioned shock as the commonest cause of death in his study.
CONCLUSION

The present study highlights the pattern of burn mortalities in Etawah region. We have also elicited the possible etiological factors for such injuries with an aim to find out the possibilities of decreasing the incidences of burn deaths in this area. As burns are preventable we emphasize on giving more priority to burn prevention rather than burn care. Thus we recommend organisation of awareness programmes for the residing population to promote fire safety education. Our study shows a very high incidence of female deaths, especially in their most productive and active years of life. Females succumb to such injuries during open fire cooking or while using inherently unsafe cookstoves which ignite their loose clothings. We appreciate the initiative of Indian Government in launching Pradhan Mantri ujjwala Yojana (PMUY) scheme to extend availability of LPG cooking gas to below poverty line households for no cost. This will certainly help in promoting use of safer cookstoves and bring down the dependence on earthen chulaha which uses coal/wood as fuel and lacks safety features. Besides this interpersonal violence is also an important factor. One of the solutions put forward for reducing or preventing ‘bride burning’ is proper implementation of existing laws, along with newer stricter legislation to abolish dowry-related crimes.

In urban settings fire escape systems should be installed in home specifically on upper floors use of emergency ladder is suggested in event of fire. Fire extinguisher should be installed in the kitchen and house members should know how to use it. To prevent electrical burn injuries we suggest certain precautionary measures such as early recognition of warning signs in houses like overloaded circuits, frayed cords or sparks from outlets or switches. Use of only authorised ISI marked electrical appliances is advocated, Parents need to be more vigilant in case of toddlers and young children in houses. Electric poles should be well away from rooftops and all transformers should be well guarded and inaccessible to public.

To ameliorate the care of people affected by burns all hospitals should establish proper upgraded burn units. All Primary and secondary health care centres need to be equipped with proper transportation facilities for referral to nearest specialised centres. We thus conclude that application of the proposed advances in prevention and care will certainly help in bringing significant reductions in rates of burn related deaths.

Conflict of Interest: None

Source of Funding: nil

Ethical Clearance: taken

REFERENCES

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A Prospective Study of Autopsy Findings in Deaths due to Hanging in Kanpur District of Uttar Pradesh, India

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ABSTRACT

Background: Hanging is ligature compression of neck by weight of one’s own body due to suspension. The current study was done with the aim of studying the external and internal postmortem findings in cases of deaths due to hanging in Kanpur region of U.P. and to correlate it with the established findings by previous authors.

Material and Method: A prospective study was conducted in the department of forensic medicine in GSVM Medical college Kanpur from jan 2013 to jan 2014. During that period out of 3667 cases subjected to medicolegal autopsy, 348 cases of hanging were selected for the present study.

Observation: We found that 96.55% cases presented with complete hanging and atypical hanging was found in 95.11% cases. The mark was obliquely placed in 100% cases and was above the thyroid cartilage in 92.24% cases. Dupatta(27.29%) was the most common ligature material used. Dribbling of saliva considered as hallmark of antemortem hanging was present in 77.29% cases and 85.6% cases had glove and stocking type of postmortem lividity. The fracture of thyroid cartilage was noted in 2.5% cases.

Conclusion: Under all circumstances it is crucial for the forensic expert to be able to consider and detect all autopsy findings as described here in order to reach reasonable medical conclusions on the cause and manner of death in each individual investigation of hanging death. Our study also highlights the importance as well as need for use of histopathological examinations which can show vital reaction changes and hence are useful for labelling Ante-mortem hanging in doubtful cases.

Keywords: Ligature material, atypical hanging, salivary stains, histopathological study.

INTRODUCTION

Hanging is that form of asphyxia which is caused due to compression of the neck by means of ligature round the neck, constricting force being the weight of the body (complete hanging) or a part of the body weight (partial hanging). It accounts for a large proportion of medicolegal autopsy cases as it is a preferred method of suicide because of its relatively painless nature and rapid loss of conciousness. The various Medicolegal queries which arise in cases of death due to hanging are whether death is caused due to hanging like in situations where allegations of postmortem suspension of body are made,

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finding leads to derivation of an inconclusive opinion. A number of studies have been conducted in recent past, in various hospitals across the country pointing towards various forms of violent asphyxial deaths and there medicolegal aspects. Our study is significant as it is of its first kind to evaluate and tabulate the autopsy findings of deaths due to hanging in Kanpur region of central Uttar Pradesh.

**MATERIAL & METHOD**

The present study is a prospective study which was carried out from January 2013 to January 2014 in the department of forensic medicine in GSVM Medical college Kanpur. During that period 3667 bodies were brought for medicolegal autopsy in the mortuary of Halet Hospital and GSVM Medical college Kanpur, the data of 348 cases of deaths due to hanging were recorded compiled and analysed for the present study. External and internal postmortem findings were observed meticulously with special reference to injuries to neck structures. During observation of ligature mark, various parameters like its site, size, level, and direction were noted. Information on type of ligature material was also collected by taking history from police and relatives and examination of ligature itself when possible in this study.

**OBSERVATIONS**

The observations of our study are as follows:

Table 1: Shows distribution of cases on the basis of degree of suspension

<table>
<thead>
<tr>
<th>Degree Of Suspension</th>
<th>No</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complete</td>
<td>336</td>
<td>96.55</td>
</tr>
<tr>
<td>Partial</td>
<td>12</td>
<td>3.44</td>
</tr>
<tr>
<td>Total</td>
<td>348</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 2: Shows distribution of cases according to position of knot

<table>
<thead>
<tr>
<th>Position of knot</th>
<th>No</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atypical</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Left side of neck</td>
<td>128</td>
<td>36.78</td>
</tr>
<tr>
<td>Right side of neck</td>
<td>202</td>
<td>58.04</td>
</tr>
<tr>
<td>Front side of neck</td>
<td>1</td>
<td>0.28</td>
</tr>
<tr>
<td>Typical</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Over the occiput</td>
<td>17</td>
<td>4.88</td>
</tr>
<tr>
<td>Total</td>
<td>348</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 3: Shows distribution of cases according to the level of ligature mark

<table>
<thead>
<tr>
<th>Position of ligature Mark</th>
<th>No</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Above thyroid cartilage</td>
<td>321</td>
<td>92.24</td>
</tr>
<tr>
<td>Over thyroid cartilage</td>
<td>27</td>
<td>7.75</td>
</tr>
<tr>
<td>Below the thyroid cartilage</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>348</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 4: Shows distribution of cases according to the direction of ligature mark

<table>
<thead>
<tr>
<th>Direction of ligature mark</th>
<th>No</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oblique</td>
<td>348</td>
<td>100</td>
</tr>
<tr>
<td>Horizontal</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>348</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 5: Shows distribution of cases according to the ligature material

<table>
<thead>
<tr>
<th>Material</th>
<th>No</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soft</td>
<td>217</td>
<td>62.35</td>
</tr>
<tr>
<td>Dupatta</td>
<td>95</td>
<td>27.29</td>
</tr>
<tr>
<td>Saree</td>
<td>59</td>
<td>16.96</td>
</tr>
<tr>
<td>Bed sheet</td>
<td>13</td>
<td>3.73</td>
</tr>
<tr>
<td>Lungi</td>
<td>37</td>
<td>10.63</td>
</tr>
<tr>
<td>Other</td>
<td>13</td>
<td>3.73</td>
</tr>
<tr>
<td>Hard</td>
<td>131</td>
<td>37.64</td>
</tr>
<tr>
<td>Electric wire</td>
<td>48</td>
<td>13.79</td>
</tr>
<tr>
<td>Jute rope</td>
<td>20</td>
<td>5.7</td>
</tr>
<tr>
<td>Nylon rope</td>
<td>63</td>
<td>18.1</td>
</tr>
<tr>
<td>Total</td>
<td>348</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 6: shows findings of external examination

<table>
<thead>
<tr>
<th>Feature</th>
<th>Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dribbling Of Saliva</td>
<td>269</td>
</tr>
<tr>
<td>Protrusion Of Tongue</td>
<td>47</td>
</tr>
<tr>
<td>Fecal Incontinence</td>
<td>1</td>
</tr>
<tr>
<td>Seminal Emmision</td>
<td>18</td>
</tr>
<tr>
<td>Urinary Incontinence</td>
<td>31</td>
</tr>
<tr>
<td>P.M. Staining On Lower Limb</td>
<td>298</td>
</tr>
</tbody>
</table>

Table 7: shows findings of internal examination of neck

<table>
<thead>
<tr>
<th>SubCutaneous Tissue</th>
<th>While glistening</th>
<th>Contused</th>
<th>Fracture of Thyroid Cartilage</th>
<th>Fracture of Hyoid Cartilage</th>
<th>Neck Muscle contusion</th>
<th>Internal Tear of Carotid artery</th>
</tr>
</thead>
<tbody>
<tr>
<td>While glistening</td>
<td>348</td>
<td>0</td>
<td>9</td>
<td>0</td>
<td>37</td>
<td>0</td>
</tr>
</tbody>
</table>
DISCUSSION

In this study we came across a total number of 348 cases of deaths due to hanging and we had observed that complete hanging was present in 336 (96.55%) cases and partial hanging in 12 (3.44%) cases which is in accordance with the findings of the studies conducted by T.Saisudheer¹ and M. Ahmad² whereas Mallikarjun S Ballur³ reported that partial hanging outnumbered the complete hanging cases in their study. Such a high incidence of complete hanging might be ascribed to firm motive of an individual to commit suicide.

Present study showed maximum cases 331(95.11%) presented with atypical hanging when compared to typical hanging cases which were found to be 17(4.88%). It was also noted that among the atypical hanging cases the commonest site of the knot was right mastoid region in 202 (58.04 %) cases followed by 128 (36.78 %) cases which had the knot on left mastoid region whereas it was found in front of neck only in a single case. This is in compliance to the findings of V. Dekal⁴ who found typical hanging in 4.4% cases and atypical hanging in 95.6% cases with the position of knot on left side of neck in 43.1% and on right side in 56.9% cases.

The most common position of ligature mark was above thyroid cartilage in 321(92.24%) cases followed by 27(7.75%) cases where it was over the thyroid cartilage whereas it was absent below thyroid cartilage. As per Sadikhusen⁵ 80% cases had the ligature mark above thyroid cartilage and 15.56% cases on the thyroid cartilage but he mentioned a high incidence rate of 4.4% showing ligature mark below thyroid cartilage. Consistent findings were reported by Sharma BR and Harish D⁶ showing 84.62% and 15.3% cases above and at the level of thyroid respectively.

In our study we encountered that all the cases presented with an oblique ligature mark passing upwards and no horizontal mark was observed. Dr. SH Bhosle⁷ found (98.81%) cases with oblique ligature mark and 1.19% cases with horizontal ligature mark.

Considering the information gathered from the police record and from the relatives of the deceased and from examination of the ligature material, wherever it has been sent along with the dead body it was observed that the maximum people used soft ligature material like Dupatta, Saree, Muffler and Lungi (62.3%) whereas 37.64% cases used hard ligature materials like nylon rope, jute rope, and electric wire. We have also noted that Dupatta was most commonly used material among soft ligatures and nylon rope among hard ligatures. The probable reason of high incidence of there use could be that Dupatta is a very common dress material used by Indian females in almost all families and Nylon rope is cheap, easily available due to common use for various domestic purposes. However the ligature material used by the victim for hanging may be anything available at that moment, which includes any household article or belongings of the victim. This view is further strengthened by the findings in our study which showed that other ligature materials used for hanging were sari, bedsheet, lungi, jute rope, and electric wire. Contrary to this Niranjan Sahoo et al⁸ mentioned that the most commonly employed material was hard ligatures as compared to soft ligatures but a similar finding in his study was that he also noted that Dupatta was most commonly used material among soft ligatures.

Dribbling of saliva, surest sign of antemortem hanging was observed as dried salivary stains and were found in 269 (77.29%) cases which is similar to finding of Patel AP et al⁹ who noted such stains in 71% cases and is contrary to findings of Ashok Kumar Samanta et al¹⁰ who observed only 32.31% cases with dribbling of saliva. In 298 (85%) cases glove and stocking type of postmortem staining was present whereas in 15% cases it was found over the back, possible explanation could be that the body was noticed by the relatives within two hrs of suspension, removed and placed in a prone position. In our study Involuntary discharge was seen in only 1 case. variable observation was made where about 11 % of victims had involuntary discharge¹¹. Involuntary discharge is often encountered in cases of hanging due to sudden raised intra-abdominal pressure and/or relaxation of sphincter muscles after death. Tongue protrusion was found in 13.5% of cases whereas Sudheer TS¹² reported protrusion and clinching of tongue in 50% of cases of hanging deaths. The tongue projects because of upward pressure on the larynx and root of the tongue.

The fracture of thyroid cartilage was noted in 9(2.5%) cases which is consistent with the finding of Dr. SH Bhosle¹³ and Meera et al¹⁴ who mentioned 2.38% as the incidence rate of thyroid cartilage fracture in there studies but they reported a significantly high incidence of hyoid bone fracture as 15.47% and 3.57% respectively.
which was not observed in any case in our study. Elfawal et al. and Naik et al. did not find any fracture of hyoid bone or thyroid cartilage in their study. There is wide variations of hyoid bone fracture as mentioned by Chormunge Patil et al. as 7.14% and Tripude BH et al. as 64.51%. It has been demonstrated in numerous studies that the incidence of fractures increases with advancing age because neck structures become more calcified and brittle, thus more liable to fracture. Thus the age composition of the study group, material of ligature and type of hanging probably plays a role in sustaining neck structure injuries and thus is expected to vary from one study to other.

**CONCLUSION**

The present study tries to emphasize that ligature mark is a vital evidence of asphyxial deaths hence its keen evaluation along with study of other external features is mandatory. But sometimes the external findings may be inconclusive and in such situations internal postmortem findings are helpful. Thus a meticulous external and internal examination of body along with correct interpretations of findings should be done in all cases of deaths due to hanging. Under all circumstances it is crucial for the forensic expert to be able to consider and detect all autopsy findings as described here in order to reach reasonable medical conclusions on the cause and manner of death in each individual investigation of hanging death.

Transverse tears in the Carotid arteries were not seen in any case on naked eye internal examination but there is a possibility that if subjected to Histopathological examination, we could have detected disruption of intimal layer of Carotid artery and thus it was a limitation of our study. We agree with that the effect of pressure on layers of skin can be seen on Histo-pathological study showing vital reaction changes which is useful for labelling it as Ante-mortem hanging. This highlights the importance as well as urgent need for use of such microscopic studies along with the opinion of forensic pathologist in such cases.

**Conflict of Interest:** None

**Source of Funding:** nil

**Ethical Clearance:** taken

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11. Ballur Mallikarjun S. Thesis, 2013 Analytical Study Of Deaths Due To Hanging Cases Reported At Dr. B. R. Ambedkar Medical College Mortuary During 2010-2012


A Study of Suicidal Death In Nagpur

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2Professor, Forensic Medicine, Govt. Medical College, Gondia, Maharashtra, India;
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4Associate Professor, Forensic Medicine, Govt. Medical College, Nagpur, Maharashtra, India

ABSTRACT
‘Suicide is characterized as the final common pathway of diverse circumstances, of an interdependent network rather than an isolated cause, a web of circumstances tightening around a single time and space’1. The maximum number of suicide in young adult (20-40 years) Maximum number of cases was in young adult (20-40 years). Males nearly two times outnumbered the females. Majority were Hindus. Maximum number of suicide occurred in summer. Maximum suicidal death cases occurred in morning (6am to 11:59 am).

Keywords: Suicide, young adult, summer and morning.

INTRODUCTION
‘Suicide is characterized as the final common pathway of diverse circumstances, of an interdependent network rather than an isolated cause, a web of circumstances tightening around a single time and space’1. As per National crime record bureau data in the year 2013, the total unnatural death was 5,68,517 out of which 33,201 cases are of homicide, 4,00,517 cases of accident and 1,34,799 cases was of suicide respectively. It indicates that homicide account for 5.84%, accident 70.45% and suicide 23.72% respectively. This indicates that suicide is second most common cause of unnatural death. Out of all the suicide in India Maharashtra accounts for 12.33%, of which 523 suicides occur in study city accounting for 3.1% of total suicide in Maharashtra and 0.38% of suicide in India. This indicates that Maharashtra has maximum suicidal load all over the India.

The means adopted for committing suicides varies from easily available and less painful such as hanging, poisoning and drowning to more painful means such as self inflicted injuries, burning and shooting etc. In the year 2013 out of total suicide hanging accounted for 39.8%, poisoning 27.9%, Self-Immolation 7.4% and drowning 5.7% were the prominent means of committing suicides.5

The present study was performed to evaluate the various aspects of suicidal deaths in this region which may help the society to reduce the rate of suicide.

MATERIAL METHOD
The study was carried out in the Department of Forensic Medicine Government medical college and hospital, Nagpur. A prospective study was conducted from Jan 2013 to nov 2014. Various information was collected from inquest papers, autopsy report, information from relative, police, chemical analysis reports and treatment record. The data were analysed by using analysed and tabulated in Microsoft Excel software packages.

Inclusion criteria:
All the dead bodies brought to department of forensic medicine for medico-legal autopsy with history of suicidal death.

Exclusion criteria:
1. Unknown, unclaimed dead bodies.
2. Dead bodies known but no relatives available.
3. Cases where the manner of death is doubtful.
Cases where the proper history about all the assessing parameters taken in study could not be elicited from investigating officers and relatives.
RESULT

Table No: 1 Showing distribution of suicidal deaths with respect to sex.

<table>
<thead>
<tr>
<th>Sex</th>
<th>Number of cases</th>
<th>% of cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>196</td>
<td>65.34</td>
</tr>
<tr>
<td>Female</td>
<td>104</td>
<td>34.66</td>
</tr>
<tr>
<td>Total</td>
<td>300</td>
<td>100%</td>
</tr>
</tbody>
</table>

Table No: 02 Shows the suicidal deaths with respect to age

<table>
<thead>
<tr>
<th>Age</th>
<th>Male</th>
<th>%</th>
<th>Female</th>
<th>%</th>
<th>Total</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Child (0-12)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Adolescent (13-19)</td>
<td>11</td>
<td>3.67</td>
<td>22</td>
<td>7.33</td>
<td>33</td>
<td>11</td>
</tr>
<tr>
<td>Young adult (20-40)</td>
<td>106</td>
<td>35.33</td>
<td>67</td>
<td>22.33</td>
<td>173</td>
<td>57.67</td>
</tr>
<tr>
<td>Adult (41-64)</td>
<td>46</td>
<td>15.33</td>
<td>13</td>
<td>4.33</td>
<td>59</td>
<td>19.67</td>
</tr>
<tr>
<td>Older 65 or above</td>
<td>33</td>
<td>11</td>
<td>2</td>
<td>0.66</td>
<td>35</td>
<td>11.66</td>
</tr>
<tr>
<td>Total</td>
<td>196</td>
<td>65.33</td>
<td>104</td>
<td>34.67</td>
<td>300</td>
<td>100</td>
</tr>
</tbody>
</table>

Table No: 3 Shows the distribution of suicidal deaths with respect to religion

<table>
<thead>
<tr>
<th>Religion</th>
<th>Male</th>
<th>%</th>
<th>Female</th>
<th>%</th>
<th>Total</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buddhists</td>
<td>25</td>
<td>8.33</td>
<td>11</td>
<td>3.67</td>
<td>36</td>
<td>12</td>
</tr>
<tr>
<td>Christians</td>
<td>2</td>
<td>0.67</td>
<td>1</td>
<td>0.33</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Hindus</td>
<td>167</td>
<td>55.66</td>
<td>91</td>
<td>30.34</td>
<td>258</td>
<td>86</td>
</tr>
<tr>
<td>Muslims</td>
<td>2</td>
<td>0.67</td>
<td>1</td>
<td>0.33</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>196</td>
<td>65.33</td>
<td>104</td>
<td>34.67</td>
<td>300</td>
<td>100</td>
</tr>
</tbody>
</table>

Table No: 4 Distribution of suicidal deaths with respect to season

<table>
<thead>
<tr>
<th>Season</th>
<th>Male</th>
<th>%</th>
<th>Female</th>
<th>%</th>
<th>Total</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Summer</td>
<td>83</td>
<td>27.66</td>
<td>40</td>
<td>13.34</td>
<td>123</td>
<td>41</td>
</tr>
<tr>
<td>Winter</td>
<td>62</td>
<td>20.66</td>
<td>35</td>
<td>11.67</td>
<td>97</td>
<td>32.33</td>
</tr>
<tr>
<td>Rainy</td>
<td>51</td>
<td>17</td>
<td>29</td>
<td>9.67</td>
<td>80</td>
<td>26.67</td>
</tr>
<tr>
<td>Total</td>
<td>196</td>
<td>65.34</td>
<td>104</td>
<td>34.67</td>
<td>300</td>
<td>100</td>
</tr>
</tbody>
</table>

Table No: 5 Distribution of suicidal deaths with respect to time of committing suicide

<table>
<thead>
<tr>
<th>Period</th>
<th>Male</th>
<th>%</th>
<th>Female</th>
<th>%</th>
<th>Total</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Morning(6 am to 11:59 am)</td>
<td>77</td>
<td>25.67</td>
<td>42</td>
<td>14</td>
<td>119</td>
<td>39.67</td>
</tr>
<tr>
<td>Noon and after noon (12pm to 5:59 pm)</td>
<td>57</td>
<td>19</td>
<td>19</td>
<td>6.33</td>
<td>76</td>
<td>25.33</td>
</tr>
<tr>
<td>Evening (6pm to 11:59 pm)</td>
<td>45</td>
<td>15</td>
<td>36</td>
<td>12</td>
<td>81</td>
<td>27</td>
</tr>
<tr>
<td>Night (12am to 5:59 am)</td>
<td>17</td>
<td>5.67</td>
<td>7</td>
<td>2.33</td>
<td>24</td>
<td>8</td>
</tr>
<tr>
<td>total</td>
<td>196</td>
<td>65.34</td>
<td>104</td>
<td>34.67</td>
<td>300</td>
<td>100</td>
</tr>
</tbody>
</table>
**DISCUSSION**

**Sex:** In the current study, out of total 300 cases, 65.34% cases were male whereas 34.66% cases were females. The male: female ratio was 1.89:1. This indicates that males outnumbered the females almost two times.

Similar findings were seen between the studies This was in accordance with, , Mohammed Madadin et al, Patel V et al, Kinyanda E, MurkeyPankaj et al VikramPalimar et.al, Singh P et.al Nigam M et., al, Sharma BR et al, Bennett AT et al, Bennett AT et al, Roberts AP et al and Martinez AP et al, Deborah J Poteet

The maximum number of suicide in male attributed to various factor such as, in India males are sole bread earning member while female are subjected to household chores. Also males frequently face financial loss in business, debts, unemployment etc. As males are supposed to earn for the family they have to work in society because of this, there is mental pressure on him so males are more prone for suicide.

The most common factors responsible for suicidal death in female was torture by the in-laws. It is known fact that for the female after marriage she has to adjust totally in new environment. She not only has to adjust with her in laws and other relatives, but also mentally. She has to compromise with her wishes and dreams at every stage after marriage.

**Age:** In the current study out of total 300 cases, maximum number of cases were of young adults (20-40 years). Not a single case of suicide was seen in children (0-12years).

Our study is in accordance with studies of Kadu SS et al, Vijayamahantesh et al, Gururaj G, Tanna JA et al, Bardale et.al, R. Ponnudurai et al, Elfwal MA, Aauer Med, Rane A et al

The maximum number of suicide in young adult (20-40years) may be attributed to various factor such as: - Prevalence of psychiatric risk factors in youth especially conduct disorder, substance abuse or depression, a higher proportion of youth in society resulting increase competition for educational access or job opportunities and if not fulfilled may result in sense of hopelessness or depression in them and change in family structure.

They are at the threshold of building their career and have the most zeal and urge to be ahead of others. It was noticed that stress did not spare even the professional students like medical and engineering students who committed suicide after exams and results. Unsuccessful academics and romance were attributed to suicide in adolescents.

**Religion:** Hindus (86%) constituted the majority of the suicidal victims, followed by Buddhists (12%), Christians (1%) and Muslim (1%) respectively. This is in accordance with Vikram Palimar et.al, Kadu S, Tanna JA et al, Bardale et.al and.

Religion may be protective against suicide at both individual and societal level. This effect may be mediated by the degree to which a given religion sanctions protect against suicide. Islam provides clear rulings against suicide whereas Hinduism is less clear about suicide. Though Hinduism discourages the act, suicides committed in the name of religion or for religious rituals have been tolerated and even accepted. Buddhism and Christianity forbid suicide. The reason for this could be that Christianity has condemned suicide as sinful. Hindu population is the major population and in Hindu religion there are no strong injunctions against suicide.

**Season:** In present study, maximum number of suicides occurred in summer season (41%) followed by winter (32.33%) and rainy season (26.67%). The current study is in accordance with Kadu SS et al, Bardale et.al.

There is association between increased risk of suicide and hot weather. High temperatures have been found to lead individual to behave uninhibited, aggressive and in violent manner which might result in increased propensity for suicidal act. There are collective evidences indicating that subject with mental illness contribute inexplicably to overall incidence of suicide and that the occurrence and severity of some affective disorder, such as depression and mania, are more pronounced in summer period.

In the present study maximum suicidal deaths 39.67%cases occurred in morning (6am to11:59am) followed by evening (6pm to 11:59pm) 27% cases, afternoon (12pm to 5:59pm) 25.33% cases and night (12am to 5.59am) 8% cases respectively.

Our study is in accordance with Tanna JA et al and Bardale et.al.

Most of suicide (6 am to 12 pm) and (12 pm to 6 pm) were attributed to various factors such as, during this
period most of family members are busy in their work or many are in their office and suicide person gets a secured place to commit the suicide.

This high incidence during the evening and night hours gives room for the speculation, whether there is any association between suicidal behaviour, diurnal variation of the depressive mood and abnormal plasma cortisol levels in the evening and night hours as reported in many depressed patients.

SUMMARY AND CONCLUSIONS

Deaths are always painful for families and friends but some are more tragic than others. Suicide represents a major public health problem and a drain on our economy with loss of human resources. The current study was carried out with the aim to analyse and aware about the various aspect of suicide. and suggest the legal and preventive measures. Keeping in mind the significance and importance of knowing the scenario of suicides, the present study entitled as ‘Study of suicidal death in central Indian population’ was undertaken. Maximum number of cases was in young adult (20-40 years). Males nearly two times outnumbered the females. Majority were Hindus. Maximum number of suicide occurred in summer. Maximum suicidal death cases occurred in morning (6am to11:59 am).

No conflict of interest and no source of funding.

Ethical Approval. No: 156-57/2013 Date 24/01/2013.

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Dowry Death, a Global Issue that Demands Action

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ABSTRACT

Dowry may be broadly defined as gifts and valuables received in marriage by the bride, the bridegroom and his relatives. Though the main cause of dowry is the desire and aspiration of every parent to marry his daughter in a higher and a rich family to keep up or to add to his prestige and also to prove comforts and security to the daughter but the endless demands for cash or kinds slowly brings inevitable sorrows for the girl. All these factors provide a cumulative effect to increase the number of unnatural death in married women. In the present study, we have tried to find out various factors responsible for increasing incidence of dowry death in our society. We have studied 72 cases where married women had died within 7 years of married life with alleged history of dowry. The autopsies were conducted at the mortuary of Shimoga Institute of Medical Science (SIMS), Karnataka during the year of 2013 and 2014. Maximum incidence of alleged dowry death was found in the age group of 20 to 29 years, during first three years of marriage, among victims with lower educational status, and where the occupation of their husband was business. Commonest cause of death was burns, followed by poisoning and hanging. Based on the findings of our study, we have formulated suggestions to concerned authorities to decrease the incidence of dowry death.

Keywords: Dowry death, Anti dowry court, Special Police Unit for Women and Children

INTRODUCTION

Even though dowry has been illegal in India since 1961, it is still prevalent. Actual numbers are not known, but anecdotally about more than half of the weddings in the country involve dowry. Still, it’s rarely reported as a crime. Dowry gets reported only when the groom’s demands go beyond what the bride’s family can afford or when the bride is physically abused or, worse, killed, as cases that gained media attention show. In India unnatural causes accounted for 18 to 30 % of deaths in adult females especially in newly married females1. According to National Crime Record Bureau (NCRB) statistics, 91,202 dowry deaths are reported in the country from January 1, 2001 to December 31, 20122. Despite these high figures, evidences indicate that hundreds of murders, attempted killings and suicides are not at all reported because their family prefers to avoid publicizing the fact considering being a shameful incident. Moreover they disguise those deaths as accidents. Some of the consequences of dowry are domestic violence, abetment to suicide, dowry murder and the worst is female feticide. Even in recent years with good literacy rate and knowledge about social responsibility among boys as well as girls, dowry is rampant in this society leading to many deaths. Hence taking as well as giving dowry is one of the great curse to the human society which needs action. This present study is undertaken to evaluate the magnitude of deaths in women due to demand of dowry with a positive outlook towards the different patterns, social factors and medico legal aspects related to it.

MATERIAL AND METHODS

Source of data:
It was a descriptive cross-sectional study. Data was collected from autopsies conducted on dead bodies of married females at the mortuary of Shimoga Institute of Medical Science (SIMS), Karnataka during the year of 2013 and 2014 at Department of Forensic Medicine, Shimoga institute of medical science, Karnataka.

In this study we included those cases in which Married women had died within 7 years of married life (cases were registered under section 302, 304 (B), 306 or 498 (A of IPC) and those cases in which married women had died within 7 years of married life with
alleged history of dowry death and whose inquest was conducted by magistrate or police under 174 or 176 CrPC, but cases were not registered under any section of IPC at that time.

During this period a total of 1688 autopsies were conducted out of which 266 cases were unnatural deaths in married women and 72 deaths out of 266 occurred within seven years of their married life due to demand of dowry.

The details of the cases were obtained from the police inquest, history from the relatives of both parties regarding age, education, socio-economic status, duration of married life, amount of dowry paid during marriage and afterwards, any demand for dowry, time of incidence, site of occurrence, nature of harassment etc., hospital records, dying declarations, suicide notes, postmortem examination and chemical examination report etc.

The data so collected were entered in a pre-designed proforma, compiled, tabulated and were analyzed by using suitable statistical methods:
- Standard statistical method like proportion.
- Representing the data in the form of appropriate tables and graphs, to draw the correlation between the different factors and outcome.

**Exclusion criteria:**
- Manner of death concluded as natural after autopsy.
- Unidentified female bodies due to lack of proper history and proper socioeconomic background.
- Decomposed female bodies where injury marks are obscured totally.

**OBSERVATION**

In our present study, alleged dowry death cases constitute 2.01% of total autopsies done in the institution and take a share of 10.74% of all the autopsies done on female. Unnatural death in married female was found to be more predominant in the first seven years of marriage constituting 47.2% of total deaths in married women. Similar finding were observed by Jatti VB et al. who conducted study in Bangalore (271 - 46.32% alleged dowry death out of 585 autopsies). It shows that magnitude of alleged dowry death in newly married female is similar in different parts of India.

All the dowry death cases were distributed among the age group of 18 years to 38 years, in which prevalence was more within the range of 20-29 years with a share of 70.8% (51) cases and least after 30 years of age (Figure: 1), similar finding was derived by Agnihotri A et al. (27.81% cases in age group of 23 to 26 years, 25.83% cases in age group of 27 to 30 years, and least prevalence after 30 years of age). All though, this was only a tip of ice berg as most of the cases were not registered or made as accidental deaths or sometimes dowry harassments were not at all reported.

In the present study, among the married female 27.1% (72) cases were belonging to 0-7 years of married life. Among those 55.56% of cases were seen in first 3 years of married life and least cases were found after 7 years of married life (Table: 1). Similar findings were observed by Jatti VB et al., Radhika RH et al. and Arora P et al. (66.42%, 73.33% and 60.14% respectively within first three years of life). Reason for such findings is that usually demands of dowry by in laws is more during initial years of marriage, while during later years of marriage, as brides become settled with in-laws family and as they have children, in-laws stop demands of dowry to save their family. Moreover, during later period of marriage, most women have children, so they do not commit suicide thinking about future of their children.

Maximum cases of alleged dowry death were found where deceased’s educational status was lower (Illiterate or up to primary school) – 55.56%, and least cases were found where deceased were highly educated (Graduate of more) – 14.5% (Table: 5). Similar findings were observed by Arora P et al. (25.87% illiterate, 45.45% educated up to primary school and 2.80% were graduate). Reasons for such findings are awareness of well educated women about rights of women and women friendly dowry related laws, moreover they are economically independent, so, they choose dissolution of marriage than to become victim of cruelty by in-laws for dowry.

Maximum cases of alleged dowry death were found where occupation of deceased’s husband was business (44.12%), followed by labourers (29.41%), and least cases (2.94%) were found where deceased’s husband was government or private employee (Table: 3). On the other hand maximum number of cases of alleged dowry death were found in the victims who were housewives (88.2%) with least economic support and social security (Table: 4). In respect to occupation, similar results were observed in studies conducted by Kailash and Kulshrestha. In the study of Arora P et al., husbands of most victim were unemployed (40.60%). Reason for such findings is monetary needs of economically poor in-laws. They harass brides to get dowry to fulfill their need, and to end their sufferings, brides commit suicide.
Out of 72 cases 55.6% accounted for suicide and most of those suicides were directly related to the dowry harassment (Table: 2). 14 out of 28 cases of homicide were seen in 0-3 years of married life. In homicidal deaths, infliction of fire leading to burns was found to be the most common method adopted by the husband and in-laws for demand of dowry, which accounted for 46% of the total cases (33 cases) followed by poisoning, hanging and drowning. Least number of cases (5 cases) were found in drowning with a share of 7% of total out of which only 1 case was homicidal and rest was suicidal in nature (Figure:2). As most of the females were of rural origin poisoning by organophosphate was found to be more common. Burns injury was more predominantly seen in homicidal cases. On contrary to that, most of the poisoning and hanging cases were suicidal in nature. Similar findings were observed in the study of Jatti VB et al.\textsuperscript{3} and Agnihotri A et al.\textsuperscript{4} where burns was the commonest cause of death. Incidence of burns in dowry death is higher due to the fact that in laws usually choose burns to kill bride so they can save themselves by stating incidence as an accident in front of judiciary.

Table 1: Distribution of cases according to duration of marriage

<table>
<thead>
<tr>
<th>Duration of Marriage (Years)</th>
<th>No. of Cases</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤1</td>
<td>20</td>
<td>27.78</td>
</tr>
<tr>
<td>&gt;1 to ≤2</td>
<td>12</td>
<td>16.67</td>
</tr>
<tr>
<td>&gt;2 to ≤3</td>
<td>8</td>
<td>11.11</td>
</tr>
<tr>
<td>&gt;3 to ≤4</td>
<td>10</td>
<td>13.89</td>
</tr>
<tr>
<td>&gt;4 to ≤5</td>
<td>9</td>
<td>12.5</td>
</tr>
<tr>
<td>&gt;5 to ≤6</td>
<td>8</td>
<td>11.11</td>
</tr>
<tr>
<td>&gt;6 to ≤7</td>
<td>5</td>
<td>06.94</td>
</tr>
<tr>
<td>Total</td>
<td>72</td>
<td>100</td>
</tr>
</tbody>
</table>

Table No.2: Distribution of Dowry related cases according to the manner of death

<table>
<thead>
<tr>
<th>Manner</th>
<th>Frequency</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Homicidal</td>
<td>28</td>
<td>38.9</td>
</tr>
<tr>
<td>Suicidal</td>
<td>40</td>
<td>55.6</td>
</tr>
<tr>
<td>Suspicious</td>
<td>4</td>
<td>05.5</td>
</tr>
<tr>
<td>Total</td>
<td>72</td>
<td>100</td>
</tr>
</tbody>
</table>

Table No.3: Distribution of Dowry related cases according to occupation of husband

<table>
<thead>
<tr>
<th>Occupation of Husband</th>
<th>No. of Cases</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farmer</td>
<td>15</td>
<td>20.83</td>
</tr>
<tr>
<td>Labourer</td>
<td>21</td>
<td>29.17</td>
</tr>
</tbody>
</table>

Table No. 4: Distribution of Dowry related cases according to occupation of deceased

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Frequency</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business</td>
<td>32</td>
<td>44.44</td>
</tr>
<tr>
<td>Unemployed</td>
<td>02</td>
<td>02.78</td>
</tr>
<tr>
<td>Total</td>
<td>72</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 5: Distribution of cases according to educational status

<table>
<thead>
<tr>
<th>Educational status</th>
<th>No. of Cases</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Illiterate</td>
<td>16</td>
<td>22.50</td>
</tr>
<tr>
<td>Primary</td>
<td>24</td>
<td>33.06</td>
</tr>
<tr>
<td>High school</td>
<td>8</td>
<td>10.90</td>
</tr>
<tr>
<td>Higher secondary school</td>
<td>14</td>
<td>19.04</td>
</tr>
<tr>
<td>Graduate</td>
<td>10</td>
<td>14.50</td>
</tr>
<tr>
<td>Post Graduate</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>72</td>
<td>100</td>
</tr>
</tbody>
</table>
CONCLUSION

From the present study, it is clearly implied that though there are different laws in our country the crimes against women are rising in number day by day ranging from abuse, harassment, humiliation, dowry death to bride burning. All these result in declination in the male female ratio (1000:940 in India). Dowry related deaths are highly affected by lower education in bride, lower income of husband and maladjustment of bride in new family. We have sorted out following recommendations to decrease the burden of dowry deaths thereby to build a healthy society.

RECOMMENDATION

“A right is not what someone gives you; it’s what no one can take from you”- Ramsey Clark

1. There is a need of recognition at the national level of the issue. Though government of India has considered this issue but, consistent follow-up is mandatory.

2. It is really a matter of disgrace that the average Indian female has only 1.2 years of schooling and still now large number of women in India are illiterate. The literacy rate stands at 54.16 per cent comprising about the half of total female population. According to the UNFPA State of World Population 2005 about 70% of graduate Indian women are still unemployed. These all the main barrier to achieve proper women empowerment. Proper initiatives should be taken to promote education among the women and efforts should be done to increase awareness and empowerment in women regarding their legal rights.

3. Special Police Unit for Women and Children (SPUWAC), should come in to action for the safeguard of the rights of women in difficult circumstance.

4. Government should provide financial and technical support to nongovernment women organization so that they can give proper service for victims like shelters, crisis centers, legal assistance, counseling and support groups.

5. There should be religious definitions of the basic rights of women like autonomy and freedom in India on federal levels and the government needs to evaluate all of the basic rights of women.

6. Special courts like “ANTI DOWRY COURT”, preferably with women judges should be created for trial of these cases. Anti-dowry laws should be suitably amended at regular intervals.

Conflict of interest: none

Source of Funding: self

Ethical clearance: Taken

REFERENCE


4. Agnihotri A. The epidemiological study of dowry death cases with special references to burial cases in Allahabad zone. Anil Aggrawal’s Internet Journal of FMT. 2001; 2(1).


Patterns of Homicidal Deaths Autopsied at Tertiary Care Institute, Thane: A Five Years Retrospective Study

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ABSTRACT

Background: Homicide is defined as killing of one human being by another human being. Mens rea and Actus reus are the two elements for commission of murder which should work together for constitution of crime. The aims & objectives of this study are to analyze various aspects of homicidal autopsy cases, to find out age, sex wise variation of homicidal cases, to find out distribution of various modes of death and various types of weapons used in homicidal offences and to draw public attention and awareness regarding current patterns of homicidal offences.

Methods: A retrospective study was conducted in department of Forensic medicine, Tertiary care institute during the period from January 2011 to December 2015 which includes 57 deceased persons died due to homicide brought for autopsy.

Results: Among 2764 medicolegal autopsies conducted during the period of 5 years, 57 cases (2.06%) were of homicidal deaths. The present study demonstrated preponderance of male victims 43 (75.44%) over females 14 (24.56%). Major bulk of the male victims belonged to age group 21-30 years. Most commonly used weapon of offence by assailant is sharp edge with tapering end (40.35%) followed by sharp edged heavy weapon (28.07%) and was of Hard and blunt weapon (15.79%).

Conclusion: Homicidal deaths constituted 2.06% of autopsies conducted in five year study. Majority of victims belonged to 3rd and 4th decades and sharp edge weapon were the most common weapon of offence.

Keywords: Homicide, weapon of offence, sharp weapon, manner, victim.

INTRODUCTION

Homicide is defined as killing of one human being by another human being¹. Mens rea and Actus reus are the two elements for commision of murder which should work together for constitution of crime².

The incidence of homicide is increasing world wide and the pattern is also changing because of population explosion, frustration, illiteracy, prevalent economic, social and political environment, insurgency, terrorism, drug addiction changing life style, modern needs of the man and easy availability of various type of weapons².

It’s a challengeable task for autopsy surgeon to reveal the mystery of death in those cases which initially comes as a natural death and later on turned into homicidal death. It’s also challenging to determine weapon of offence, probable position of accused and victim at the time of incidence. Many a times, crime scene visit of forensic expert is helpful to the investigating authority and ultimately for judiciary to award a deterrent sentence to the guilty. Hence, scientific interpretation of autopsy findings along with detailed analysis of circumstances is imperative.

DOI Number: 10.5958/0974-1283.2018.00025.7
This retrospective study was undertaken to analyze profile of homicide and pattern of injuries to the victims to understand the patterns of murders occurring in Thane region. The knowledge gained through this study can be highlighted to reveal magnitude of the problem and its impact on the society, as well as to find out various ways to reduce this menace.

OBJECTIVES
1. To analyze various aspects of homicidal autopsy cases e.g. age, sex, pattern of injuries.
2. To find out distribution of various modes of death and various types of weapons used in homicidal offences
3. To draw public attention and awareness regarding current patterns of homicidal offences.

MATERIAL AND METHOD
A retrospective study was conducted in department of Forensic medicine of Apex institute during a five year period from 1 January 2011 to 31 December 2015. All the cases brought for postmortem examination with alleged history of homicidal death and those cases which were later registered as homicide were included in this study and those cases initially subjected for autopsy with alleged history of homicide but later on registered as non homicidal based on the autopsy findings, circumstantial evidence and investigating agency were excluded. Ethical clearance was obtained from Institutional ethics committee. Post mortem examination of the case was carried out as per standard protocol with preservation of appropriate samples in appropriate preservatives. The data was taken from PM Register as well as from case papers and were analyzed using MS Xcel. Category data was presented as tables and presented as proportions.

RESULTS
A total of 2764 medico legal autopsies were conducted during the period of 5 years. Of these, 57 cases (2.06%) were of homicidal deaths.

Table 1 shows age and sex distribution of deaths due to homicide. There is a preponderance of male victims (43, 75.44%) over females (14, 24.56%). Major bulk (29, 50.88%) of the male victims belonged to age group 21-30 years. Among female victims, majority belonged to 21-30 years, followed by 11-20 years. The least incidence was noted in above 50 years and below 10 years age group as these groups is least involved in any hazardous activity.

Table 1: Age and sex wise distribution of death due to homicide

<table>
<thead>
<tr>
<th>Age</th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>11-20</td>
<td>6</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>21-30</td>
<td>22</td>
<td>7</td>
<td>29</td>
</tr>
<tr>
<td>31-40</td>
<td>10</td>
<td>1</td>
<td>11</td>
</tr>
<tr>
<td>41-50</td>
<td>3</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>&gt;51</td>
<td>2</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>43</td>
<td>14</td>
<td>57</td>
</tr>
</tbody>
</table>

As seen in table 2, the most commonly used weapon of offence by assailant was sharp edged weapon with tapering end (23, 40.35%), followed by sharp edge, heavy weapon (16, 28.07%), followed by hard and blunt weapon(9, 15.79%). Among females, asphyxial deaths were more common among by using ligature material or hands. The only victims of firearm injury were two males.

Table 2: Type of weapon used in homicidal cases

<table>
<thead>
<tr>
<th>Weapon</th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hard and blunt</td>
<td>8</td>
<td>1</td>
<td>9</td>
<td>15.79</td>
</tr>
<tr>
<td>Sharp edged with tapering end</td>
<td>16</td>
<td>7</td>
<td>23</td>
<td>40.35</td>
</tr>
<tr>
<td>Sharp edged and heavy</td>
<td>15</td>
<td>1</td>
<td>16</td>
<td>28.07</td>
</tr>
<tr>
<td>Soft Ligature</td>
<td>0</td>
<td>3</td>
<td>3</td>
<td>5.26</td>
</tr>
<tr>
<td>Hard ligature</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>3.51</td>
</tr>
<tr>
<td>Manual force by hand</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>3.51</td>
</tr>
<tr>
<td>Electrocution</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1.75</td>
</tr>
<tr>
<td>Firearm</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>3.51</td>
</tr>
<tr>
<td>Total</td>
<td>43</td>
<td>14</td>
<td>57</td>
<td>100.00</td>
</tr>
</tbody>
</table>

Table 3 shows the gender differentials in the involvement of body parts which received the fatal injury. Of the 57 cases, 12 (21.10%) demonstrated fatal injuries over the head. Chest received fatal injuries in (9, 15.80%) cases. However, neck received fatal injuries in 7 (12.30 %) cases. Head was most common region involved among males and the neck region involved in females.
Table 3: Part of body on which fatal homicidal injury conceived

<table>
<thead>
<tr>
<th>Body part involved</th>
<th>Female</th>
<th>Male</th>
<th>Total</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Head</td>
<td>1</td>
<td>11</td>
<td>12</td>
<td>21.1</td>
</tr>
<tr>
<td>Head + Chest</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1.8</td>
</tr>
<tr>
<td>Neck</td>
<td>6</td>
<td>1</td>
<td>7</td>
<td>12.3</td>
</tr>
<tr>
<td>Neck + Abdomen</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1.8</td>
</tr>
<tr>
<td>Head + Neck</td>
<td>1</td>
<td>5</td>
<td>6</td>
<td>10.5</td>
</tr>
<tr>
<td>Neck + Chest + Abdomen</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>5.3</td>
</tr>
<tr>
<td>Chest</td>
<td>3</td>
<td>6</td>
<td>9</td>
<td>15.8</td>
</tr>
<tr>
<td>Abdomen</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>5.3</td>
</tr>
<tr>
<td>Chest + Abdomen + Back</td>
<td>0</td>
<td>5</td>
<td>5</td>
<td>8.8</td>
</tr>
<tr>
<td>Multiple parts involving whole body</td>
<td>1</td>
<td>4</td>
<td>5</td>
<td>8.8</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>0</td>
<td>5</td>
<td>5</td>
<td>8.8</td>
</tr>
<tr>
<td>Total</td>
<td>14</td>
<td>43</td>
<td>57</td>
<td>100.0</td>
</tr>
</tbody>
</table>

In majority of victims cause of death was shock and haemorrhage (28, 47.46%), followed by head injury (11, 18.64%) and mechanical asphyxiatiion (9, 15.25%). Death due to shock and haemorrhage, mostly by stab wounds followed by chop wounds. A single case of decapitation brought for postmortem examination in which head was missing and body with ante mortem clean cut at cervical region brought for examination which showed brutality of assailant. Among asphyxia deaths, death by ligature strangulation and manual strangulation were common. A rare case was seen in which victim was initially beaten by wooden stick (having tramline contusions over back) and later on was exposed to electric current to the fingertips leading to death due to electrocution.

Table 4: Distribution of cases according to cause of death

<table>
<thead>
<tr>
<th>Cause of death</th>
<th>No. of cases</th>
<th>%</th>
<th>Total %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shock and haemorrhage by sharp edge weapon due to</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stab wound</td>
<td>21</td>
<td>36.84</td>
<td>70.12</td>
</tr>
<tr>
<td>Chop wound</td>
<td>11</td>
<td>19.30</td>
<td></td>
</tr>
<tr>
<td>Incised wound</td>
<td>5</td>
<td>8.77</td>
<td></td>
</tr>
<tr>
<td>cut throat</td>
<td>2</td>
<td>3.51</td>
<td></td>
</tr>
<tr>
<td>Decapitation</td>
<td>1</td>
<td>1.75</td>
<td></td>
</tr>
<tr>
<td>Shock and haemorrhage by hard and blunt impact</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Head injury</td>
<td>4</td>
<td>7.02</td>
<td></td>
</tr>
<tr>
<td>Facial-maxillary injury</td>
<td>2</td>
<td>3.51</td>
<td>12.28</td>
</tr>
<tr>
<td>multiple injuries</td>
<td>1</td>
<td>1.75</td>
<td></td>
</tr>
</tbody>
</table>

**Asphyxial death**

<table>
<thead>
<tr>
<th></th>
<th>No. of cases</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ligature strangulation</td>
<td>3</td>
<td>5.26</td>
</tr>
<tr>
<td>Throttling</td>
<td>2</td>
<td>3.51</td>
</tr>
<tr>
<td>Gaging</td>
<td>1</td>
<td>1.75</td>
</tr>
<tr>
<td>smothering with multiple injuries</td>
<td>1</td>
<td>1.75</td>
</tr>
<tr>
<td><strong>Miscellaneous</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Firearm injuries</td>
<td>2</td>
<td>3.51</td>
</tr>
<tr>
<td>Electrocution</td>
<td>1</td>
<td>1.75</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>57</td>
<td>100.0</td>
</tr>
</tbody>
</table>

**DISCUSSION**

The empirical evidence from many different countries shows consistently that the bigger the city the higher the crime rate. Due to increase in urbanization and industrialization homicides are one of the major offences which is on a rise. Financial disputes, infidelity, love affairs, poverty, stress, poor educational and recreational facilities, migratory population, easy accessibility of addictive substances and weapons of violent offences, poor temperament, unemployment, substance abuse etc. are some provoking circumstances for such type of violent offences.

During the study period, from Jan 2011 to Dec 2015, a total of 2764 medico-legal post-mortem examinations were done at tertiary care institute in Thane, among which 57 deaths were of homicide. So homicidal rate 2.06% which is quite near to Zanzrukiya, Parmar and Shah3,4,5. Some authors like Hugar, Rastogi and Patel2,6,7 showed higher rate.

This study has shown male predominance with male: female ratio of 3.07:1. This preponderance of male victims might be due to their aggressive nature, outdoor activities and risk taking behaviour and females are less exposed to violence in our country due to cultural and religious reasons. Similar findings were seen in studies of Rastogi, Santosh and Singh6,8,9.

Almost half of homicidal deaths were seen in 21 to 30 years age group, followed by 31-40 years age group (which together comprises 70.20% of total victims). Male predominance was seen in every age group. These findings are in line with Parmar DJ et al4, Hugar BS et al6,Dhiraj B et al5. However, Kominato Y, et al11 reported 46–55 years group to be the most commonly involved age group. This could be because the age group of 21 to 30 years (especially males) is of youngsters
who start their responsibilities of earning, marriage and having enormous struggle changing socio-economic trends. This vulnerable age group get frustrated easily and are prone for violence.

Regarding modes of death, majority of homicide victims died due to Haemorrhagic shock (82.39%) which was followed by Asphyxial deaths contributing in 12.27% of cases. Rastogi and Zanzrukiya also found similar observations6,3.

Considering fatal injuries, maximum 12 (21.10%) cases demonstrated fatal injuries over the Head (Craniocerebrum) followed by fatal injuries over chest(15.80%) and neck(12.30%) Head is most commonly involved region among death due to hard and blunt impact. Fatal injuries over head, neck and in combination comprises(43.86%) which comprises major bulk among homicidal death as the head face and neck region is easily accessible to physical blows and even single impact causes fatal injury. These findings corroborate with observations of Parmar DJ et al4, Mishra PK et al12 and Shah JP et al5. However, Prajapati et al13 considered the chest and abdomen and Zanzrukiya K et al3 who described the neck as a chief body part receiving the fatal injuries.

If we consider the frequency of the type of weapon used for homicide, death due to sharp edge weapon with tapering end weapon injuries (40.35%) were the commonest pattern followed by sharp edge heavy weapon injuries (28.07%) followed by hard and blunt weapon (15.79%) which can be attributed to the easy availability of various sharp weapons in the city. Most of the sharp weapon injuries were pre-meditated and mainly involved gang rivalry where as most of the blunt weapon injuries were unpreameditated and assailants used the blunt weapon available at the scene of occurrence2. This finding is similar to the studies conducted by Gupta14(57.40%) and Wahlsten15(39.00%). Only two cases were due to fire arm injury were found in present study as the law in India is very strict and very difficult to get gun license. Whereas in western countries studies by Ullha et al16 and Alan Fox17, showed that firearms were the most common means used for homicides.

CONCLUSION

In present study it was observed that there is a great difference exists between male and female homicidal victims in relation to the method of killing, weapon of offence, the location of the crime, the motive and the relationship with the offender. Arguments being one of the most common reason for death of female and most of females victim cases their close relatives are the accused person, whereas among males, acquaintances and strangers were the most common assailants and the revenge was the main reason. Therefore investigation of the crime scene of death, circumstantial knowledge and the victim’s past history are important factors in solving homicide cases.

Homicidal deaths constituted 2.06% of autopsies conducted in five year study. Majority of victims belonged to 3rd and 4th decades and sharp edge weapon were the most common weapon of offence. We believe that intolerance is common denominator in this age group. Though, continuous research in this field is need of hours to constitute strategies which can foil unlawful human killings.

LIMITATIONS

1. Study was confined to a particular area.
2. The information about the victims, and the circumstances was based on the history provided by the police, panchnama, victim’s relatives and friends and only in few cases crime scene of occurrence was visited and the photograph of scene of occurrence were taken.

RECOMMENDATIONS

1. As most of the victims and offenders were in 21-40 years age group the problems of this age group like unemployment should be addressed by the Government, marital disputes and family problems should be addressed by referring the parties to an appropriate authority.
2. Strict enforcement of law on possession of dangerous weapons like sharp heavy cutting weapons, pointed weapons or firearms.
3. Awareness about the hazards of alcohol to be conveyed to the public.
4. In the Indian scenario the investigating officer, the forensic expert and the judiciary system work independently and not in tandem as in the western countries where there is established homicide
unit is constituted who share their knowledge in solving a crime. Hence investigating officer should work or co-ordinate with the forensic expert in solving homicides.

**Ethical Clearance:** The study was carried out after obtaining ethical clearance from the Institutional Ethics Committee.

**Source of Funding:** Nil

**Conflict of Interest:** Nil

**REFERENCES**


Profile of Sexual Offences Survivors Below 18 Years of Age: A 3 Year Retrospective Study of Western Maharashtra Region

Santosh Baburao Bhoi1, Kunal Bhimrao Shirsat2, Satin Kalidas Meshram3, Sushim Amrutrao Waghmare1, Rizwan Allaudin Kamle2

1Associate Professor, 2Professor & Head, 3Assistant Professor, Dept. of Forensic Medicine, Dr. V. M. Govt. Medical College and Shree. C.S.M.G. Hospital, Solapur

ABSTRACT
A 3 year retrospective study was carried out in Dept of Forensic Medicine & Toxicology, Dr. Vaishampayan Memorial Government Medical College, Solapur, Maharashtra. Total 340 cases of sexual offences examined, out of these 190 cases were of age group less than 18 years consisting of 55.88% of total cases of sexual offences. Maximum 71.05% cases were from the age group 15 to 18 years, followed by the age group 12 to 15 years i.e. 14.21%. A total 46.31% were from rural area and 53.63% were from the urban region. In 14.21% there was evidence of external injury. Most of the incidences took place in assailant’s house in 39.47% cases followed by victim house 33.15%. Among accused stranger were 17.89% while acquaintance were 44.73%, close friend 29.47%, neighbor 3.68% and near relative 4.21%

Keywords: Sexual offences, victim of sexual offences, accused of sexual offences, Solapur.

INTRODUCTION
The World Health Organization (WHO) defines Sexual Violence as: “any sexual act, attempt to obtain a sexual act, unwanted sexual comments/ advances and acts to traffic, or otherwise directed against a person’s sexuality, using coercion, threats of harm, or physical force, by any person regardless of relationship to the victim on any setting, including but not limited to home and work.”

A survey by United Nations International Children Education Fund (UNICEF) on demographic and health was conducted in India from 2005 to 2013, which reported that ten per cent of Indian girls might have experienced sexual violence when they were 10–14 years of age and 30% during 15–19 years of age. Overall, nearly 42% of Indian girls have gone through the trauma of sexual violence before their teenage.

According to the studies conducted throughout the world, children and adolescent oriented sexual assaults are increasing, and both females and males become victims of this heinous crime in high percentages in any period of their lives. Sexual offence is one of the most heinous crimes against women and children. The various social Organizations and women Welfare Organizations, legal and administrative steps have taken by the Government to give protection to the women and children against such crimes. Sexual assault is a neglected public health issue in most of the developing countries and there is even smaller percentage of reporting sexual assaults. Only 10- 50% female victims report such assaults. The under reporting of sexual assault is due to various social stigma and delay in the administration of justice.

This study we propose to boost the understanding of demography of the rape/sexual offences victims and analyzing the victim- assailant relationship and circumstances.

MATERIAL AND METHOD
This retrospective study was carried out in Dept of Forensic Medicine & Toxicology, Dr. Vaishampayan Memorial Government Medical College, Solapur, Maharashtra from January 2014 to December 2016
The record of sexual assault victim (child and adolescent) who had been brought for examination in department was studied. The detailed information regarding to age, sex, resident area of victim, place of incident, relationship with assailants, finding of physical examination were collected. The data collected on a predesigned pro-forma was tabulated, studied and statistically analyzed.

**OBSERVATIONS**

A total 340 cases have been examined for sexual offences during the study period. Of these cases only the victims below the age of 18 years have been studied and analyzed as shown below:

In present study total 340 cases of sexual offences examined in the three year duration. Out of these 190 cases were of age group less than 18 years consisting of 55.88% of total cases of sexual offences. (Table 1)

<table>
<thead>
<tr>
<th>Year</th>
<th>Total</th>
<th>&lt;18</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>96</td>
<td>51</td>
<td>53.12</td>
</tr>
<tr>
<td>2015</td>
<td>100</td>
<td>58</td>
<td>58</td>
</tr>
<tr>
<td>2016</td>
<td>144</td>
<td>81</td>
<td>56.25</td>
</tr>
<tr>
<td>Total</td>
<td>340</td>
<td>190</td>
<td>55.88</td>
</tr>
</tbody>
</table>

The age wise distribution shows that out of 190 cases maximum i.e. 135 cases (71.05%) were from the age group 15 to 18 years, followed by the age group 12 to 15 years i.e. 27 cases (14.21%). (Table 2)

<table>
<thead>
<tr>
<th>Age in years</th>
<th>Number</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Below 3</td>
<td>1</td>
<td>0.52</td>
</tr>
<tr>
<td>3 to 6</td>
<td>7</td>
<td>3.68</td>
</tr>
<tr>
<td>6 to 9</td>
<td>8</td>
<td>4.21</td>
</tr>
<tr>
<td>9 to 12</td>
<td>12</td>
<td>6.31</td>
</tr>
<tr>
<td>12 to 15</td>
<td>27</td>
<td>14.21</td>
</tr>
<tr>
<td>15 to 18</td>
<td>135</td>
<td>71.05</td>
</tr>
<tr>
<td>Total</td>
<td>190</td>
<td>100</td>
</tr>
</tbody>
</table>

88 cases (46.31%) were from rural area and 102 cases (53.63%) were from the urban area. (Table 3)

<table>
<thead>
<tr>
<th>Locality</th>
<th>Number</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rural</td>
<td>88</td>
<td>46.31</td>
</tr>
<tr>
<td>Urban</td>
<td>102</td>
<td>53.68</td>
</tr>
<tr>
<td>Total</td>
<td>190</td>
<td>100</td>
</tr>
</tbody>
</table>

In 27 cases (14.21%) there was evidence of external injury. External injury were absent in 163 (85.78%) cases. (Table 4)

<table>
<thead>
<tr>
<th>External injury</th>
<th>number</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Present</td>
<td>27</td>
<td>14.21</td>
</tr>
<tr>
<td>Absent</td>
<td>163</td>
<td>85.78</td>
</tr>
<tr>
<td>Total</td>
<td>190</td>
<td>100</td>
</tr>
</tbody>
</table>

In present study most of the incidences took place in assailant’s house in 75 (39.47%) cases followed by victim house 63 (33.15%). (Table 5)

<table>
<thead>
<tr>
<th>Place of incidence</th>
<th>Number</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Victims house</td>
<td>63</td>
<td>33.15</td>
</tr>
<tr>
<td>Accused house</td>
<td>75</td>
<td>39.47</td>
</tr>
<tr>
<td>Relatives house</td>
<td>18</td>
<td>9.47</td>
</tr>
<tr>
<td>Roadside/isolated place</td>
<td>19</td>
<td>10</td>
</tr>
<tr>
<td>Hotel</td>
<td>15</td>
<td>7.89</td>
</tr>
<tr>
<td>Total</td>
<td>190</td>
<td>100</td>
</tr>
</tbody>
</table>

While considering relationship, stranger were 34 (17.89%). While acquaintance were 85 (44.73%) close friend, 56 (29.47%), neighbor 7 (3.68%) and near relative 8 (4.21%). (Table 6)

<table>
<thead>
<tr>
<th>Type of relationship</th>
<th>Number</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acquaintance</td>
<td>85</td>
<td>44.73</td>
</tr>
<tr>
<td>Stranger</td>
<td>34</td>
<td>17.89</td>
</tr>
<tr>
<td>Close friend</td>
<td>56</td>
<td>29.47</td>
</tr>
<tr>
<td>Neighbor</td>
<td>7</td>
<td>3.68</td>
</tr>
<tr>
<td>Near relative</td>
<td>8</td>
<td>4.21</td>
</tr>
<tr>
<td>Total</td>
<td>190</td>
<td>100</td>
</tr>
</tbody>
</table>
DISCUSSION

According to a study published by Ministry of Women & child development in 2007, India has world’s largest number of sexually abused children, children below 16 years are raped every 155th min and below 10 years are raped every 12th hour and there is severe underreporting of such crimes.8

In present study out of 340 reported cases 190 (55.88%) cases were of age group less than 18 year. In the study conducted by Maring S K et.al.9 there were 51.4% cases in the age group below 18 years and study by Bandyopadhay S. et.al10 shows 34% of victims less than 18 years.

Samuel O.et.al.11in their study recorded 93.3% cases were less than 18 years of age Sinhal A. et.al.12 showed 39.21% cases were of age group less than 20 years. Similarly Sarkar SC et.al.13. recorded 81.1% cases, Shweta L. et.al.14 reported 70% cases which were of age group less than 20 years.

From this study it is clear that more than half of cases were child and adolescent. It might be due to comparatively easiness for assailants to rape the victims of this age group as they are innocent and cannot resist and defend themselves. Also there is a myth in India as in some other countries, rape of children is due to superstitious belief that gonorrhea and syphilis can be cured by sexual intercourse with virgin13. But this fact could not be verified in absence of the data of the accused.

In present study we classified the study population in different age groups. Maximum cases occur between 15 to 18 years. Consisting of 71.05% of cases followed by age group 12 to 15 years of age consisting of age 14.21% of cases.

Samuel O.et.al.11in their study recorded that most common age group 13 to 17 years consisting of 20.9% cases. Similar results were reported by Maring S K et.al.9 showing most common age affected age group 15 to 18 years consisting of 39.20% of cases followed by age group 12 to 15 years of age consisting of age 31.08% of cases. Demisew A. et.al.16 recorded in their study that most common group affected was 16 to 20 years (40.4% cases) followed by 11 to 15 years (36.4% cases). Sweta L. et.al.14 recorded in their study showed that 25% cases were in age group 10-15 years while 23% cases in age group 15-20 years. Sarkar SC et.al.17 recorded that 67.16% cases were between 11-20 years of age group. Study by Mariam A.et al.18 recorded that most common age group affected was 12-15 years consisting of 57.89% cases followed by 16-18 years consisting of 21.05% cases. B. Sukal et.al.19 showed that 39.08% cases were in age group 10-18 years. Study by Bijoy TH, et.al.20 recorded 24.53% cases were below age 12 years. Malhotra N et .al.21 reported that majority of Victims (76.9%) in their study were adolescent. Hence our study is in consistent with the other studies in this regard.

In present study out of 190 cases in 34 cases (17.89%) the assailant was stranger while in 44.73% cases it was acquaintance, in 29.47% cases close friend, in 3.68 % cases neighbor and in 4.21% cases it was a near relative.

In study conducted by Bijoy TH, et.al. et.al.2013.46 % cases the assailment was unknown. Maring S K et.al.9 recorded that 9.5% assailant were stranger for victim in their study. Mariam A.et al18 revealed that in 15.58% of cases association were stranger to victim. Sarkar SC et.al.13 recorded that 18.8% assailants were stranger to the victim. Sinhal A. et.al.12 showed that in 7.84% cases assailants were stranger for victim. Sweta L. et.al.14 states that in 22% cases assailants were unknown to the victim.

The assailant of this offence ranges from a person who is acquaintance close friend, neighbor, near relative to stranger. It is easier for a known person to convince or lure a child for commission of the offence.

In present study maximum incidence took place at accused house in 75 cases (39.47%) followed by victims house in 63 cases (33.15%) In study by Samuel O.et.al.11most of the events of sexual assault occurred at assailants home in 50% cases. Bijoy TH, et.al.20 recorded that most of incidences occurred at accused house consisting of 36.53%. Mariam A.et al.18 revealed that maximum of incidence of sexual offences took place in accuses house (57.89%)

But Study by Sarkar SC et.al.(study in tripura)17 state that most of sexual offences took place in victim house according 49.25% cases. Study by Sarkar SC et.al. (study in south delhi)13 recorded that in their study most of offences took place in victims house (41.1%) cases which are not consistent with our study.
In present study maximum cases occurred in assailant’s house. Whatever may be the place whether house of victim or assailant this could have been because victim knew the assailant and she did not suspect a person she knew could have such malice motive. She can be easily lured to the assailant’s house.

In Present study evidence of external injury was present in 27 cases (14.21%) only.

Marium A. et.al. in their study revealed that in 10.52% of their studied population external injuries were present. Sarkar SC et.al.(study in south delhi) recorded external injuries m 6.7 % cases. Singhal A. et.al recorded that in 5.88% cases there was evidence of external injuries. Bijoy TH. et.al. recorded external injuries in 19.01% cases

Marring S K et.al. revealed that in 14.8% cases there is evidence of external injuries. Sarkar S.C. et.al. in their study in Tripura recorded external injuries in 10.44% cases .The victim of this age group are weak, less defensive and less aware of incident, their resistance to the accused is less. This might be the reason for fewer amounts of external injuries on the body of victim also there is much disproportionate physical power between assailant & victim.

The absence of physical injuries may also be due to missing of rapidly healing injuries as with cases which are reported delayed for examination and in most of cases consent for act was given due to immature thinking hence the less chances of external injuries may be due to consented sexual act.

In present study 88 cases (46.31%) are from rural area and 102 cases (53.68%) are from urban area

In study by Bijoy TH.et.al. recorded that 67.3% cases were from rural and 32.7% cases were from urban area .Marium A. et.al. mentioned that 100% cases from their study were from urban area.

Study by Demisew A.et.al. recorded that 31.3% cases, were from urban & 68.7 % cases were from rural area. This difference in proportion of rural & urban area in different studies might be due to difference in social and cultural backgrounds in different areas.

In our study there is much less difference in cases from rural and urban area. This might be due to proximity of rural areas to the studied region and penetration of print and audiovisual medias up to rural areas as in urban areas too.

CONCLUSION

Sex related offence continues to be a panic to the society. Although most of the offences were conducted against married females, children and young and unmarried girls, are also among common victims of this heinous crime. Most of the victims had fallen prey to the lust of their known people.

Conflict of interest: none

Source of Funding: Self

Ethical clearance: A retrospective study without disclosure of any identity.

Permission of head of department has been taken for retrieval of data.

Inclusion criterion: Sexual offences victims below the age of 18 years during the study period.

Ethical committee clearance: As the data was retrospectively collected and as no revelations identity ethical committee clearance not required. However permission of head of the department is taken to collect the data.

Conflict of interest and sources of funding: None

REFERENCES


A retrospective, autopsy based study on custody-related deaths, during the period of 12 years from the year of April 2005 to April 2017. A total 22 cases were analyzed out of which 19 were males and 3 were females. The age of cases varies from 20 years to 71 years and maximum cases occurred in age group 30-39 years consisting of 31.81%. 8 deaths occurred in police lock up, 5 in jail, 8 in hospital and 1 at other place. 11 cases were recorded as due to natural deaths and 11 cases were recorded as unnatural out of which 31.81% were suicidal, 13.63% were accidental, 4.54% were homicidal. In natural deaths most common cause of death was pulmonary TB and in unnatural deaths most common cause of death was hanging.

Keywords: custody death, natural death, unnatural death, autopsy

INtRODUCtIoN

As per the Oxford dictionary custody means “protective care or guardianship of someone or something”. In the legal parlance custody is defined as “Any point in time when a person’s freedom of movement has been denied by law enforcement agencies, such as during transport prior to booking, or during arrest, prosecution, sentencing, and correctional confinement”.

Custodial death means deaths occurring in custody of law-enforcing agencies during proceeding, apprehension, detention, in lockup or jails, during interrogation or willful negligence of the investigating agency as well as convicts dying in hospitals.

Whenever such deaths occur in custody or during incarceration, controversial and legal issues or litigation may occur and a postmortem examination with meticulous investigation needs to be done. These deaths lie in a very complicated brew of ethical, legal and medical hurdles involving several authorities which can be hard to handle. In the past, some deaths became important public issues. Due to the paramount sensitivity attached to custodial deaths, in India every custodial death autopsy report was mandatorily submitted to the National Human Rights Commission along with video shoot copy in unnatural deaths respectively. Comprehensive studies detailing the statistical findings of the causes and manners of death have established the profiles of what constitute normal occurrences of deaths in-custody and have been important in determining what areas of health care in prison, need improvement.

The present study was conducted with a view to provide information which will help to design effective preventive programs and the establishment of better preventive strategies to prevent incidences of death in custody.

MAteRIAL  AND MeTHoD

This retrospective, autopsy based study on custody-related deaths, during the period of 12 years from the year of April 2005 to April 2017, was conducted in the Department of Forensic Medicine and Toxicology, Dr.
We examined all available documents of inquest papers, autopsy reports, toxicological analysis reports, histopathology reports and case papers into the death of people in custody through 2005 to 2017. A standard Performa was designed to collect the information to ensure consistency for the whole sample. Information collected includes age, sex, and type of custody (jail or police cell), place of death, medical attention received, and cause of death and manner of death.

The data thus collected is tabulated, analyzed, interpreted and discussed.

**ETHICAL ISSUE**

As the study is retrospective and data is collected from the postmortem memorandum and as there is no disclosure of any identity ethical committee permission is not required. Permission of Head of Department, Forensic Medicine is taken to collect the data for research purpose.

**OBSERVATION AND RESULT**

During Period of April 2005 to April 2017, Total 22 cases were analysed. Out of these cases males were 19 (86.36%) & Females were 3 (13.63%). Average Age in males was 36.16 & in females 39.66. out of these 22 cases 10 cases (45.45%) were in police custody & 12 cases (54.54% ) were in prison. While considering place of death, 5 death occurred in prison , 8 death occur in police lock up, 8 death in hospital & 1 death in other place. Natural death constitute 50% cases & unnatural death 50% cases. In unnatural manner suicides were 7 (31.81%), Homicide 1 (4.54%) & accident were 3 (13.63%). In natural deaths tuberculosis is most common cause of death. The respiratory diseases amount 8 (72.72%) of total natural deaths. In un natural manner hanging is most common cause of death. In un natural 11 cases 7 (63.63%) cases in police cell & 4 (36.36%) in prison.

**Table 1: Age and gender wise distribution of cases**

<table>
<thead>
<tr>
<th>Age in years</th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Below 20</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>20-29</td>
<td>5</td>
<td>1</td>
<td>6</td>
<td>27.27</td>
</tr>
<tr>
<td>30-39</td>
<td>7</td>
<td>0</td>
<td>7</td>
<td>31.81</td>
</tr>
<tr>
<td>40-49</td>
<td>5</td>
<td>1</td>
<td>6</td>
<td>27.27</td>
</tr>
<tr>
<td>50-59</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>9.09</td>
</tr>
<tr>
<td>Above 59</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>4.54</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>19</td>
<td>3</td>
<td>22</td>
<td>100</td>
</tr>
</tbody>
</table>

**Table 2: Custody wise distribution of cases**

<table>
<thead>
<tr>
<th>Type of Custody</th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Police</td>
<td>8</td>
<td>2</td>
<td>10</td>
<td>45.45</td>
</tr>
<tr>
<td>Prison</td>
<td>11</td>
<td>1</td>
<td>12</td>
<td>54.54</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>19</td>
<td>3</td>
<td>22</td>
<td>100</td>
</tr>
</tbody>
</table>

**Table 3: Places of death wise distribution of cases**

<table>
<thead>
<tr>
<th>Place of death</th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prison</td>
<td>4</td>
<td>1</td>
<td>5</td>
<td>22.72</td>
</tr>
<tr>
<td>Police Lock up</td>
<td>7</td>
<td>1</td>
<td>8</td>
<td>36.36</td>
</tr>
<tr>
<td>Hospital</td>
<td>7</td>
<td>1</td>
<td>8</td>
<td>36.36</td>
</tr>
<tr>
<td>Other</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>4.54</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>19</td>
<td>3</td>
<td>22</td>
<td>100</td>
</tr>
</tbody>
</table>
Table 4: Manner and Gender wise distribution of cases

<table>
<thead>
<tr>
<th>Manner</th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Natural</td>
<td>11</td>
<td>0</td>
<td>11</td>
<td>50</td>
</tr>
<tr>
<td>2. Unnatural</td>
<td>08</td>
<td>03</td>
<td>11</td>
<td>50</td>
</tr>
<tr>
<td>2a. Suicide</td>
<td>4</td>
<td>3</td>
<td>7</td>
<td>31.81</td>
</tr>
<tr>
<td>2b. Homicide</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>4.54</td>
</tr>
<tr>
<td>2c. Accident</td>
<td>3</td>
<td>0</td>
<td>3</td>
<td>13.63</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>22</strong></td>
<td><strong>100</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 5: Distribution of cases as per causes in Natural deaths (N=11)

<table>
<thead>
<tr>
<th>Causes of death</th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pulmonary Tuberculosis</td>
<td>5</td>
<td>0</td>
<td>5</td>
<td>45.45</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>18.18</td>
</tr>
<tr>
<td>Liver cirrhosis with Gastroenteritis</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>9.09</td>
</tr>
<tr>
<td>Massive hepato-cellular necrosis</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>9.09</td>
</tr>
<tr>
<td>Pulmonary oedema and hemorrhage</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>9.09</td>
</tr>
<tr>
<td>Acute myocardial infarction</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>9.09</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>11</strong></td>
<td><strong>0</strong></td>
<td><strong>11</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Table 6: Distribution of cases as per causes in Unnatural deaths (N=11)

<table>
<thead>
<tr>
<th>Causes of death</th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hanging</td>
<td>4</td>
<td>2</td>
<td>6</td>
<td>54.55</td>
</tr>
<tr>
<td>Head injury</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>9.09</td>
</tr>
<tr>
<td>Injury to multiple organs</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>9.09</td>
</tr>
<tr>
<td>Shock due to burns</td>
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<td>1</td>
<td>1</td>
<td>9.09</td>
</tr>
<tr>
<td>Shock &amp; hemorrhage due to firearm injuries on abdomen with injury to stomach &amp; mesentery</td>
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<td>0</td>
<td>1</td>
<td>9.09</td>
</tr>
<tr>
<td>Shock due to injury to stomach &amp; fracture ribs associated with multiple surface injuries</td>
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<td>1</td>
<td>9.09</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>8</strong></td>
<td><strong>3</strong></td>
<td><strong>11</strong></td>
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</tr>
</tbody>
</table>

**DISCUSSION**

In developing countries like India, custodial deaths are the hovering issue on human rights violation when seen all over the world. Accusations of police misdemeanors, media speculation and passionate community grief were coupled with sudden and unanticipated deaths in custody. Because of the law enforcement misdemeanors there is a need of systematic and vigilant examination by the forensic pathologist to provide certain facts with respect to cause of death.6

Deaths in prison are obviously correlated to the difficult conditions the detainees are facing in everyday life. Overcrowding, impoverished prison conditions, segregation and poor medical care have direct implications on people’s mental and physical health7.

Out of the total cases of custodial deaths males were 86.36% and females were 13.63% only showing male predominance. This may be due less criminal involvement of females.

Our study correlates with studies of Shilesh Mittal et al8 (97.82% male), Bansal et al9 (95% males), Bardale et al,10(97.18% male), Vaibhav Sonar et al 11(96.96% males).

The maximum deaths occurred in the age group 30-39 years (31.81%). Our study correlates with the studies of Jhamad A R et al12 (25-35 years), Vijay Jadhav et al13(31-35 years)
Present study shows that in 50% of cases manner of death is due natural causes with pulmonary TB as the most common cause of death i.e. 45.45% and deaths due to respiratory ailments including tuberculosis accounts for 72.72%. Rests of the 50% deaths were due to unnatural causes.

The different studies in India by Shilesh Mittal et al. shows 80.43% natural manner of death. The study by Bansal et al. shows natural death 89%, Jhamad A R et al. in their study of New Delhi reveals that 66.66% cases are natural death, Bardale et al., observed 82.85% deaths due to natural cause, as per Vaibhav Sonar et al. the natural death are 95.45%, Mandar Sane et al. reveals natural death accounting for 68.88%. Vijay Jadhav et al. in their study reveals that natural manner of death constitutes 81.35%. All have the common results that respiratory diseases accounts for majority of cases with predominance of tuberculosis. Hence our study results were in consistence with the Indian studies.

But our study was in contrast to the studies conducted in advanced nations. In study by Sohyung Park et al. (Korea) natural causes constitutes 49.4%, Wandy L. Wobeser (Canada) natural causes constitutes 41%, Steiffen Heide (Germany) natural causes constitutes 25%, Seena fazel. (England Wales) natural causes constitutes 44.3%, Okoye M. (Nebraska USA) the natural death constitutes 45.1%, Cristian Ghreman et al. (Romania) natural deaths constitutes 87.61 %. And in all of their studies the most common cause of death is cardiovascular disease with male as the most common gender and most common age group varies from 20-40 years.

From above analysis it is clear that in Indian studies the rate of natural diseases ranges from 66.66% to 95.45% most common cause of death is respiratory system diseases in which tuberculosis predominates. And in the studies which were conducted outside India shows that the percentage of natural deaths varies from 25% to 49.4% and the most common cause of death is cardiovascular system diseases.

Overcrowding makes environment worse for prisoners. Most of the prisons have limited sunlight and fresh air and full of bad odors and poor health services. Bland and unappealing food, clothing and extremely confining shelter makes life more measurable to prisoners. Hence an important fact responsible for the deaths occurring in custody is the condition of the jails in India.

Besides these, inmates are also prone to various non-communicable diseases such as cardio-vascular diseases, respiratory diseases, mental disorders. These are mainly due to physical inactivity, unhealthy and stressful environment, unhealthy food, physical and sexual violence, deliberate self-harm, various drug abuse and mental health problems mainly depression, anxiety, adjustment problems and psychosis.

According to the WHO guidelines, prison staff should be educated to address the basic health issues. UN also provides certain standard minimum rules for the treatment of Prisoners. These rules are required to be followed as was also recommended by the World Congress on Men’s Health which considered poor sanitation in prison to have a “major impact” on their health.

Present study shows that in 50% of cases manner of death is unnatural and in these unnatural deaths, hanging (54.55%) is the most common cause of death. Of these unnatural deaths 63.63% were in police cell.

The different studies in India by author Shilesh Mittal et al. shows 19.57% unnatural manner of death in which poisoning is most common cause of death, Bansal et al. shows 11% are cases of unnatural death in which fall from height and trauma is leading cause of death. Jhamad A R et al. in their study of New Delhi reveals that 33.33% cases are of unnatural deaths in which head injury and hanging are most common cause of death. Bardale et al. stated that out of 173 cases 14 cases were noted as suicidal and most common cause of death is hanging. Mandar Sane et al. reveals unnatural death accounting for 30% and poisoning is most common cause of death. Vijay Jadhav et al. in their study reveals that unnatural manner of death constitutes 15.25% and most common cause of death is hanging.

In study by Sohyung Park et al. (Korea) unnatural deaths constitutes 48.2% the most common cause of death is hanging. Wandy L. Wobeser (Canada) unnatural deaths constitutes 59% and the most common cause of death is suicide by strangulation.

In study by Steiffen Heide (Germany) unnatural deaths constitutes 75% and the most common cause of death is acute alcoholic intoxication. As per Seena fazel. (England Wales) unnatural deaths constitutes 55%, Okoye M. (Nebraska USA) the unnatural deaths constitutes 27% and as per Christian Gashreman et al. (Romania) unnatural deaths constitutes 12.38% and the most common cause of death is hanging.
From above analysis it is clear that in the studies in India, the rate of unnatural deaths ranges from 11%-30% and 27%-75%. In the studies outside India. Our study correlates with the studies outside India but is in contrast with studies in India. This may be due to small sample size and high death rates in police cell in the study region. Most common cause of death is hanging in studies at India and outside India and it correlates with the findings of our study.

If a suicide occurs in a prison or police cell, it not only has a bearing on the other prisoners but also to the prisoner’s staff, relatives and of course to their family members. It is understood that failure to create a safe environment inside the prison is the main cause for these deaths.1

As per the guidelines of NHRC, the government and the concerned authorities should take all necessary precautions to prevent custodial death.

**CONCLUSIONS**

Though not in every case of death in custody will be avoidable, it will be possible to reduce numbers of such cases by preventive measures.

Prevention of custody related deaths should be recognized as an area of concern and should be given priority by government and concerned authority

Early identification of pathological conditions, referral to specialists for diagnosis and hospitalized treatment will reduce the number in custody deaths.

Overcrowding and poor medical care are general problems in prisons that directly affects physical and mental health.

CCTV should be installed so that the persons who are in custody are under direct vision.

**Conflict of interest:** none

**Source of Funding:** Self

**Ethical clearance:** Not required.

**REFERENCES**


Analysis of Burns Deaths in GMC Chandrapur:  
1 yr Autopsy Study

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¹Professor, ²Assistant Professor, Department of Forensic Medicine, Govt. Medical College, 
TB Campus, Ramnagar, Chandrapur, Maharashtra, India

ABSTRACT
Burns have tremendous medicolegal importance as they may be considered to be the commonest cause of unnatural death in India¹. In this study total 43 cases of burns deaths were explored in one year. Most commonly affected age group was of young aged of 20-40 yrs (69.77%) followed by 40-60 yrs (16.28%). Most of the victims were illiterate (34.88%) & (79.07%) cases were of married. Females were leading to male; amongst them most of were housewives of Hindu families of lower middle socio-economic class. The most of victims (51.16%) sustained 76-100% burns followed by 51-75% burns (34.88%). Most common manner of death was accidental burns (95.35%).

Keywords: Burns, unnatural death, accidental, females.

INTRODUCTION
Often, the circumstances of Burns are enveloped in mystery, obscurity and unreliable statements. The reason behind this action may be personal, domestic, occupational or social tragedy and more recently dowry death.¹ It took a man a long, long time to understand, appreciate, and reproduce these occurrences, it took him no time at all to realize that fire can hurt and hurt badly². Burns is injuries produced by application of dry heat, such as radiant heat, flame or any other heated solid substance like metal or glass to the surface of the body³.

Burns is the 4th most common type of trauma in the world, subsequent traffic accidents, falls, and interpersonal violence⁴. According to WHO (2000) report, 2, 38,000 individuals died of fire related deaths and 95% of these deaths occurred in low and middle income countries⁵. A significant number of deaths in India occur due to burns every year and over 10,00,000 people are moderately or severely burnt every year in this country⁶.

The present study was undertaken to study the pattern of burns injuries in relation to socio-demographic factors; marital status and manner of death and total percentage of burns sustained.

MATERIAL AND METHODS
The present study was carried out during the period from January 2016 to December 2016 in the Department of Forensic Medicine at Government medical college and Hospital, Chandrapur. Socio-demographic data were collected from post mortem reports, statements of relatives and police inquest. The data required for this study was collected in a predetermined proforma and it was analysed and presented for the discussion.

OBSERVATION AND RESULT
Out of the total deaths and autopsies conducted during this study period, total 43 cases of burns deaths were explored in one year.

Table no. 1 Showed that distribution of burns victims month wise over the period of one year where most of victims burnt in September and November; i.e. 6 (13.95%) cases in each.
### Table No. 01: Month wise distribution of Burns deaths

<table>
<thead>
<tr>
<th>Month</th>
<th>Male</th>
<th>Percentage</th>
<th>Female</th>
<th>Percentage</th>
<th>Total</th>
<th>Percentage</th>
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<td>0</td>
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<td>2</td>
<td>4.65</td>
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<td>3</td>
<td>6.98</td>
<td>4</td>
<td>9.30</td>
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</tr>
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<td>0</td>
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<td>4.65</td>
<td>2</td>
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</tr>
<tr>
<td>June</td>
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<td>July</td>
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<td>9.30</td>
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<tr>
<td>August</td>
<td>1</td>
<td>2.33</td>
<td>2</td>
<td>4.65</td>
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<td>13.95</td>
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<td>0</td>
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<td>November</td>
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<td>13.95</td>
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<tr>
<td>December</td>
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<td>0</td>
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<td>Total</td>
<td>6</td>
<td>13.95</td>
<td>37</td>
<td>86.05</td>
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### Table No. 02: Socio demographic factor of Burns deaths

<table>
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<th>Socio Demographic Profile</th>
<th>Male</th>
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<th>Female</th>
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<td>13.95</td>
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<td>16.28</td>
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<td>10</td>
<td>23.26</td>
<td>11</td>
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<td>Lower-middle</td>
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<td>23.26</td>
<td>13</td>
<td>30.23</td>
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<td>11.63</td>
<td>6</td>
<td>13.95</td>
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<td>13.95</td>
<td>37</td>
<td>86.05</td>
<td>43</td>
<td>100</td>
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<tr>
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<td></td>
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<td></td>
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<tr>
<td>Illiterate</td>
<td>3</td>
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<td>12</td>
<td>27.91</td>
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<td>23.26</td>
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<td>25.58</td>
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<td>8</td>
<td>18.60</td>
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<td>2</td>
<td>4.65</td>
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<tr>
<td>Total</td>
<td>6</td>
<td>13.95</td>
<td>37</td>
<td>86.05</td>
<td>43</td>
<td>100</td>
</tr>
<tr>
<td>Marital Status</td>
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<td>16.28</td>
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<td>18.60</td>
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<tr>
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<td>2.33</td>
</tr>
<tr>
<td>Total</td>
<td>6</td>
<td>13.95</td>
<td>37</td>
<td>86.05</td>
<td>43</td>
<td>100</td>
</tr>
</tbody>
</table>

Table No. 2 Described Socio demographic profile of victims.

Most of the victims 15 (34.88%) were illiterate followed by with primary education 11 (25.58%). 34 (79.07%) cases were of married. Females were leading to male; amongst them most of were housewives of Hindu families of lower middle socio-economic class i.e. 13 (30.23%) followed by Upper lower i.e. 11 (25.58%).
Most commonly affected age group was of young aged of 20-40 yrs 30 (69.77%) followed by 40-60 yrs 7 (16.28%) and 0-20 yrs 6 (13.95%). The most of victims 22 (51.16%) sustained 76-100% burns followed by 51-75% burns 15 (34.88%) cases. Most common manner of death was accidental burns 41 (95.35%).

DISCUSSION

Burns injury occur universally and has plagued mankind since antiquity. In all societies including developed or developing countries, burns constitute a medical and psychological problem. It has also severe economic and social consequences not only to the victims, but also to their family and society in general.1

In the present study, we found that amongst 43 study cases, 37 cases (86.05%) were female and 6 (13.95%) were males. The male to female ratio was 1:6.16. Such similar findings with ratio of females predominance were found in studies like Mangal HM et al7 showing 1:2.7 ratio; Ghaffar UB et al1 showing 1:1.13 ratio, Zanjad NP et al8 showing 1:4.86 ratio; Ambade VN et al9 showing 1:2.87 ratio; Haralkar SJ et al10 showing 1:2.10 ratio; Dasari H et al11 showing 1:2.2 ratio. This may be due to large no. of housewives and their social & family problems like cook, children, job, working crowded rooms, and dowry related problems.

Most commonly affected age group was of young aged of 20-40 yrs 30 (69.77%) followed by 40-60 yrs 7 (16.28%) and 0-20 yrs 6 (13.95%). The most of victims 22 (51.16%) sustained 76-100% burns followed by 51-75% burns 15 (34.88%) cases. Most common manner of death was accidental burns 41 (95.35%).

<table>
<thead>
<tr>
<th>Age</th>
<th>Male</th>
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<th>Female</th>
<th>Percentage</th>
<th>Total</th>
<th>Percentage</th>
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</thead>
<tbody>
<tr>
<td>0-20 yrs</td>
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<td>5</td>
<td>11.63</td>
<td>6</td>
<td>13.95</td>
</tr>
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<td>20-40 yrs</td>
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<td>29</td>
<td>67.44</td>
<td>30</td>
<td>69.77</td>
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<td>6.98</td>
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<td>16.28</td>
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<td>0</td>
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</tr>
<tr>
<td>Total</td>
<td>6</td>
<td>13.95</td>
<td>37</td>
<td>86.05</td>
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<table>
<thead>
<tr>
<th>Percentage of Burns</th>
<th>Male</th>
<th>Percentage</th>
<th>Female</th>
<th>Percentage</th>
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<tbody>
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<td>0-25%</td>
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<td>6.98</td>
</tr>
<tr>
<td>51-75%</td>
<td>2</td>
<td>4.65</td>
<td>13</td>
<td>30.23</td>
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<tr>
<td>76-100%</td>
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<td>9.30</td>
<td>18</td>
<td>41.86</td>
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<td>13.95</td>
<td>37</td>
<td>86.05</td>
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<table>
<thead>
<tr>
<th>Manner of Burns Deaths</th>
<th>Male</th>
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<th>Female</th>
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<tr>
<td>Total</td>
<td>6</td>
<td>13.95</td>
<td>37</td>
<td>86.05</td>
<td>43</td>
<td>100</td>
</tr>
</tbody>
</table>

Considering the marital status of the victims, most common victims were married (79.07%). The findings were in accordance with the studies of Vaghela et al12, Buchade et al13, Pathak and Sharma14, Pandey and Chaurasia15.

This study revealed that most of victims were females & housewives belonging to Hindu families and were from lower middle class socio-economic status 13 (30.23%). Most of victims of this study illiterate 15 (34.88%) followed by primary school education 11 (25.58%).

Pathak and Sharma14 showed that most common religion was Hindu consisted 398 (82.91%) while Gadge et al16 & Chawla et al17 concluded that most common victims were housewives i.e. 179 (57.6%) and 28 (56%) respectively. Memchoubi & H. Nabhachandra18 showed that most of cases were in low socio economic status.

Gadage et al16 concluded that most victims had middle school level of education (31.6%) while Gupta et al19 showed that the most of cases had done their education upto primary school level(49.2%)

In this study most commonly affected age group was of young aged of 20-40 yrs 30 (69.77%) followed by 40-60 yrs 7 (16.28%) and 0-20 yrs 6 (13.95%).
These findings and reasoning were consistent with that of Pathak and Sharma\textsuperscript{14}, and Buchade et al\textsuperscript{13}.

As per Dere and Rajoo\textsuperscript{20} most common age group involved was 26-30 years (24.53%) followed by 21-25 years (21.93%). Zanzad and Godbole\textsuperscript{21} showed peak incidence in age 21-30 yrs (39.5%). Gadage et al\textsuperscript{16} found that 68% cases were in age 21-40 yrs. Pandey and chaurasia\textsuperscript{15} revealed same that predominant age group was 21-30yr (45.13%). While Vaghela\textsuperscript{12} study most common vulnerable group was 21-30 yr i.e. 344 (33.7%). Gupta et al\textsuperscript{11} found that most common group was in age 15-30 yr (59.6%).

This is the productive age and they are generally active and exposed to hazardous situations both at home and work.\textsuperscript{16}

In the present study most of victims 22 (51.16%) sustained 76-100% burns followed by 51-75% burns in 15 (34.88%) cases.

Buchade et al\textsuperscript{13} showed most of victims sustained 51 to 75% burns (56.12%) while Zanzad&Godbole\textsuperscript{21} showed (41.4%) of $>80\%$ burns which were more common in victims. Field et al\textsuperscript{16} found that most of burns involving body surface area 80-100% were most common (51.4%). Memchoubi & H. Nabachandra\textsuperscript{18} found that (73.84%) cases involved in $>80\%$ of burns. Rahul Chawla\textsuperscript{17} showed 91-100% burns cases were most common (32%). Only study of Usama B. Ghaffar et al\textsuperscript{1} where burns upto 25% was most common (32.5%) followed by 26 to 50% burns (28.8%) was most commonly affected the burns victims.

In this study of burns death, most common cases belonged to accidental manner of death i.e 41 (95.35%).

Buchade et al\textsuperscript{13}, Dere and Rajoo\textsuperscript{20}, Pathak and Sharma\textsuperscript{14}, Memchoubi & H. Nabachandra\textsuperscript{18}, Vaghela et al\textsuperscript{12}; Zanzad & Godbole\textsuperscript{21} all studies found that most common manner of death were accidental in nature.

CONCLUSION & RECOMMENDATIONS

In this region rural population specially married females in reproductive age group are still at risk of accidental burns injuries at their home. Lower middle class is more likely to suffer this domestic burns injury.

For planning and implementing prevention programs & school education programs, male concerning risk in work locations, the family especially the housewives and parents

Safety precautions to be adopted to prevent domestic accidents should be given to the families through government and non-government agencies.

The purpose of the present study was to analyse the present situation of Burns deaths in Chandrapur as compared to that of other cities in India and to find out the possibilities of decreasing the incidences of Burns deaths in the state.

Conflict of interest : None.

Source of Funding : Self.

Ethical Clearance : It has been taken from Institutional Ethics Committee.

REFERENCES


Physiological Responses to Noise in Preterm Infants Admitted to Neonatal Intensive Care Unit of a Tertiary Referral Hospital in South India

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ABSTRACT

Background: The preterm infants admitted to a high-tech Neonatal Intensive Care Unit (NICU) are vulnerable to noise in the environment.

Aim of the study: To determine the physiological responses of preterm infants exposed to noise in the NICU.

Materials and Methods: Noise levels in the NICU were measured using calibrated Sound Level Meter (SLM) i.e, Hand Held Analyzer Type 2250, Brüel and Kjær, Denmark. The physiological responses of preterm infants were recorded in the Phillips IntelliVue MP20 Junior multichannel monitors.

Results: The maximum hourly equivalent sound L eq of 62.12 ± 2.24 dB A was found on the 2nd day of the measurement that was carried out for a week’s time. The preterm infants cared for in the open care system were exposed to noise levels as high as 78.89 dB A over a period of 24 hours. There was a slight increase in heart rate (HR) on the second day, third day and sixth day of the measurement. Respiratory rate (RR) and Oxygen saturation (SpO2) were within normal range.

Conclusion: The study has found that preterm infants were exposed to noise above the recommended levels on a day-to-day basis.

Keywords: physiological responses, preterm infants, noise, NICU

INTRODUCTION

The progress in neonatal care has helped the survival of neonates, especially the preterm infants. Yet, preterm infants spend prolonged periods in the Neonatal Intensive Care Unit (NICU) not only for want of intensive care but also for their continued existence. Incorporating sophisticated technologies have turned the NICUs to be very noisy and chaotic. The high-tech environment of the NICU contributes to increased survival, but at the
same time the neonates admitted to the NICU, especially
the preterm infants are defenseless and very vulnerable
to the adverse effects of this environment.

The World Health Organization (WHO),\(^{(1)}\) American Academy of Pediatrics (AAP) committee on
Environmental Hazards\(^{(2)}\), the Environmental Protection
Agency - Office of Noise abatement,\(^{(3)}\) AAP Committee
on environmental health\(^{(4)}\), and the Committee to establish
recommended standards for Newborn ICU design\(^{(5)}\)
have recommended the permissible noise in the NICU.
Regardless of the recommendations and standards for
permissible noise in the NICU by various committees of
repute, the noise levels in the NICU have exceeded the
standard recommendations.\(^{(6)}\)

The NICU is a hub of noise from various sources
like that of the life support equipment like ventilators,
infusion pumps, open care system units, warmers,
physiological monitors, phototherapy units, nebulizers
and the like. Adding to this is the noise emanating from
people caring for the neonates. The therapeutic process
thus turns out to be detrimental for the preterm infants
who are also biologically fragile, predisposing them to
various iatrogenic effects of the NICU.

It is well documented in literature that preterm
infants are susceptible to several iatrogenic ill effects
and their potential complications due to their immature
body systems.\(^{(7)}\) The American Academy of Pediatrics
(AAP) joint committee on infant hearing in their position
statement for principles and guidelines for early hearing
detection and intervention programs state that the
equipment used for therapeutic purposes in the NICU
could affect its inmates. The noise originating from the
equipment in the NICU also increases heart rate (HR),
respiratory rate (RR) and also decreases peripheral
oxygen saturation.\(^{(8)}\)

The present study was undertaken to evaluate the
noise exposure in preterm infants admitted to a tertiary
level NICU and their physiological responses during
measurement of noise.

MATERIALS AND METHODS

An evaluative study was conducted after the ethical
approval of the institutional ethical committee (IEC)
of Manipal University, Manipal (UEC/14/2011). Proxy
informed written consent was obtained from the parent(s)
of the preterm infants. The setting of the study was the
NICU of a tertiary referral hospital of Udupi district in
South India. The tertiary level NICU is a subspecialty
of the department of Pediatrics of Kasturba Hospital,
Manipal with facilities pertaining to Level III A level
of functioning but accredited presently by National
Neonatal Forum (NNF) as Level II B. The NICU caters
to an average of 940-1045 new admissions per year. Out
of these, around 250 to 300 are preterm infants. The
preterm infants were chosen to be included in the study
if the following inclusion criteria were fulfilled.

Inclusion criteria

- were gestational age of 28\(^{6/7}\) to 33\(^{6/7}\) weeks of
  postmenstrual age (PMA)
- had passed the hearing screening test to confirm
  hearing ability by Oto-Acoustic Emission (OAE) test
- Parental consent

Exclusion criteria

- died during the study period
- had major congenital malformations
- had major surgical complications

Noise levels were measured using a Sound Level
Meter (SLM) i.e., the Hand Held Analyzer type 2250,
Brüel and Kjær, Denmark calibrated using a Sound Level
Calibrator 4231 (Class 1), Brüel and Kjær, Denmark on
a weighted frequency A and reported as dB (A). The
physiological responses were recorded concurrently in
the physiological monitoring system - Phillips IntelliVue
MP20 Junior multichannel monitors.

The noise levels were measured continuously for a
period of eight hours for seven days, since the averages
taken were representative. A smaller period of assessment
would also help to minimize the Hawthorne effect attention
bias,\(^{(9)}\) where the health care professionals and ancillary
staff in the NICU could alter their behavior when they
are aware that the study is conducted and avoid any other
confounding variables influencing the study. The results
of the study are reported as mean values and standard
deviations. The statistical analyses were conducted with
the software IBM SPSS Statistics 20.
The baseline characteristics of the preterm infants are presented in table 1. The data show that majority 20 (66.67%) of the preterm infants were males, belonged to PMA of 28/7 to 30 6/7 i.e., 17 (56.67%), 22 (73.33%) were AGA, 28 (93.33%) were singleton and 23 (76.67%) were intramural births. The mean weight in grams and standard deviation was 1194 ± 204 g and majority 17(56.67%) of the preterm infants admitted to the NICU during the period of data collection were Very Low Birth Weight (VLBW) infants.

Further, to estimate the expected noise-exposure in preterm infants, the normalized total daily noise exposure...
for a period of 8 hours was calculated. The normalized total daily noise exposure level (8 hours) was calculated as per the following formula\(^{(10)}\):

\[ L_{A_{eq}}, 8h = L_{A_{eq}}, T + 10 \log_{10}(T/8) \]

The \( L_{A_{eq}}, 8h \) is the average noise level in the ambience of the NICU for a period of 8 hours, \( L_{A_{eq}}, T \) is the actual total duration of exposure to the average noise levels, where \( T \) refers to total time of exposure. Substituting in the formula, the maximum \( L_{A_{eq}} \) recorded for the open care system care units, where the preterm infants are cared for in acute NICU amounted to 62.12 dB A and \( T \) is period of 24 hours.

So, \( L_{A_{eq}}, 8h = 62.12 + 10 \log_{10} (24/8) = 62.12 + 10 \log_{10} (3) = 62.12 + 10 \times \log 30 \)

\[ L_{A_{eq}}, 8h = 62.12 + (10 \times 1.477) = 62.12 + 14.77 = 76.89 \text{ dB A} \]

So, the adjusted equivalent one day noise-exposure level in preterm infants who were admitted to the acute NICU during the period of measurement and cared for in the open care system unit was likely to be: 76.89 dB A + 2 dB = 78.89 dB A. Thus, the noise exposure levels in preterm infants was as high as 78.89 dB A over a period of 24 hours.

**Physiological responses of preterm infants during the measurement of noise levels**

The mean values and standard deviations of the physiological responses of preterm infants recorded using a physiological monitoring system –Phillips IntelliVue MP20 Junior multichannel monitors during the period of measurement of noise levels are presented in table 3.

The data presented in table 3 show that the physiological responses were within a normal range i.e., HR (139.59 ± 5.42 to 148.89 ± 9.32), RR (41.19 ± 6.01 to 43.80 ± 4.04) and \( \text{SpO}_2 \) (95.00 ± 2.02 to 96.18 ± 2.61), during the period of measurement of noise levels in the NICU. However, there was slight increase in HR on the second day, third day as well as the sixth day of the measurement. However, HR values were within the normal range. No major changes were noted in the other physiological responses i.e., the RR and \( \text{SpO}_2 \) of preterm infants.

**DISCUSSION**

The noise levels measured for a period of seven days show that the hourly equivalent sound (\( L_{A_{eq}} \)) exceed the recommendations of the Sound Study Group (SSG)\(^{(3)}\) and permissible hourly \( L_{A_{eq}} \) for nurseries.\(^{(11)}\) Many studies done around the world to determine the noise levels in the NICU\(^{(12-15)}\) also show that the noise levels present in the background of the NICU do not conform to the recommendations.\(^{(4)}\)

The present study showed that the preterm infants cared for in the open care systems were likely to be exposed to noise levels as high as 78.89 dB A over a period of 24 hours. This noise exposure level appears to be very much above the recommended levels.\(^{(4)}\) This likely exposure of noise may lead to several problems in the preterm infants, primarily deafness. The study compliments a review\(^{(16)}\) highlighting that the mean characteristic sound levels in the NICU usually range from 70-80 dB (linear) and sometimes reaches potentially hazardous levels of 118 dB (linear). The AAP Committee on Environmental Hazards\(^{(2)}\) in their review on the neonatal aspects of noise pollution, highlight that excessive noise exposure produces deafness by damaging the organ of Corti. As Graven suggests that continuous exposure to noise at 60 dB and above also potentiates the effect of ototoxic agents and may lead to physiological instability.\(^{(17)}\)

The present study showed that the physiological responses of the preterm infants nursed in the open care system units during the period of noise measurement in the NICU were within normal ranges. The HR of preterm infants in the present study ranged from 139.59 ± 5.42 to 148.89 ± 9.32. Though HR was within normal range, a slight increase was observed on the second, third and the sixth day of the measurement. This change in HR was corresponding to the increase in the noise levels on the respective days i.e., 62.12± 2.24 dB A on the second day, 61.8 ± 2.12 dB A on the third day and 61.89± 2.36 dBA on the sixth day respectively. These findings are in line with a Brazilian study\(^{(18)}\) conducted on newborns in the NICU, which found that a variation of 110 to 160 beats per minute was observed in the HR of newborns. The present study however did not find any other major change or variation in the other physiological responses i.e., the RR and \( \text{SpO}_2 \) of preterm infants. However, the Brazilian study\(^{(18)}\) found that oxygen saturation showed a variation of 91% to 98% in the newborns who were exposed to noise.
The noise levels in the NICU that exceed the recommendations and the continuous noise exposure may have serious effects on a vulnerable population like that of preterm infants who invariably spend prolonged periods in the NICU primarily for their survival and continued existence.

CONCLUSION

The study has found that preterm infants were exposed to noise above the recommended levels on a day-to-day basis. It is important that NICUs and the health care professionals working in the NICUs make an honest attempt to mimic the protective intra-uterine conditions for the preterm infants.

Source of Funding: Indian Council of Medical Research (ICMR), India

Conflict of Interest: Nil

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A Mediolegal Study of Poisoning Deaths in and around Vijaywada Area, AP

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ABSTRACT

Background: Rapid development in science and technology and rapid growth in agriculture and industrial sector has led to increase in the incidence of poisoning, taking away a lot of precious human life.

Objective: This study was planned to investigate the incidence and pattern of poisoning from the Postmortem findings of various cases of poisoning at Government General Hospital(GGH), Vijayawada.

Methods: 176 fatal cases of acute poisoning autopsied at were evaluated. Complete autopsy of the body was carried out in each case.

Results: Incidence was more in the age group of 20-29 years in both sexes. Organophosphorus constituted 81 cases (47%). The stomach mucosa was congested in 128 of the total cases, followed by nil particular changes in 37 cases, congested and hemorrhagic appearance in 26 cases and charred/eroded appearance in 5 cases of corrosive acid poisoning.

Conclusion: Poisoning is more common in young males. The overall mortality is substantially high, mainly contributed by self-poisoning with insecticides and corrosives. Early care in a tertiary care center may help to reduce mortality in India.

Keywords: Poisoning, Suicide, Insecticide, Death, Organophosphorus

INTRODUCTION

Poisoning is and likely to remain one of the commonest cause of unnatural death. Knowledge of poisons and causing death by poisoning was prevalent in India right from ancient times. The present era being no exception, it is estimated that some form of poison is directly or indirectly responsible for more than 1 million illness worldwide and this problem is getting worse from time to time as newer drugs and chemicals are developed in vast numbers owing to vast developments in the fields of biochemistry, agriculture, horticulture, microbiology, medicine and toxicology. Knowingly or unknowingly millions of people are exposed to danger by hazardous occupational practices and unsafe storage of toxic chemicals products in their day to day life.

Lack of specialized toxicological services in developing countries like India has further contributed to the higher rate of morbidity and mortality.

Poisoning being invariably medicolegal in nature among fatal cases, postmortem examination is done to establish the exact cause and manner of death. Manner of death in these cases is predominately suicidal because of the general belief that it terminates life with minimal sufferings or accidental but however homicidal cases are also reported and alleged which was more prevalent in the past as there were no well established means of detecting poison from the viscera, etc. It is very difficult to draw a report to say which kind of poisoning is more frequent, has the nature of poisoning varies from one region to other region depending upon the poison availability and the knowledge of the local population regarding the properties of poisons.

The rising incidences of fatal poisoning with prevalence of certain groups of poisons in this particular geographical area has prompted us to undertake this
study to know the epidemiological aspects, patterns & other significant features of deaths due fatal poisoning and to compare it with the observations of various authors by scientific discussion. This study was taken up at a tertiary care hospital in to analyze these changing pattern of poisoning which is a ever-increasing medicolegal, epidemiological and social problem, also to stress the need to establish poison information centers so as to provide information and evidence concerning to diagnosis, treatment, prognosis and prevention of poisoning. So this study aimed to ascertain the common type of poisoning in the cases referred for medicolegal autopsy at Government General Hospital(GGH), Vijayawada.

**METHODS**

The present study has been carried out in the Department of Forensic medicine at Government General Hospital(GGH), Vijayawada during July 2014 to December 2015. All the cases brought to the department for medicolegal autopsy with history of poisoning and cases that were diagnosed as poisoning during the post mortem examination were selected. A sum total of 206 poisoning cases were analyzed during this study period. Permission of the ethical committee on the use of human material for research purpose was obtained.

Detailed information of the deceased pertaining to the case was collected from the concerned police and from the relatives of the deceased by a questionnaire with their consent. Post mortem findings were analyzed with the chemical analysis reports. In treated cases information was acquired by perusal of hospital records. In cases of allegations, information was supplemented by either visit to the scene of crime or from the photographs of the scene of crime.

In all cases, viscera were subjected for chemical analysis at Government General Hospital(GGH), Vijayawada. Dissection of the body was carried out as per the procedure mentioned in “Autopsy Diagnosis and Technic” by Otto Sapphire. **Inclusion** criteria included were all cases with the alleged history of poisoning, Cases diagnosed as poisoning after complete Post Mortem examination and Perusal of chemical analysis reports.

The data was analyzed using MS Excel and Epi-info. 7 version software and appropriate statistical tests of significance were employed in the needed situations in the presentation of data.

**RESULTS**

Of the 1049 cases of postmortem examination, poisoning constituted 196 cases, amounting to 17.05% during this study period.

**Table 1:** Distribution of the study population according to Age

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Age Group</th>
<th>Male (n)</th>
<th>Female (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1-9 years</td>
<td>1(0.75%)</td>
<td>4 (6%)</td>
</tr>
<tr>
<td>2</td>
<td>10-19 years</td>
<td>2 (2%)</td>
<td>9 (14%)</td>
</tr>
<tr>
<td>3</td>
<td>20-29 years</td>
<td>25(19%)</td>
<td>27(42%)</td>
</tr>
<tr>
<td>4</td>
<td>30-39 years</td>
<td>27(20%)</td>
<td>12(19%)</td>
</tr>
<tr>
<td>5</td>
<td>40-49 years</td>
<td>30 (23%)</td>
<td>05 (8%)</td>
</tr>
<tr>
<td>6</td>
<td>50-59 years</td>
<td>26(19%)</td>
<td>0(0)</td>
</tr>
<tr>
<td>7</td>
<td>60-69 years</td>
<td>13(10%)</td>
<td>3 (5%)</td>
</tr>
<tr>
<td>8</td>
<td>70-79 years</td>
<td>9(6%)</td>
<td>3(5%)</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>133(100%)</td>
<td>63(100%)</td>
</tr>
</tbody>
</table>

**Table 2:** Distribution of the study population according to Manner of Death

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Type of Poison</th>
<th>Number</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Suicidal</td>
<td>185</td>
<td>94</td>
</tr>
<tr>
<td>2</td>
<td>Alleged Homicide</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>Accidental</td>
<td>7</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>196</td>
<td>100</td>
</tr>
</tbody>
</table>

**Table 3:** Comparison of Alleged poisons with poisons in FSL Reports

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Type of poison</th>
<th>Alleged</th>
<th>In FSL report</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Organophosphates</td>
<td>67</td>
<td>91</td>
</tr>
<tr>
<td>2</td>
<td>Organophosphate+Alcohol</td>
<td>23</td>
<td>16</td>
</tr>
<tr>
<td>3</td>
<td>PPDA (Para Phenylene DiAmine)</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>4</td>
<td>Alcohol</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>Unknown/Negative</td>
<td>63</td>
<td>33</td>
</tr>
<tr>
<td>6</td>
<td>Corrosive acid</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>7</td>
<td>Kerosene(Petroleum product)</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>Engine oil(Petroleum product)</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>Brake oil(petroleum product)</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>10</td>
<td>Phosphide</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>11</td>
<td>Oduvan</td>
<td>17</td>
<td>17</td>
</tr>
</tbody>
</table>
As per Table 1, the maximum number of poisonings in the study population are seen in the age group of 20 to 29 years (27%). In males it amounted to 23% in the age group of 40-49 years followed by 30 to 39 years (20%). Least number were noticed in the age group of 1 to 9 years (0.75%) and in females maximum number of poisoning cases were observed in age group of 20 to 29 years accounting to 27 cases (43%) followed by 30 to 39 years age group (19%).

According to table 2, 94% of the victims the manner of death were concluded as suicidal, 3.58% accidental and only in 2.04% there were allegations of homicide (Table 2).

There were 133 cases (67.85%) with a known alleged poison and in 63 cases (32.15%), alleged poison was unknown. On comparison with type of poison detected from FSL reports, it is observed that in 30 cases (47.61%), unknown alleged poison was revealed, among which majority were organophosphorus group with 17 cases (56.7%), 5 cases (16.66%) were carbamates, 2 cases (6.66%) each of pyrethroids, organochlorates, imidacloprids and one case each of (3.33%) phosphide poison and cinnarizine (anti histamine group) (Table 3).

**DISCUSSION**

The result of the study showed that maximum number of poisonings were in the age group of 20 to 29 years (27%). Similar results were observed in the studies of Adarsh Kumar\(^1\) and Sharma B.R\(^8\).

The maximum incidence of poisoning in the age group of 20 to 29 years is attributed to the factors like failures in facing the difficulties of academics, unemployment, love failures, family conflicts, marital disharmony, improper judgment of the problem, dowry harassment in case of females and ill health.

Males (68%) outnumbered the females (32%) in the study population. Similar results have been stated by Sharma B.R\(^8\).

In the present study population, poisoning is seen more among married people (81%) as compared to single/unmarried (19%). These findings tallied with studies conducted by Gargi J\(^9\).

In the study population, it is observed that poisoning cases were predominantly seen in rural areas (61%) as compared to urban areas (39%). Similar findings were seen in the studies of Karamjith Singh\(^10\).

In rural areas the predominant factors are financial losses in agriculture, family problems, draught conditions and ill health. In urban areas the reason being due to rapid urbanization leading to stiff competition, lack of employment opportunities, economic instability and high cost of living in urban setup.

In the present study, it is observed that majority of the victims were Illiterates (31%) followed by Under-Matriculate (28%), Matriculates (23%) and least were among Postgraduates (1%).

Illiterates mainly being rural inhabitants, are dependent entirely on agriculture and related works, which are mainly confined to a season. They are left without any work or income for remaining part of the year. Also lack of minimum education makes them prone for bad habits and unable to cope up with the stressful states, thereby losing mental balance and are prone to take drastic decisions and end their lives.

It is similar to the study of Manish Nigam\(^11\) and is in disagreement with study conducted by Karamjith Singh\(^10\).

As per the present study it is observed that 31 (15.82%) cases who died without receiving the treatment, included 21 victims who were categorized under spot deaths and 10 other cases of poisoning where death occurred before receiving any treatment. The results differed from the study conducted by B.D. Gupta\(^12\).

Among treated cases, 29.07% of the victims survived for 1-3 days, followed by 21.93% of the victims surviving for 12-24 hours, 19.38% for 6-12 hours and the least in 5.11% of the victims, who survived for more than 7 days, of which the highest period of survival is 15 days by a male victim aged 28 years who had consumed organophosphorus insecticide.

Our study also showed that in 94.39% of the victims the manner of death were concluded as suicidal,
4% accidental and only in 2% there were allegations of homicide. The results were similar to the studies of B R Sharma and S K Dhattarwal.

The Manner of death that were concluded as suicide were based on the history furnished by the police and the relatives of the deceased, Suicide note, circumstantial evidence and on the Postmortem examination.

Of the 196 cases subjected for chemical analysis, 163 cases (83%) were positive for a poison and in 33 cases (17%) no poison was detected for any residues of cyanide, volatile poisons, pesticides, benzodiazepine drugs, toxic metal ions and anions.

This is similar to the study of Rahul Jain and is in contrast to the study of Adarsh Kumar.

Among the positive cases organophosphate poisoning (91 cases) outnumbered others which was followed by oduvan poisoning, organophosphate along with alcohol poisoning, supervasmol (PPDA) poisoning, phosphide poisoning, carbamate poisoning, corrosive acid poisoning, pyrethroid poisoning, poisoning by petroleum products, organochlorates, benzodiazepines, imidacloprid group and lastly by anti-histaminic drugs.

Among the 163 positive cases detected by chemical analysis, when co-related to the post mortem findings, lung congestion was observed in 108 cases (66%), pulmonary oedema in 39 cases (24%), consolidation changes in 6 cases (4%) and no particular changes observed in 10 cases (6%).

Among 33 cases negative for poison, lungs were congested in 19 cases (58%), consolidation was noted in two cases (6%), pulmonary edema in 6 cases (18%) and no particular changes noted in 6 cases (18%).

There were 133 cases (68%) with a known alleged poison and in 63 cases (32%), alleged poison was unknown. On comparison with type of poison detected from FSL reports, it is observed that in 30 cases (47.61%), unknown alleged poison was revealed, among which majority were organophosphorus group with 17 cases (56.7%), 5 cases (17%) were carbamates, 2 cases (7%) each of pyrethroids, organochlorates, imidacloprids and one case each of (3%) phosphide poison and cinnarizine (anti histamine group).

The results are similar to the studies conducted by Kishan R Siddapur, Naveen Kumar T. The results are in contrast with the studies of Adarsh Kumar, Gargi J and Sharma BR.

**CONCLUSION**

Incidence of poisoning was more in the age group of 20-29 years in both sexes and was more in males as compared to females. Out of the positive chemical analysis report, organophosphorus constituted majority of cases , followed by oduvan poisoning, organophosphate along with alcohol poisoning, supervasmol (PPDA) poisoning, phosphide poisoning, carbamate poisoning, corrosive acid poisoning, pyrethroid poisoning, poisonig by petroleum products, organochlorates, benzodiazepines, imidacloprid group and lastly by anti-histaminic drugs.

**Conflict of interest:** Nil

**Source of funding:** Nil

**Ethical clearance:** Obtained from institutional ethics committee

**REFERENCES**


Study of Patterns of Fatal Cranio-Cerebral Injuries in Deaths due to Road Traffic Accidents

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ABSTRACT

Background: Head injury is any injury that results in trauma to the scalp, skull or brain can be defined as a head injury. Vehicle accidents are one of the important common causes of traumatic head injuries. Objective: to investigate the pattern of cranio-cerebral head injuries sustained by the victims as they are considered to be one of the leading causes of death due to road-traffic accidents.

Methods: This Study was conducted on bodies (n=110) coming for medicolegal postmortem examination to Department of forensic medicine, Government General Hospital(GGH), Vijayawada during the period of January 2015 to December 2016.

Results: Males domination prevailed (82%). In scalp injuries, the contusions was observed in 52% of cases. In the skull fractures, linear / fissure fractures (39%) are more common. Middle cranial fossa (45%) fractures were common as anterior cranial fossa (44%). More cases of subarachnoid (45%) and subdural haemorrhages (44%) were observed.

Conclusion: Young people drive their vehicles with higher speed, increasing consumption of alcoholic beverages as well as other drugs, lack of awareness of the peoples and poor understanding of the traffic rules by citizen, although there is good medical facilities, accounts for the majority of such deaths.

Keywords: Road traffic accident, Crano – Cerebral Injuries, intra cranial hemorrhage

INTRODUCTION

Deaths in Road Traffic Accidents have taken a major portion of toll of death apart from public health problems. Road Traffic Accidents cost a lot not only to the individuals affected and their families but also to the nation as some of the victims are eminent personalities, Industrialists and celebrities who were the pride of the nation. The injuries, disabilities and fatality resulting from injuries due to Road Traffic Accidents put a significant drain on the economy and significant collapse in infrastructure of the nation1.

The risk lies in enormous increase in the number of motor vehicles, rampant encroachment of roads, nasty tendency of violating traffic rules and anarchic traffic systems. Population explosion is another factor to rapid increase in Road Traffic Accidents.

The number of road accident fatalities and the number of persons injured in road accidents in the country between 2001 and 2011 increased by 5.8% and 2.4% respectively. During 2008, Road Traffic Injuries (RTI) ranked fourth among the leading causes of death in the world. Nearly 1.3 million people die every year on the world’s roads and 20 to 50 million people suffer non-fatal injuries, with many sustaining a disability as a result of their injury.1-4 Road traffic injuries are the leading cause of death among young people aged 15-29 years and cost countries 1-3% of the gross domestic product.

Hence this study was conducted to ascertain the pattern of occurrence, incidence and type of Intra cranial injuries of fatal Road traffic Accident victims in and around Vijayawada area.

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METHODS

The Study was conducted on bodies coming for medicolegal postmortem examination to Department of Forensic Medicine, Government General Hospital (GGH), Vijayawada during the period of January 2015 to December 2016. The epidemiological data was obtained with all pathological features of these cases and the forensic aspects of the craniocerebral injuries were studied particularly details of scalp injuries pattern of skull fractures, extent and location, intracranial haemorrhages and their distribution and brain damage with respect to gross findings.

A good attempt is made to study the findings in the case records, investigations like radiography, ultrasonography and CT scans, surgical interventions if any. The inquest reports were studied well and information was gathered from the police officials, relatives, friends and the nearest kin of the deceased and the eye witnesses of the road traffic accident. Details regarding the age, sex, date, time, place, manner of death and the circumstances of the accident were recorded.

The photographs and the proforma are preserved to produce when necessity arises. A master chart is prepared which is an easy access to look into the details of each case, with regard to the postmortem number, name, sex, age, date, time of occurrence of accident, details about injuries, time of death, place of death, manner of death and the circumstances of the incident.

In determining the cause of death, all autopsy findings were evaluated and if there are multiple injuries involved, priority was given to the more fatal injury.

Criteria for selection of cases

1. All cases of head injuries due to RTAs are taken for the study.
2. All head injury cases due to RTA associated injuries over other parts of the body are also included.
3. Decomposed bodies are not included in the present study.
4. 100 cases were studied during the period of Jan 2012 to Jun 2013. This study would include
(a) Detailed history regarding the incident and complete clinical history including operative procedures, if any.
(b) Detailed external examination including the height, weight, sex, age, built, external injuries, internal injuries and and additional observations, if any.

A detailed medico legal postmortem examination was conducted in each case as per Virchow’s method.

RESULTS

Table 1: Age and Sex wise distribution cases of fatal RTAs

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Age</th>
<th>Male No of cases</th>
<th>Male %</th>
<th>Female No of cases</th>
<th>Female %</th>
<th>Total No of cases</th>
<th>Total %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0-15yrs</td>
<td>4</td>
<td>4.70</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>16-30yrs</td>
<td>25</td>
<td>23.5</td>
<td>0</td>
<td>0</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>3</td>
<td>31-45yrs</td>
<td>28</td>
<td>32.9</td>
<td>4</td>
<td>20</td>
<td>32</td>
<td>32</td>
</tr>
<tr>
<td>4</td>
<td>46-60yrs</td>
<td>30</td>
<td>35.2</td>
<td>10</td>
<td>53.4</td>
<td>39</td>
<td>39</td>
</tr>
<tr>
<td>5</td>
<td>&gt;60yrs</td>
<td>3</td>
<td>3.5</td>
<td>6</td>
<td>26.6</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>90</td>
<td>100</td>
<td>20</td>
<td>100</td>
<td>110</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 2: Distribution of the skull fractures with respect to site in cases of fatal RTAs

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Types of Skull Fractures</th>
<th>No of cases</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Intact</td>
<td>35</td>
<td>33</td>
</tr>
<tr>
<td>2</td>
<td>Linear/Fissure</td>
<td>40</td>
<td>37</td>
</tr>
<tr>
<td>3</td>
<td>Depressed</td>
<td>11</td>
<td>9</td>
</tr>
<tr>
<td>4</td>
<td>Communited</td>
<td>12</td>
<td>11</td>
</tr>
<tr>
<td>5</td>
<td>Perforated</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>Crush</td>
<td>10</td>
<td>9</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>110</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 3: Distribution of Intracranial haemorrhages with respect to site in case of fatal RTAs

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Type of Hemorrhage</th>
<th>No of cases</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Extra Dural Hemorrhage(EDH)</td>
<td>9</td>
<td>4.6</td>
</tr>
<tr>
<td>2</td>
<td>Sub Dural hemorrhage(SDH)</td>
<td>85</td>
<td>41</td>
</tr>
<tr>
<td>3</td>
<td>Sub Arachnoid hemorrhage(SAH)</td>
<td>82</td>
<td>42</td>
</tr>
<tr>
<td>4</td>
<td>Brainstem hemorrhage</td>
<td>4</td>
<td>2.05</td>
</tr>
</tbody>
</table>
Conted...

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Cause of Death</th>
<th>No. of Cases</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Cranio Cerebral Injury(CCI)</td>
<td>85</td>
<td>77%</td>
</tr>
<tr>
<td>2</td>
<td>Neurogenic Shock(NS)</td>
<td>6</td>
<td>6%</td>
</tr>
<tr>
<td>3</td>
<td>Hemorrhagic Shock(HS)</td>
<td>15</td>
<td>14%</td>
</tr>
<tr>
<td>4</td>
<td>Septic Shock(SS)</td>
<td>2</td>
<td>2%</td>
</tr>
<tr>
<td>5</td>
<td>Asphyxia(AS)</td>
<td>2</td>
<td>2%</td>
</tr>
<tr>
<td>6</td>
<td>Diffuse Axonal Injury(DAI)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>7</td>
<td>Others</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>110</td>
<td>100%</td>
</tr>
</tbody>
</table>

Table 4: Different causes of Death in cases of fatal RTAs

There was showing gradual increase in toll of deaths due to Road Traffic Accidents among all unnatural deaths during this study period.

In RTA no age seemed to escape trauma. Out of 110 cases, 90 were males and 20 were females. Male to female ratio was more than 5:1. Among total cases the largest number of cases were found in the age group of 46-60 years (38%) and 31-45 years (31%) followed by 16-30 years (20%), >60 years (7%) and least being in the age group of 0-15 years (4%) (table 1).

Out of 100 victims, 42 were pedestrians, 25 were drivers and 33 were vehicular occupants.

In the present study, 34 victims died on the spot, followed by 16 victims within 6 hours, 9 victims during 6 hours - 12 hours, 12 victims during 12 - 24 hours, 5 victims during (24 - 48 hrs), 9 victims during 48 - 72 hrs and 15 victims after 72 hrs.

In the present study, contusions of scalp are more common 81 (51.59%), followed by lacerations 63 (39.32%), lacerations 8 (5.09%), abraded contusions 4 (2.51%), and avulsed lacerations 1 (0.6%).

Out of 110 cases studied, 33 were intact without fracture at all. 67 cases had skull fractures. Among then linear/fissure fractures topped the list of skull fractures 37, followed by comminuted fractures 37, Communed 11, Depressed 9, crush injuries (expressed fractures) 9 and the least being the perforated fracture 1, rarely seen in RTAs (table 2).

In the present study maximum number of intracranial haemorrhages are subarachnoid 85 (42%), followed by subdural haemorrhages 80 (41%), intracerebral 17(8.7%), extradural 9(4.6%), brainstem haemorrhages 4 (2.05%), intra ventricular haemorrhages 2 (1.02%) and last being cerebellar 1 (0.5%)(Table 3).

Out of 80 subdural haemorrhages 48 were with skull fracture and 32 were without skull fracture.

Out of 110 cases 80% of the victims died of cranio-cerebral injuries, 10% with haemorrhagic shock, 6 with neurogenic shock, 2% with associated injuries like fracture of spinal column causing asphyxia and 2% with septic shock (table 4).

**DISCUSSION**

Detailed study of 110 autopsies was carried out with regard to Fatal cranio-cerebral injuries in road traffic accidents in and around Vijayawada area during Jan 2015 to Dec 2016 in the Dept. of Forensic Medicine, Government General Hospital(GGH), Vijayawada.

Regarding age and sex, the findings of our study are similar to the results of other studies 5-8.

The male preponderance may be due to the paternalistic nature of our society where males keep themselves most of the time outdoors to earn bread and butter for families besides males lead a more active life and most of the time are involved in activities such as driving and traveling. In total more than half (63%) of victims were in the age group 21-50 years. This may be due to the fact that persons of this age group lead more active life, more mobile and go out for work and keep themselves outdoors most of the time.

The pedestrians were hit by the buses followed by lorries, cars, Auto rickshaws and two-wheelers. Vehicle
occupants of lorries, Autos and the jeeps are more involved as victims in accidents.

The contributory factors for the fatal injuries to the vehicle occupants include ejection from the vehicle and blunt impact or sudden change in movement and impact within the vehicles, deformation of vehicles, trapping inside the vehicle etc.

Maximum number of pedestrian casualties can be explained by the fact that they are the majority road users in our country. They are comparatively more exposed to the risk of accidents.

Regarding contusions of scalp are more common in frontal, temporal, parietal, occipital areas, multiple site contusion were equally significant suggesting that any part of the head is vulnerable for injury in road traffic accident. The RTA events are fast and do not give the victim enough time for his trauma evading reflexes to act and protect himself.

With respect to linear/fissure fractures which were more commonly seen in parietal area, followed by temporal, occipital and frontal. Comminuted fractures are found in the frontal area, parietal and temporal and occipital areas. Depressed fractures are more commonly seen in the frontal and parietal bones. In the frontal bone, comminuted fractures are more common, than the fissure and depressed fractures. In the parietal bone, majority are fissure fractures followed by comminuted.

In a retrospective study done at Istanbul, Turkey, a total of 501 victims of fatal RTAs with skull fractures were analysed. Linear fracture found to be the most common type of skull fracture (46.56%). In another study carried out there were 79.87% of victims with skull fracture was present. Fracture of the vault of skull was more common than the base of the skull and most common type of fracture was linear. These results are similar to the results of our study.

Subdural and subarachnoid haemorrhages are mostly present over the frontal, parietal and temporal areas. Association of intracranial haemorrhages irrespective of skull fractures was studied.

Among 9 extradural haemorrhages 4 were without skull fractures and 5 were with fractures. Among 17 victims of intracerebral haemorrhage 8 were without skull fracture and 9 were without fracture.

Ghosh P K studied that out of 47 cases, 45.55% had fracture skull with combined intracranial haemorrhage. In 28 cases (12.17%) there were evidences of intracranial haemorrhage without skull fracture.

Even though Diffused axonal injury was a clinical diagnosis for the cause of death, all the cases invariably presented with some kind of intra cranial or intra cerebral haemorrhages being the cause of death.

The present observation helped to understand that the bleeding process can also occur at a delayed period after the original injury which often missed by the neurosurgeons.

The department of neuro surgery in SVIMS operated on 19 patients, and some of them subsequently died even within one day after surgery. Though the outcome was poor an attempt was made to save the life in affordable cases and Arogya sree eligible cases.

In head injuries cerebral compression involves a build up of pressure on the brain and can be life threatening, most often requiring surgery. Cerebral compression occurs when there is an accumulation of blood within the skull or injured brain tissue swells.

Generally accepted notion is that the incidence of accidents is directly related to alcohol consumption. This plays a major role especially if the driver is under the influence of alcohol or substance. The study cannot substantiate the convincing theory. In majority of the cases the surgeon need to gather evidence to declare alcohol intoxication in the victims or in the accused.

**CONCLUSION**

As multiple factors are responsible for causing accidents, the problem requires a multidirectional approach to reduce the rate of incidence and thus reduce the death rate and sufferings of the injured victims. This should be aimed at maintenance of healthy road environment and administration of education to the public at large regarding proper traffic sense and proper enforcement of traffic rules.

**Conflict of interest:** Nil

**Source of funding:** Nil

**Ethical clearance:** Obtained from institutional ethics committee
REFERENCES


Study of Ossification Centres of Bones of Shoulder Joint in Adolescents

K. P. Vasantha Kumar¹, Raza Malik Khan¹, Raju Badisha²
¹Assistant Professor; ²Professor & Head, Department of Forensic Medicine, Kakatiya Medical College, Warangal, Telangana State

ABSTRACT

Objective: This study was aimed to estimate age from epiphyseal fusions at shoulder joint in the local population of Warangal area in the age group of 14-16 years.

Methods: 100 subjects (both male and female) between the age of 14 to 16 years in and around Warangal were studied. X-rays of the right shoulder joint was taken in the Anterior posterior view. Observations regarding the degree of epiphyseal union were recorded for each subject and tabulated in age groups.

Results: Overall mean height of adolescents was found to be between 152± 8.02 cm and 149.71±6.12 cm in Adolescent males and females, respectively. Ossification was progressive with age in males of 14 to 16 years age and fusion of epiphysis with diaphysis was completed in about 46.6% of males of 16-years age group. In females, ossification was much more rapid than in males and by 16 years of age 93.4% of the female subjects showed fusion of the epiphysis with diaphysis.

Conclusion: The ossification at the Shoulder joint is completed in all instances at the age groups of 17-18 year. It was progressive in both sexes.

Keywords: Epiphyseal Union, Shoulder Joint, Proximal end of Humerus

INTRODUCTION

The determination of age in adolescents is important in medicolegal work. It arises in relation to fixing up of criminal responsibility, rape, kidnapping, awarding judicial punishment and employment. Determination of age is much more important in homicidal cases where only skeletal remains are available for analysis. Sometimes, bones are found disposed off in jungle, in the open in ditches or rubbish dumps, etc., or may be found while digging foundations for buildings or skeleton may be exhumed. In cases of mass disaster, where many persons die in the same area and same time from fire, air crashes, etc., the help of forensic expert is sought in identification1-3.

Generally, ossification activities earlies in our Indian population than in western population5-7. The activities are generally earlier in females than in males. Radiological examination is a must as the courts give more importance to it, hence radiological examination of various bones is most valuable investigation with certain limitations, as the union of Epiphysis with diaphysis differs from region to region. Even in normal individuals the appearance and fusion of ossification centres of bone shows variations in relation to sex, race, region and nutrition. So, it is in this context, this study was aimed to estimate age from epiphyseal fusions at shoulder joint in the local population of Warangal area in the age group of 14-16 years.

METHODS

This study was carried out between May 2014 – July 2015, in the Department of forensic medicine and Radiology, MGM Hospital, Warangal. The material for this study consisted of 100 subjects (both male and female) between the age of 14 to 16 years. Subjects were from various schools of local area.
The total number of cases studied for the present study is 100 (both male and female) between 14-16 years. The cases were divided into 3 groups in each sex.

**Group I:** 14 to 15 years (14 years to 14 years 11 months 29 days)

**Group II:** 15 to 16 years (15 years to 15 years 11 months 29 days)

**Group III:** 16 to 17 years (16 years to 16 years 11 months 29 days)

Total number of cases included in this study is 90 (both males and females).

**Radiological Technique:** X-rays of the right shoulder joint was taken in the Anterior posterior view (A.P. view). The epiphyseal appearance and Union was divided into nine stages.

### RESULTS

**Table 1: Age group by Mean weight (Male Adolescents)**

<table>
<thead>
<tr>
<th>Age (Years)</th>
<th>Total number</th>
<th>Weight (Mean ± SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>14</td>
<td>15</td>
<td>36.78 ± 2.88</td>
</tr>
<tr>
<td>15</td>
<td>15</td>
<td>39.00 ± 5.22</td>
</tr>
<tr>
<td>16</td>
<td>20</td>
<td>44.75 ± 5.61</td>
</tr>
<tr>
<td>Total</td>
<td>50</td>
<td>40.97 ± 5.47</td>
</tr>
</tbody>
</table>

The overall mean weight of adolescents was found to be 40.97 ± 5.47Kg. There was a study increase in the mean weight with increase in the age evidently due to the growth spurt in puberty which is also statistically significant (table 1). The overall mean height of adolescents was found to be 152.08 ± 8.02 Cm.

**Table 2: Ossification of Humerus by age Upper end (Common epiphysis) (Male adolescents)**

<table>
<thead>
<tr>
<th>Stage of Ossification</th>
<th>Age of Years</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>14</td>
</tr>
<tr>
<td>A</td>
<td>8 (57.1)</td>
</tr>
<tr>
<td>B</td>
<td>2 (13.3)</td>
</tr>
<tr>
<td>C</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Total</td>
<td>10 (22.2)</td>
</tr>
</tbody>
</table>

Overall, 22.2% were in G(i) Stage, 57.8% in G(iii) Stage, 11.1% in H(i)Stage and 8.9% in I Stage. In the lower age group of 14 years, all were in the earlier stages of ossification [G(i) and G(iii)]. In the group of 16 years, 46.6% were in higher level of ossification [H(i) and I stages]. The difference among the various age groups were also statistically significant (table 2).

**Table 3: Ossification of Acromion Process by age (Male adolescents)**

<table>
<thead>
<tr>
<th>Stage of Ossification</th>
<th>Age of Years</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>14</td>
</tr>
<tr>
<td>A</td>
<td>8 (53.3)</td>
</tr>
<tr>
<td>B</td>
<td>6 (40.0)</td>
</tr>
<tr>
<td>C</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>E2(Eii)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>F</td>
<td>1 (6.7)</td>
</tr>
<tr>
<td>G(i)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>G(iii)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Hi</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>I</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Total</td>
<td>15 (100.0)</td>
</tr>
</tbody>
</table>

In all 24.4% were in Stage A and 24.4% were in Stage B level of Ossification. In the 14-years age group, 53.3% were in Stage A and 40.0% were in Stage B. In the 16-years age group 33.3% were in the Stage G1, and 26.7% were in Stage H of ossification (higher level of ossification). The differences among various age groups were also statistically significant (table 3).
Table 4: Age group by mean weight (Female Adolescents)

<table>
<thead>
<tr>
<th>Age (Years)</th>
<th>Total number</th>
<th>Height (Mean ± SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>14</td>
<td>15</td>
<td>38.46 ± 3.72</td>
</tr>
<tr>
<td>15</td>
<td>15</td>
<td>39.73 ± 3.91</td>
</tr>
<tr>
<td>16</td>
<td>20</td>
<td>42.26 ± 7.04</td>
</tr>
<tr>
<td>Total</td>
<td>50</td>
<td>40.15 ± 5.25</td>
</tr>
</tbody>
</table>

The above mean weight of adolescents was found to be 40.15 ± 5.25 years. There was a steady rise in the mean weight with increase in the age evidently due to the growth spurt in puberty which is also statistically significant (table 4). The overall mean height of adolescents was found to be 149.71 ± 6.12 cm.

Table 5: Ossification of Humerus by age (Upper common epiphysis) (Female Adolescents)

<table>
<thead>
<tr>
<th>Age (Years)</th>
<th>Staging of ossification</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>D (i)</td>
<td>E (ii)</td>
</tr>
<tr>
<td>14</td>
<td>1 (6.7)</td>
<td>1 (6.7)</td>
</tr>
<tr>
<td>15</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>16</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Total</td>
<td>1 (2.2)</td>
<td>1 (2.2)</td>
</tr>
</tbody>
</table>

Overall, 26.7% of subjects were in stage H(i) and 33% were in stage ‘I’ level of ossification. In the age group of 14 years, 26.7% were in stage ‘H’ and none of them were in stage ‘I’ level of ossification. In the 16-years age group, 26.7% were in stage H and 66.71% were in stage ‘I’ level of ossification. The differences among the various age groups were also statistically significant (table 5).

Table 6: Ossification of Acromion process by age (Female Adolescents)

<table>
<thead>
<tr>
<th>Age in Years</th>
<th>Stage of Ossification</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>14</td>
<td>2 (13.3)</td>
<td>3 (20.0)</td>
</tr>
<tr>
<td>15</td>
<td>1 (6.7)</td>
<td>1 (6.7)</td>
</tr>
<tr>
<td>16</td>
<td>0 (0.0)</td>
<td>1 (6.7)</td>
</tr>
<tr>
<td>Total</td>
<td>15 (100.0)</td>
<td>15 (100.0)</td>
</tr>
</tbody>
</table>

In all, 35.6% were in stage ‘H’ and 15.6% were in stage ‘I’ level of ossification. In the 14-years age group, 26.7% were in stage ‘H’ and none of them were in stage ‘I’ level while in 16-years age group 53.3% were in ‘H’ level and 40.0% were in stage ‘I’ level of ossification. The differences among various age groups were also statistically significant (table 6).
DISCUSSION

Study of fusion of the ossification centres around shoulder joint as visualised on radiograph has been time tested method. Numerous workers both in India and others have proved age ranges relevant to their population,

Stewart et al, observed that head of the humerus separated from Diaphysis under 20 years, partially united with diaphysis between 19 to 20 years, united with diaphysis but joint was visible between 20 to 21 years and completely united with diaphysis at about 21 years and above. The findings of present study showed that the union was progressive in 16 years of age group (males) as 46.6% were in higher level of ossification (H(i) and I stages) compared to 14 years of age group where all were in earlier stages of ossification (G1 & G3 stages). According to Flecker (1932) the age of fusion was around 17 years in females and 19 years in males.

The present study showed that fusion was progressive in 16 years of age group is males where 46.6% were in higher level of ossification (Hi & I stages) when compared to 14 years of age group where all were in earlier stages of ossification (G1 and G3 stages). In females, fusion was much more progressive than males in 16-year group where 93.4% were in higher level of ossification (in stages (H(i) and I) compared to 14 years of age group where 26.7% were in stage H and none of them were in stage I level of ossification. According to Davies and Parsons recorded the age of fusion was occurring between 19 to 21 years of age in English subjects (both boys and girls). They did not give separate figures for males and females, so it is not possible to correlate present observations with their study.

The findings of present study showed that the union was early and progressive in both sexes, when compared to the findings of Davies and Parsons.

Gelstaun (1937) showed the age of union in Bengali girls as 14 to 16yrs. This study in females, fusion was much more progressive than males especially in 16-years age group where 93.4% were in higher level of ossification (in stages (Hi) and I) Compared to 14 years of age group where 26.7% were in stage H and none of them were in stage I level of ossification.

Lall and Townsend studied the union in males of U.P as 19 years. Present study showed that union was progressive in 16 years of age group in males as 46.6% were in higher level of ossification (H(i) and I stages) compared to 14 years age group where all were in earlier stages of ossification (G1 and G3 stages). According to them the union in females was around 18 years of age.

This study showed that fusion was much more progressive than males in 16-years age group to females, where 93.4% were in higher level of ossification (in stages H(i) and I) compared to 14-years of age group where 26.7% were in stage H and none of them were in stage I level of ossification.

Apurba Nandi (1995) noted that fusion occurs as 16 to 17years in males. Present study showed that the union was progressive in 16 years of age groups in Males as 46.6% were in higher level of ossification (H(i) and I Stages) compared to 14-years of age group where all were in earlier stages of ossification (G1 and G3 stages). According to them fusion in females occurs between 15 to 16 years of age. Present study revealed that the union was much more progressive in females around 16 years of age where 93.4% were in higher level of Ossification than 14-years age group where 26.7% were in stage H and none of them were in stage I level of ossification. According to flecker (1932) the age of appearance was around 14 years in females and 15 years in males. Fusion of Acromial Centre with body of scapula was around 17 years in both sexes.

The present study showed that the fusion of acromial ossification centre with body of scapula was progressive in 16 years of age group in male where 33.3% were in stage G1 and 26.7% were in stage H of higher level of ossification when compared to 14 years of age group where 53.3% were in stage A and 40.0% were in stage B level of ossification.

According to the present study in females also, fusion of the ossification centre is progressive in 16 years of age group, where 53.3% were in stage H and 40.0% were in I level of ossification when compared to 14 years of age group Where 26.7% were in stage H and none of them were in stage I level of ossification.

Gal Staun (1937) recorded the age of appearance of the Acromion ossification centre as 12 to 14 years in females and 14 to 17 years is males. fusion of the Acromion centre with body of scapula was between 13 to 16 years in females and 14 to 19 years in males.
The present study showed that the fusion of Acromial ossification centre was progressive in 16 years of age group in males where 33.3% were in state G1 and 26.7% were in stage H level of higher level of ossification when compared to 14 years of age group where 53.3% were on stage A and 40.0% were in stage B level of ossification.

In females also, fusion is progressive in 16 years of age group, where 53.3% were in stage H and 40.0% were in I level of ossification when Compared to 14 years of age group where 26.7% were in stage H and none of them were in stage I level of ossification.

Apurba Nandy (1995) noted that the ossification centre of Acromion appears between 12 to 14 years of age in females and between 14 to 15 years of age in Males. Fusion with body of scapula was between 13 to 16 years of age in females and between 14 to 19 years of age males15.

This study showed that the appearance and fusion of acromial ossification centre was progressive in 16 years of age group in Males were 33.3% were in stage G1 and 26.7% were in stage H of higher level of ossification when compared to 14 years of age group where 53.3% were in stage A and 40.0% were in stage B level of ossification.

The present study in females also showed fusion of the ossification centre is much more progressive in 16 years of age group ,where 53.3% were in stage H and 40.0% were in I level of ossification when compared to 14 years of age group where 26.7% were in stage and none of them were in stage I level of ossification.

CONCLUSION

Ossification was progressive with age in males of 14 to 16 years age and almost group and fusion of epiphysis with diaphysis was commenced complete in about 46.6% of males of 16-years age group. In females, ossification was much more rapid that in males and by 16 years of age 93.4% of the female subjects showed fusion of the epiphysis with diaphysis.

Conflict of interest : NIL

Funding : NIL

Ethical clearance : Institutional ethical clearance was obtained

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Forensic Applications and Important Legislations Associated to Wild Life Crime

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ABSTRACT

Wildlife and forest crime is the 3rd biggest crime in the world. Such crimes are our shared responsibility and mainly refers to all flora and animal including birds and fish, as well as timber and non-timber forest products, taking, trading (supplying, selling or trafficking), importing, exporting, processing, possessing, obtaining and consumption of wild fauna and flora, as well as timber and other forest products, in contravention of national or international law. In that such type other words we can say that it is the crime of illegal exploitation of the world’s wild flora and fauna. It is juvenile grassland which uses traditional and next generation techniques to help the investigation of such crime and mainly causes biodiversity and endangered species, the livelihood of people, and severely impacts national security, social and economic development.

To manage illegal wildlife-product trade and protect endangered species several national and international agencies like CITES, WWF, WCCB, UNODC, IUCN, etc. are contributing in the wildlife crime prevention and monitoring. In this article the author has tried to focuses about the variety of wildlife products smuggled and trafficked by criminals and other aspects of protective this biggest crime in our planet as well as various types of legislations associated with it.

Keywords: Wildlife crime, flora and fauna, wildlife forensics, illegal trade etc.

INTRODUCTION

Wildlife crime (WLC) is a momentous branch of the law enforcement and it involves the unlawful trade in animals, plants and their derivatives¹. The computation of such crime concern to wildlife is still mysterious but it is on the increase and has observable effects with the dramatic turn down in many species of flora and fauna. The estimated size of the trade in wild life, and the threat to species, it would be assumed that there is investment in forensic science to aid in combating these unlawful activities². There are several methods in the field of forensic science those pertinent to the enforcement of wildlife legislation viz. veterinary pathology, where skilled persons in the particular discipline perform a similar role as their human counterparts and determine the cause and time since death; inspection of crime scene, to record and collect such as latent fingerprints and exhibits contains DNA, human and animal both³. Forensic science has a range of tools and it is essential that the appropriate tool is used to address the allegation. There are two principal issues that are addressed in wildlife crime and these transmit to the phrasing of the various types of legislations. The first being the ability to identify a particular species and the second is the ability to determine whether the biological material can be assigned with confidence to a particular individual member of that species.

Scope of WLC: It covers an extensive range of assorted crimes forms from which trafficking in live specimens, hunting out of season, cruelty to animals, habitat destruction, poaching for meat, poaching for trophies, poaching to use animal parts in medicines, horns and tusks used for jewellery and ornaments etc.

Estimation of the exact amount of illegal trade is very difficult because there are not the same international surveillance teams that are used for drug enforcement
for the prosecution of offences involving wildlife. Organized crime has not been proven to be linked to wildlife crime but there are indications that this is the case. Another influencing factor in wildlife crime is that there is a high financial return with little chance of being caught and, even if the perpetrators are caught, the penalties are light. Rarely does the maximum penalty for the alleged event meet the potential financial gains.

**Forensic Approaches Concern to WLC Investigation:**
A contradiction to the limited prosecutions is the rise in interest in the forensic community in wildlife forensic science. Each and every forensic scientist should keep one thing in mind that during investigation of the crime concern to the wildlife that all the general techniques i.e. Fingerprinting, fiber and fabric analysis, footprint and bare print skid and trademarks, questioned documents and handwriting analysis, digital forensics evidences, human DNA examination, firearms examinations, soil and chemical analysis etc; those has been used to investigate other types of crime can also be used for wildlife crime.

Briefings of current forensic techniques those are available till now for the investigation of wildlife crime are briefly summarized here under:

(a) **Taxonomy:** Mainly deals with the study of the structure of animals and plants and is useful for identification of species.

(b) **Stable Isotope Analysis:** Principally based on measuring natural variation in the chemical elements present in biological samples to establish the geographical origin or the age of a sample.

(c) **Radiocarbon Dating:** Generally used to decide the age of the samples on the basis of levels of carbon isotopes.

(d) **Wildlife DNA Forensics:** DNA is the genetic material present in human and animal and can be originate from all biological samples viz. Timber products, hair, fur, feathers, bones, blood, ivory, horn, saliva, faeces, nails, claws, teeth etc. and therefore, it can then be used in several applications, including molecular species identification, parentage testing and individual identification.

(e) **Toxicology analysis:** Wherever any wildlife poisoning is suspected, the chemical analysis of the victim and any bait material can establish for the presence or absence of pesticide, if any, has been used.

**Specific Applications for WLC Investigation:**

(a) **Identification of Species:** The species identification plays a key role in many wildlife crime investigations and it involved determining whether a crime has taken place. It can be identify by Physical inspection and DNA.

(b) **Identification of Geographic Origin:** This may be important for species which are protected by varying legislation across their range, for example ivory from African Elephants is listed under CITES Appendix- I everywhere except in Botswana, Namibia, South Africa and Zimbabwe where it is listed under CITES Appendix II . Stable isotope analysis and DNA Analysis are two possible methods can be employed to locate geographical location.

(c) **Aging samples:** In few wildlife crime investigations it is necessary to know the age of a sample to identify endangered species. For example, if a rhino horn was collected prior to 1947, then it pre-dates laws prohibiting trade in rhino horn. In order to determine whether the rhino horn was legally collected before 1947, a form of stable isotope analysis known as radio carbon dating can be employed.

(d) **Animal sexing:** It is study of the gender of a specimen to determine whether an animal was legally killed where the open and closed hunting season vary between males and females (e.g. deer).

(e) **Parentage analysis (captive breeding verification):** The patterns of inheritance from parent to offspring allow DNA profiles to be used to verify family relationships. If genetic variants are observed in an individual that do not match those found in the putative parents, then the possibility of the individual being their offspring can be excluded.

(f) **Taxidermy:** Taxidermy involves preparing, preserving and mounting the skins of deceased animals to replicate their lifelike state. It may be possible to determine the likely cause of death even once the specimen has been mounted.
(g) **Soil analysis**: Soil is comprised of a mixture of organic, mineral and/or synthetic components and is considered as trace evidence and can be used to link a suspect with an offence and is normally collected by the Scenes of Crime Officer.

(h) **Pollen analysis**: Pollen grains are abundant in almost all environments, are very durable and may persist on surfaces and in soils for many years. The pollen produced by flowering plants and conifers, along with the spores produced by ferns are microscopic and not visually obvious trace evidence at a crime scene.

**Legislative Microscopy**: Forensic science can only be employed if there is reason to believe that a piece of legislation has been breached and that there is a need for an investigation to determine whether a crime has occurred, and if so who committed the crime. The relevant legislation of wildlife crime falls under two broad areas i.e. international and national.

The international organization that oversees the trade in protected species is the ‘Convention on the International Trade in Endangered Species of Flora and Fauna’ (CITES). Founded in 1973 it currently has 175 countries (known as Parties) as signatures to the Convention. The role of CITES is to monitor trade species and recommended a ban of all trade in particular species when necessary. There are three appendices that underpin the role of CITES. Appendix I lists species that are threatened with extinction trade is not prohibited. Trade is permitted only in exceptional circumstances such as the movement of the samples/organisms for research or conservation purposes. Species on Appendix II are those that are not necessarily in danger of extinction but could become so if trade were not strictly regulated. Appendix II also contains some species that are not in themselves threatened but have similar morphology to a species that is endangered and hence allows better enforcement of trade for the endangered species. Those species on Appendix III are species which individual Parties to the Convention choose to make subject to regulations and for which the cooperation of other Parties is requested in controlling trade. The numbers of some of the species listed currently under the three appendices are provided in Table-I here under:

<table>
<thead>
<tr>
<th>Species</th>
<th>Appendix-I</th>
<th>Appendix-II</th>
<th>Appendix-III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mammal</td>
<td>297</td>
<td>492</td>
<td>44</td>
</tr>
<tr>
<td>Birds</td>
<td>156</td>
<td>1275</td>
<td>24</td>
</tr>
<tr>
<td>Reptiles</td>
<td>76</td>
<td>582</td>
<td>56</td>
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<tr>
<td>Amphibian</td>
<td>17</td>
<td>113</td>
<td>1</td>
</tr>
<tr>
<td>Fish</td>
<td>15</td>
<td>81</td>
<td>-</td>
</tr>
<tr>
<td>Invertebrate</td>
<td>64</td>
<td>2142</td>
<td>22</td>
</tr>
<tr>
<td>Total fauna</td>
<td>625</td>
<td>4685</td>
<td>147</td>
</tr>
<tr>
<td>Total flora</td>
<td>301</td>
<td>29105</td>
<td>119</td>
</tr>
<tr>
<td>Total Species</td>
<td>926</td>
<td>33790</td>
<td>266</td>
</tr>
</tbody>
</table>

**Note: this information is up to date as of 2017**

Nationally, countries are required to enact laws in order to implement and enforce CITES, and additionally many countries have enacted laws to protect other wildlife with in their borders. In Australia, the international movement of wildlife and wildlife products is regulated under Part 13A of the Environmental Protection and Biodiversity Conservation Act 1999 for all wildlife, including cetaceans. The Act regulates: the export of Australian native species other than those identified as exempt; the export and import of species included in the Appendices if CITES; and the import of live plants and animals that (if they became established in Australia) could adversely affects native species or their habitats (hence a threat to the biodiversity).

Recent estimate are that approximately 50% of timber exports from the Amazon Basin, Central Africa, South-East Asia and the Russian Federation originate from timber that has been logged illegally. The scale of illegal logging is believed to be one of the chief causes of worldwide deforestation. Additionally the trade in illegal timber and wood products creates market disadvantages for products from legal and sustainable forestry. The WWF estimates the global costs illegal timber at approximately $15 billion per year (wwf.panda.org), although this figure is an estimate and cannot be verified easily.

European Union (EU) timber regulation (No. 995/2010) were enacted in December 2010 and will come into force in March 2013 to make it illegal to place illegally harvested timber and timber products on the European market. The new rules target the trade
of illegally sourced timber and place responsibility on traders and importers to perform due diligence by seeking guarantees that the timber products they sell have been harvested in a sustainable way and according to the laws of the country of origin. The EU has negotiated a Voluntary Partnership Agreements (VPA) with individual timber-producing countries. VPA countries agree to export to the EU only verified legal timber with a forest law Enforcement, Governance and Trade (FLEGT) license. It should be noted that the new EU rules are modeled on similar legislation adopted in the United States in 2008, as an amendment of the Lacey Act. This amended Act prohibits in the United States all trade in plants and plant products, including timber and timber products that are sourced illegally from any US State or foreign country. Further, the amended Act requires importers to declare the country of harvest and the species name of all plants contained in their products. This maximizes the opportunity of tracking legally traded timber to the place of origin.

The trade in mahogany species is regulated by CITES with members of the genus *Swietenia* on Appendix II. Species on this Appendix allows commercial trade from some plantations only if subject to appropriate controls. Examples of these include the prohibition of all imports into the EU of *Swietenia marcophylla* from Bolivia (enacted in August 2010). The problem of identification of mahogany species and products from these trees has led to CITES regulating the trade in look-alike species.

In the United Kingdom, the Wildlife and Countryside Act 1981 and recent amendments (1985, 1991 and 2010) are the main pieces of legislation for the protection of wildlife. Additionally, separate Acts have been established for particular species (e.g. seals and badgers, 1970, 1992) or activities, such as hunting or scientific research. Most countries have their own laws pertaining to the enforcement of CITES and the protection of wildlife within their borders. Examples include the Indian Wildlife (Protection) Act (1972) amended in 1993 and 2002; the United States Endangered Species Act 1973; in Canada there is the Canada Wildlife Act 1985, Wild Animal and Plant Protection and Regulation of International and Interprovincial Trade Act 1992 and Wild Animal and Plant Trade Regulation 2009; Ireland has the wildlife Act 1976; and Thailand has the Royal Decree for Wildlife Preservation and Protection B.E. 2535 (1992) amended 2003.

In addition to national and international legislation the European Union also has an Environmental Directorate General9 that regulates trade into and out of the 27 member states. There are several regulations that have been enacted for different aspects of wildlife protection and conversation. These include:

The Council Regulation has been passed in 9th December 1996 on the protection of species of wild fauna and flora by regulating trade therein, in (EC) No 338/97 1997: European Union.


In order to aid in the enforcement of wildlife crime the CITES Secretariat has a Memorandum of Understanding with the US National Fish and Wildlife Forensics Laboratory10 in Oregon. This laboratory is devoted entirely to the investigation of wildlife crime and provides a free service to any party of CITES. There are few such dedicated wildlife forensic science laboratories in existence; normally much of the investigation, if performed, is sent to the operational police laboratories or units within universities. The UK Partnership against Wildlife Crime (PAW) provides financial assistance with wildlife crime cases. More recently the society for wildlife Forensic Science11 has been established to bring together those with a common interest in this particular area of forensic science. A Common phenomenon with specialist wildlife laboratories in that they can be underutilized as they can only examine the samples that are collected and submitted. It is the examination of crime scenes in remote areas that is more of a problem. This is particularly evident in underdeveloped countries where crimes against people and property may not be examined due to lack of resources, far less alleged wildlife.
The wording of any relevant legislation is essential as this forms the question to which forensic tests are addressed. The purpose of any further testing is to be determining whether there is scientific support for the allegation or whether the scientific data supports a credible alternative scenario. The allegation must relate back to a particular piece of legislation.

**Ethical Clearance:** Not Required

**Funding Agency:** Self

**Conflicts of Interest:** Nil

**REFERENCES**


11. www.wildlifeforensicscience.org, Assessed on 22nd April 2107.
Comparative Study of Pattern and Nature of Sharp Force Injury with Reference to the Weapon - A Retrospective Autopsy Based Study

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ABSTRACT

A retrospective study over a period of six years where the pattern and nature of injuries by sharp forces were evaluated and compared with the weapon used for infliction. The influence of the action of the weapon on the nature of the wound inflicted was also observed. The objective of the study also included an attempt to retrospectively evaluate the nature of the weapon during examination of injury at Medicolegal autopsy. Permission was obtained from institutional Ethics and research committee. The study concluded by evaluation of defence wounds, incised wounds, punctured wounds, their pattern and distribution, internal organs involved, injuries to underlying bones and nature of weapon used for infliction of injury.

Keyword: Sharp force injuries – Weapon – Correlation

INTRODUCTION

The injuries by sharp cutting weapon include incised wounds, punctured wounds and chop wounds. Incised wounds are injuries with sharp cut margins the length of the wound being more than the depth and punctured wounds are wound which have more depth than the length. Chop wounds are wounds produced by heavy cutting weapons during a chopping action. The nature of edges of sharp force injuries are influenced by the sharpness of the weapon, heavy nature, nature of cutting blade and manner of infliction. The shape of the external wound is also influenced by the nature of weapon. Wounds produced by a heavy cutting weapon result in bruised skin margins. Twisting or turning the weapon when within the wound result in side cuts or V – shaped injury. Sliding contact during withdrawal of weapon results in tailing of the wound which helps in evaluating the position of the assailant and reconstruction of crime. Suicidal wounds and homicidal wounds has to be differentiated during a medicolegal autopsy to prevent false incrimination of crime. The nature and multiplicity of injuries on the body also often conveys the emotional state of the assailant at the time of committing the crime. The pattern and nature of injuries during a murder for gain will be different from that of a murder under provocation or murder with vengeance. The presence of more than one independently fatal injury on the body conveys the intention and deliberate nature of the act to ‘kill’ and injuries amounting to mutilation is consistent with the concept of ‘over killing’.

AIMS AND OBJECTIVES

1. Correlation of pattern and nature of injuries by sharp forces with the weapon used for infliction.
2. Evaluation of the probable nature and appearance of weapon by observing the morphology of injuries during medicolegal autopsy.

MATERIALS AND METHOD

Retrospective evaluation of death by sharp force injuries were conducted by evaluation of detailed postmortem case records in the Department of Forensic Medicine, Govt.Medical College, Kozhikode. The study extends over a period of 6 years from the year 2005 to 2010. The details of the injuries (pattern and nature...
mentioned in antemortem injuries are noted) and the morphology of injury were correlated with the nature and appearance of weapon submitted before the medical officer. The wounds were diagrammatically represented on human body diagrams and the observations evaluated.

**Inclusion criteria:** Postmortem examination in homicides by sharp cutting weapons where the weapon of crime has been recovered has been incorporated in the study.

**Exclusion criteria:** Decomposed dead bodies has been exempted from the study as the evaluation of details of the injuries may show variations. Homicides where the weapon of crime has not been recovered is excluded from the study as correlation is not possible. Delayed death following hospital admission has also been excluded from the study.

Approval from Institutional Ethics Committee has been obtained for conducting the study.

**OBSERVATIONS**

### Table 1: Pattern and distribution of sharp force injury

<table>
<thead>
<tr>
<th>No of cases</th>
<th>Incised Wound</th>
<th>site</th>
<th>Punctured wound</th>
<th>site</th>
<th>Internal organ</th>
<th>Bone cut</th>
<th>Light/heavy cutting weapon</th>
</tr>
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<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>2005</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Defence wounds 7</td>
<td>22</td>
<td>Head 2</td>
<td>8</td>
<td>Neck - 2</td>
<td>7/22 IW</td>
<td>6 IW</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Neck 7</td>
<td></td>
<td>Chest - 5</td>
<td>8/8 Pw</td>
<td>4 PW</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Chest 8</td>
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<td>Abdomen - 1</td>
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<td></td>
<td></td>
<td></td>
<td>Abdomen 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Chop wound 4</td>
<td></td>
<td></td>
<td></td>
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<td>2006</td>
<td></td>
<td></td>
<td>Head 5</td>
<td>10</td>
<td>Neck - 3</td>
<td>10/30 IW</td>
<td>8 IW</td>
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<td>Defence wounds 9</td>
<td>30</td>
<td>Neck 6</td>
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<td>8/10 PW</td>
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<td></td>
<td></td>
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<tr>
<td>2007</td>
<td></td>
<td></td>
<td>Head 8</td>
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<td>15/26 IW</td>
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<td>11/12 PW</td>
<td>5 PW</td>
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<td></td>
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<tr>
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<td>Head 9</td>
<td>13</td>
<td>Chest - 7</td>
<td>16/23 IW</td>
<td>7 IW</td>
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<td></td>
<td>Defence wounds 11</td>
<td>23</td>
<td>Neck 3</td>
<td></td>
<td>Abdomen - 5</td>
<td>9/13 PW</td>
<td>6 PW</td>
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<td></td>
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<td>Chest 6</td>
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<td>Neck - 1</td>
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<td>Abdomen 4</td>
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<td>Chop wound 1</td>
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</table>
**Fig. 1: Chop Cut Injury**

**Fig. 2: Defence Wound**

**Fig. 3: Stab Injury**

**Fig. 4: Weapon in stab injury**

**DISCUSSION**

In the year 2005, 15 medico legal autopsies in homicides by sharp force trauma revealed 22 incised wounds and 8 punctured wounds. Out of the 22 incised wounds, 2 were seen on the head, 7 on the neck, 8 on the chest wall and 5 on the abdominal wall. Out of the 22 incised wounds 4 showed characteristics of chop injuries. Out of 8 punctured wounds, 2 were seen on the neck, 5 on the chest wall and 1 on the abdominal wall. The vital organs of chest and abdomen were involved in 7 incised wounds and 8 punctured wounds. The wounds were bone deep cutting the underlying bone in 6 incised wounds and 4 punctured wounds. Out of the incised wounds, 20 were inflicted using a light cutting weapon and 2 using a heavy cutting weapon. All the punctured wounds were inflicted using light cutting weapon. Defense wounds were seen only in 7 cases.

In the year 2006, 17 homicides were evaluated and out of the thirty incised wounds, 5 were on the head, 6 on the neck, 9 on the chest, 6 on the abdomen and 4 were chop wounds. The punctured wounds were 10 in number out of which 3 were on the neck, 5 on the chest and 2
on the abdomen. The underlying internal organs were involved in 10 incised cuts out of 30 wounds and in 8 cases out of 10 punctured wounds. The underlying bone was found cut in 8 incised wounds and 6 of the punctured wounds. The weapon used for inflicting the injuries was a light cutting weapon in 26 cases of incised wounds and in 4 cases of incised wounds the weapon was heavy cutting in nature. Out of 10 punctured wounds 9 were inflicted by using light cutting weapon and one of them was by a heavy cutting weapon. Defense wounds were seen only in 9 case.

In the year 2007 on evaluating 19 homicides by sharp force injuries there were 26 incised wounds, out of which 8 were on the head, 3 on the neck, 9 on the chest, 3 on the abdomen and 3 of them were chop wounds. The punctured wounds were 12 in number out of which 8 were on the chest and 4 on the abdomen. The internal organs were involved in 15 incised wounds out of 26 injuries and 11 punctured wounds out of 12 injuries. The underlying bone was found cut in 11 incised wounds and 5 punctured wounds. The weapon was light cutting in nature in 20 incised wounds and heavy cutting in nature in 6 incised wounds. All the punctured wounds were by using light cutting weapon. Defense wounds were seen only in 12 cases.

In the year 2008, 13 cases were evaluated with 20 incised wounds, 6 on the head, 4 on the neck, 5 on the chest, 3 on the abdomen with 2 being chop wounds. Out of the 14 punctured wounds, 9 were on the chest, 4 on the abdomen and 1 on the thigh. The vital organs were seen involved in 10 out of 20 incised wounds and 12 out of the 14 punctured wounds. The underlying bone was found cut in 9 persons with incised wounds and 4 persons with punctured wounds. The weapon recovered was light cutting in nature in 14 cases with incised wounds and heavy cutting in 6 cases. 12 cases of punctured wound was inflicted with light cutting weapon and 2 cases of punctured wound was inflicted with heavy cutting weapon. Defense wounds were seen in 10 out of the 13 cases of homicides by sharp cutting weapon.

In the year 2009, 16 homicides by sharp force injuries were analysed. There were 23 incised wound, out of which 9 were on the head, 3 on the neck, 6 on the chest, 4 on the abdomen and 1 of them was a chop cut. Punctured wounds were 13 in number, out of which 7 were on the chest, 5 on the abdomen and 1 on the neck. The internal organs were involved in 16 incised wounds and 9 of the punctured wounds. The underlying bone was found cut in 7 incised wounds and 6 punctured wounds. The weapon was light cutting in nature in 20 of incised wounds and heavy cutting in nature in 3 of the incised wounds. 10 of the punctured wounds were produced by light cutting weapon and 3 by heavy cutting weapon. Out of the 16 cases 11 had defence wound.

In the year 2010, 18 cases were evaluated and out of 33 incised wounds, 9 were on the head, 4 on the neck, 8 on the chest and 8 on the abdomen and 4 of them were chop wounds. There were 16 punctured wounds, out of which 2 were on the neck, 9 on the chest and 5 on the abdomen. The internal organs were involved in 24 incised wounds and 14 punctured wounds. The underlying bone was found cut in 12 incised wounds and 6 punctured wounds. 24 incised wounds were inflicted using a light cutting weapon and 14 by heavy cutting weapon. 13 of the punctured wounds were produced by light cutting weapon and 3 of them by heavy cutting weapon. There were defence wounds in 11 of the homicides by sharp force injuries.

**CONCLUSION**

Defence wounds were seen in more than 50% of homicides by sharp force injuries. Incised wounds were seen distributed on the head, neck, chest and abdomen in varying proportions which suggest that incised wounds inflicted during the course of attack by sharp force were not predetermined or planned action and was influenced by the movement of the victim, weapon and the assailant. Most of the wounds were distributed over the prominent portions like head, chest and abdomen which are likely to be involved during the slashing or swaying action. In homicide by sharp force injuries incised wounds were more common than stabbing action. Punctured wounds were seen more over the chest with respect to other areas of the body followed by the abdomen. Injuries to the neck were relatively less compared to other areas which suggests the possibility to be ‘injury by chance’ during the course of inflicting injuries deliberately. The internal organs were seen more involved in punctured wounds as they were relatively deeper and more over the chest and abdomen. The intention of the assailant may also have an influence on the relative number of the punctured wounds on the chest and abdomen. The injuries to the underlying bones were more in incised
wounds possibly as it is influence by the depth and site of the sharp cut. Injuries to chest and abdomen are more likely to involve the viscera whereas over other areas the underlying bone could have come in contact with the weapon during the swaying or slashing action. The injury to the bone in punctured wounds appear to be due to contact with the tip of the weapon which is sharp. Most of the incised wound and punctured wound were produced by light cutting weapon, the action producing the injuries being different. The heavy cutting weapons used for homicide produced more incised wounds on the body than punctured wound during the chopping action, the shape of the weapon, having an influence on the pattern and nature of the injuries produced.

Conflicts of interest: Nil

Source of funding: Self

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Intracranial Extraskeletal Myxoid Chondrosarcoma in CNS – An Exceptionally Rare Case Report

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ABSTRACT

Extraskeletal myxoid chondrosarcoma is a rare soft tissue sarcoma. Though usually indolent it can have aggressive course. Since its recognition as a distinct clinicopathologic entity, now considered an intermediate grade neoplasm rather than a low grade neoplasm as previously considered. They are most commonly located in the extremities, limb girdles or trunk. However, unusual locations have also been reported including central nervous system, nasal cavity breast and vulva. In CNS there have been very few cases (less than 10) of EMC reported predominantly in the intracranial location with sites of origin including the choroid plexus, pineal gland and cortex.

We are reporting a case of 35 years female with complaints of headache, severe bilateral proptosis with loss of vision and altered sensorium. MRI revealed a predominantly cystic mass lesion involving the anterior skull base, paranasal sinus and nasal cavity. Intraoperative crush cytology diagnosed it as an extra skeletal mesenchymal tumor with chondrocytic differentiation which was confirmed on histopathology and marker studies as extra skeletal myxoid chondrosarcoma.

Keywords: Extraskeletal chondromyxoid sarcoma (EMC), soft tissue sarcoma, intermediate grade neoplasm, intraoperative crush cytology, histopathology, immunomarker studies.

INTRODUCTION

Extraskeletal myxoid chondrosarcoma is a rare soft tissue sarcoma that comprises less than 3% of all soft tissue sarcomas.¹⁵ Extraskeletal chondromyxoid sarcoma was first described by Stout and Verner ¹ who called such group of tumors as” Chondrosarcomas of the extraskeletal soft tissues”. In 1972, Enzinger and Shiraki described 34 cases of a distinctive soft tissue neoplasm and described their histological and biological features giving the designation as EMC.² Authors concluded that EMC is a low grade SA in which the prognosis is determined predominantly by tumor cellularity. Though its histogenesis as well as grade is challenged by recent studies and it is now considered as an intermediate grade neoplasm with origin from primitive mesenchymal cells with focal multidirectional differentiation.

Case report: A 35 yrs. female presented with complaint of headache off and on since 4-5 yrs., severe bilateral proptosis since 2 months with loss of vision in both eyes – in the left eye since 2 months and in the right eye since 7 months, accompanied by watering from both eyes since the same duration. Patient was drowsy and irritable with altered sensorium. She was opening eyes on pain, no verbal response with B/L spontaneous movements.

O/E – Pupils bilaterally dilated = 6-7 mm, not reactive to light.

Extraocular movements could not be assessed as the patient was non cooperative.

Radiological findings: MRI scan of PNS with contrast revealed predominantly multiloculated cystic mass lesion showing enhancing walls appearing hyperintense on T2W images and hypointense on T1W sequences seen involving the nasal cavity, anterior cranial fossa and
frontal lobe. It also involved the hard palate inferiorly, laterally it extended into bilateral orbits causing compression over bilateral optic nerves and bilateral medial recti, and posteriorly it involves the sella turcica and sphenoid. The mass also involved the superior part of the nasopharynx. Fossa of Rosenmullar on both sides appears normal. Acute infarct is seen in right occipital and right temporal lobe appearing hyperintense on T2W, DW1 and FLAIR images and a few hyper intensity on T1W sequences.

**Opinion:** predominantly cystic enhancing mass arising from?? nasal cavity with above described extension- possibility of Esthesioneuroblastoma is likely.

- Acute infarct with haemorrhagic transformation in right PCA territory.

**Predominantly cystic tumor mass with its extension**

**Intra-operative findings:** Capsulated, well demarcated partially suckable, soft, moderate to highly vascular, greyish red mass present in the anterior cranial base and this mass caused defect in the anterior cranial base and reached up to paranasal sinus and nasal cavity.

Mass taken out subtotally and was highly vascular. Nasal cavity was inspected endoscopically and patient’s relatives were asked to give consent to proceed for the endoscopic removal of nasal mass but they refused at that time. Anterior cranial base was reconstructed using peri-cranial patch reinforced with fibrin glue.

After few days patient gave consent for endoscopic removal of nasal mass. Endonasal excision was done with near total removal of the tumor. Tumor was soft, suckable invading the nasal cavity, B/L maxillary sinus, orbital floor and medial wall. There was diffuse oozing. The remaining tumor mass was not controlled by surgical pressure, so liquid gel foam (surgiflow) was used and nasal packing done using merocoele and roller gauze. Pharyngeal packing was also done. Patient was also shifted to ICU on ventilator support and later she expired due to septic shock, DIC and cardiopulmonary arrest.

Intraoperative crush cytology was done and the tissue was sent for biopsy in both operative procedures.

**Pathological findings:**

**Intraoperative Crush cytology:** smears are cellular and comprised of cells in small sheets and clusters embedded in abundant myxoid and basophilic chondromyxoid stroma. Cells are mostly uniform with small round to oval to elongated nuclei, some showing hyperchromasia and presence of nuclear grooves. There is no significant pleomorphism and mitotic activity.

**Impression:** Cytomorphological features are suggestive of mesenchymal malignancy with chondrocytic differentiation.

**Intraoperative crush cytology – suggestive of EMC**

**Histopathology:** biopsy submitted shows predominantly chondromyxoid tissue with hypo- and hyper-cellular areas. The cells have variable morphology, they are spindle to stellate cells floating in the myxoid matrix. At places chondroid lacunae are seen. The cells show pleomorphism and are arranged in lobular configuration. Brain parenchyma–white matter shows gliosis. Overall morphology favours a chondromyxoid neoplasm with aggressive behaviour.

**Diagnosis:** Overall morphology favours a chondromyxoid neoplasm with aggressive behaviour. Possibility of-
(i) Chondromyxoid sarcoma  
(ii) Chondroid chordoma  
(iii) Malignant mesenchymal neoplasm with chondromyxoid differentiation

Marker studies were advised for exact histogenesis.

**Histopathology–features suggestive of EMC**

![Fig. 1](image1.png) ![Fig. 2](image2.png) ![Fig. 3](image3.png) ![Fig. 4](image4.png)

![Fig. 5](image5.png) ![Fig. 6](image6.png) ![Fig. 7](image7.png) ![Fig. 8](image8.png)

**Immunohistochemical Marker studies–**

Morphology was of a mesenchymal neoplasm of malignant potential.

Vimentin, CD 68, S 100 & p 53 were positive in tumor cells.

SMA focally positive.

CD 34 positive around blood vessels and blood vessels were increased.

CD1a, CD10, CD99, CD117, Caldesmon, Desmin , Factor XIIa, Synaptophysin, Calretinin, EMA, CK PAN (AE1-AE3) and GFAP are negative in the tumor cells.

Ki 67/MIB was approximately 5-9 %.

**Impression:** Immunomarkers favour extraskeletal chondromyxoid sarcoma.

Further evaluation by molecular and cytogenetics may be considered.

**DISCUSSION**

Extraskeletal myxoid chondrosarcoma is a rare mesenchymal soft tissue malignancy of putative chondrocytic differentiation. Occasional overt cartilage formation, positivity for S-100 protein and ultrastructural analysis has supported this view. However, most extraskeletal myxoid chondrosarcomas do not show chondroid tissue formation and S-100 protein positivity also is much less commonly found than has been reported, thus ,creating a doubt regarding the histogenesis of EMC as a chondroblastic entity. A study suggests that the basic cellular phenotype of EMC is not chondrocytic or pre-chondrocytic rather most likely consists of primitive mesenchymal cells with focal multidirectional differentiation and that chondrocytic differentiation is an unusual facet in the spectrum of differentiation patterns exhibited by this tumor.

The original hypothesis of this tumor being a variant of chondrosarcoma has been challenged in recent years. The absence of true cartilage formation ,the presence of myxoid matrix rich in mucin and poor in collagen II and aggrecan core protein, as well as presence of neurosecretory granules, microtubule associated protein – 2 and beta – tubulin in some cases suggest that EMC has a neural – neuroendocrine differentiation and is not strictly as cartilaginous tumor.

Even though, histologically, the tumor has a vague resemblance to human cartilage, but with a marked phenotypic plasticity that overlaps with other mesenchymal malignancies and an uncertain histogenesis. Since, its recognition as a distinct clinicopathological entity, the debate regarding tumor behaviour has shifted towards an understanding of its nature as intermediate grade rather than a low grade neoplasm. This idea is substantiated by studies with long median follow up that demonstrate a high rate of local tumor recurrence and distinct spread despite a prolonged clinical course.

Myxoid lesions in D/D of EMC are benign lesions like myxoma and nodular fasciitis – diagnostic confusion is due to low cellularity and abundant myxoid matrix. The presence of nuclear hypochromasia and the typical septated nodular growth patterns helps in distinguishing EMC from myxoma and nodular fasciitis. Chordoma is D/D if in the axial skeleton but the presence of vacuolated physaliferous cells which are positive for S-100 protein, EMA, cytokeratin and brachyury. In contrast to this, EMC is typically negative for epithelial markers and S-100 is also expressed only focally, if at all.

Tumor cells are positive for vimentin in virtually all cases but only positive for S-100 protein focally in a minority of cases, points to a non- hyaline cartilage phenotype. Epithelial markers, GFAP,HMB–45,desmin and myoglobin are all typically negative.
Some studies show that tumor cells usually express vimentin, synaptophysin, S-100 protein and EMA. In others tumor cells were diffusely positive for vimentin, focally positive for EMA, S-00 protein and cytokeratin & negative for CD 34 and CD 99.

Further confirmation may be done my molecular and cytogenetic studies.14,16

Recognition of variants of EMC, including predominantly cellular to solid forms with minimal myxoid (cellular variant), rhabdoid differentiation or spindle cell variant resembling fibrosarcoma or pleomorphic sarcoma, is also important. Solid tumors may resemble other tumors with small round cells; including Ewing’s SA and small cell synovial SA. However, careful sampling of the tumor reveals areas with histologic features of conventional EMC. In cases where histologic distinction of EMC is difficult on morphological grounds alone, studies to detect the presence of characteristic gene fusion involving EWSR 1 and the presence of fusion partner in Ewing’s SA are invaluable in aiding in accurate classification of this tumor.

In CNS there have been very few cases (less than 10) of EMC reported predominantly in the intracranial location with sites of origin including the choroid plexus, pineal gland and cortex.3,4,5,6,7. There is limited prognostic information available about EMC in CNS, prior reports of EMC arising in an intracranial location has shown high recurrence rate.7,16,17

To conclude, EMC is a rare soft tissue tumor that can occasionally occur as a primary dural based lesion in various locations within the CNS. Though rare EMC should be considered in the D/D of myxoid lesions of the CNS. Molecular studies demonstrating involvement of the EWSR1 locus are invaluable aids in the diagnostic work up in CNS lesions especially. EMC is distinguished from other SA by its unique histology and a characteristic chromosomal translocation, typically t (9; 22) (q22; q12.2) fusing EWSR 1 to NH4A3 (genes formerly termed EWS & CHN, TEC or NOR 1 respectively).18,19,20 A small proportion of EMC has a different translocation t (9; 17) (q 22; q11.2) which results in a RBP 56 – NR4A3 fusion gene and neuroendocrine differentiation in some cases.21 The chromosomal translocations result in fusion gene products responsible for alterations in cellular growth and differentiation.22

EMC is an intermediate grade neoplasm with a tendency to recurrence and metastasis.

CONCLUSION

Developing understanding of EMC is that this disease is less indolent than previously believed, given its high rates of recurrence and propensity for lung metastasis. A single largest study of EMC found that approximately one half patients will experience local recurrence after resection and other half will develop metastatic disease.

EMC is a genetically distinct sarcoma with a propensity for local recurrence and metastasis despite an indolent course. The French federation of cancer centres (FNCLCC)23,24 staging system lists EMC as grade 2/3 tumor. Median survival of less than 18 months from the onset of metastasis is consistent with an intermediate grade to high grade sarcoma; only satisfactory chance of cure of these tumors is surgical intervention in patients with localized disease.

Our case was of extraskeletal chondromyxoid sarcoma of malignant potential with development of acute symptoms within one year,though she complained of headache off an on since 4 to 5 yrs. The tumor was locally aggressive with fatal outcome. EMC should be considered in the differential diagnosis of CNS soft tissue lesions.

Ethical clearance: Taken
Source of funding: Self
Conflict of intrest: Nil

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Knowledge, Attitude Vis-À-Vis to Medico Legal Autopsies among the Non-Teaching Staff in a Private Medical College in Mangaluru

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ABSTRACT

Prerequisite to establish the cause and manner of death has always existed from time immemorial. Autopsies are a part of the health and justice systems that have commonly been poorly understood by the community, including the medical profession in current times. The Medico legal Autopsy, which is performed on the directives of the legal authority in situations relating to suspicious, sudden, obscure, unnatural, litigious or criminal deaths, and the evidence so derived is applied for lawful purposes to support the path of justice.

Objective: The objective of this study is to measure the public’s knowledge, attitude about and towards medico legal autopsy and to identify the reasons if any and suggest some corrective measures.

Material and methods: A cross sectional prospective study was carried out in a private medical college in Mangaluru. Total of 153 individuals who fulfil the inclusive criteria responded to a self-administered questionnaire.

Results: The study have established that the public has some understanding of the procedures involved in autopsy and to some degree the role of medico legal autopsy but very few individuals have true idea and understanding of medico legal autopsy. The general public’s attitude towards autopsy is encouraging but there is a need for improvement on outlooks towards medico legal autopsy.

Conclusion: There is a requirement to upturn the awareness and attitude among the general public related to medico legal autopsy.

Keywords: Knowledge; Attitude; Medico legal autopsies; Non-teaching staff; Medical College.

INTRODUCTION

Autopsy/necropsy infers examination of the dead body (postmortem examination) with a view to probe mainly for the cause of death. The requisite to establish the cause and manner of death has always existed. It is vitally important to know whether a death is due to natural causes (i.e., where there are no signs of violence), an accident, by the hostile action of a community member or, perhaps an act of God (i.e. unavoidable). There are two kinds of frameworks in which an autopsy is conducted: in a hospital or clinical setting, or as part of
a medico legal (forensic) investigation in both the cause of death is suspicion among the clinicians and then to give a valid legal report.

In situations concerning to suspicious, sudden, ambiguous, unnatural, litigious or criminal deaths, the medico legal or Forensic Autopsy, is carried out on the directives of the legal authority. The information derived is used for legal purposes to help the course of justice. In situations concerning to suspicious, sudden, ambiguous, unnatural, litigious or criminal deaths, the medico legal or Forensic Autopsy, is carried out on the directives of the legal authority. The information derived is used for legal purposes to help the course of justice. The world without autopsies, would have been a different scene and there would have been numerous circumstances where it would not be imaginable to say why death occurred: or not likely to be able to untangle and differentiate, for instance, between natural and accidental deaths or suicides and homicides. Despite strong religious and cultural disapproval to providing medico legal autopsies, in some places legal organizations are depending more and more on forensic pathology. The amount and kinds of deaths examined by autopsy differ significantly from place to place. Even though the unwillingness on cultural or religious grounds to carry out more autopsies than are totally essential must be valued but definitely must be proceeded with care. Autopsies are a part of the health and justice systems that have largely been poorly assumed by the public, as well as the medical line of work in recent times. The general community is certainly uncomfortable and not unexpected, given that numerous people are sore discussing or rationalizing about death, and autopsies. In some situations the physical mechanisms of death is directly confronted in a very intimate way. The present study is an attempt to reach the general population and look for their views on medico legal autopsy. Public understanding and feedback are necessary to make certain that autopsy investigations and the systems established to recognize their wider worth accord with the law and reveal present values as the procedure of autopsy is a way towards the justice.

MATERIAL AND METHOD

This prospective cross sectional study will be conducted among non-teaching personnel in a private medical college in Mangaluru, Karnataka. Total of 153 people of Mangalore were included in a study population. Study population were given a well-structured self-administered questionnaire designed by medical professionals was used to assess the attitude and knowledge of participants towards medico legal autopsies. Validation of questionnaire will be done. The questionnaires is designed in English and translated to the local language (Kannada) in order to have common understanding among participants. Statistical analysis will be done on SPSS Ver. 17.0 Software association will be found by applying chi square test and ANOVA. P< 0.05 will be considered as significant.

RESULTS

Out of 200 questionnaires which were sent out and 153 non-teaching personal responded, giving a response rate of 76.5%. The response rate was slightly higher among men (53.6%) than women (46.4%) with a female: male ratio of 1:1.1. the demographics showed the mean age of the respondents to be 39.65 years. More than two third of all respondents 122 (79.7%) knew the term autopsy and out of those respondents, 64 (41.8%) thought autopsy was examining both the inside and outside of the body. Table 3 shows out of 35 (22.8%) post graduate respondents, 18 (51.4%) replied autopsy is examining both inside and outside of the body as compared to PUC educated respondents who out of 22 (14.3%), 11 (50%) thought autopsy is examining the inside of the body only. 83 (54.2%) out of 153 respondents knew the term medico legal autopsy (Figure 1). Among the respondent’s answers for reasons to perform medico legal autopsy, the two most common were to know cause of death 21 (25.3%) and confirm cause of death 17 (20.4%).

Above two third of all respondent 111 (72.5%) thought all autopsies involved police. and Out of those, 91 (82%) supposed the body would be given to the family after performing medico legal autopsy. The commonest reason for responding no to the question
whether all autopsies involve police or not was that out of 43 (27.5%), 10 (20.9%) thought police were involved only for hospital death followed by reasons alike; only for accidental death, only for unnatural death and only for unidentified/unknown bodies with equal respondent rate of 9 (20.9%) respectively as shown in Figure 2.

![Figure 2](image)

**Figure 2. Reasons why all autopsies do not involve presence of police**

The study shows majority of respondents 101 (66%) replied yes when asked if the doctor can start the autopsy immediately after receiving the body. And out of those, 45 (43.6%) did not know the steps to be followed after receiving the body. Out of the remaining 52 (34%) who responded no, 16 (33.3%) reasoned the doctor should wait for the family.

From many factors affecting attitude towards medico legal autopsy, respondents strongly disagreed to the statements I fear autopsy disfigures the body 48 (31.4%), I have strong worries on organ removal during autopsy 53 (34.6%), given the choice at death I would give prior consent for medico legal autopsy to be performed on myself 68 (44.4%) and performing medico legal autopsy is a disrespect to the body 39 (25.5%) (Figure 3a and b). The research shows 69.9% strongly agreed that autopsy delays funeral arrangements.

![Figure 3(a)](image)

**Figure 3(a). Attitude towards medico legal autopsy**
The research shows majorly of respondents agreed to the statements despite my religious objections autopsy must be performed 54 (35.3%), and despite my cultural objections autopsy must be performed 52 (34%), medico legal autopsy benefits the family of the deceased/deceased and should be performed 82 (53.6%) and medico legal autopsy gives definitive reasons of death to the families of the deceased 93 (60.8%). Majority of respondents were neutral 40 (26.2%) to the statement “I believe the deceased suffered enough and no need for medico legal autopsy while 39 (25.5%) strongly disagreed, 32 (20.9%) disagreed and agreed equally and 10 (6.5%) strongly agreed. Bulk of respondents also disagreed 45 (29.4%) to the statement “autopsy would disturb the peace of the family of the deceased” while 27 (17.6%) strongly disagreed, 40 (26.1%) agreed, 19 (12.5%) strongly agreed and 22 (14.4%) were neutral.

Out of 37 (24.2%) who disagreed to the performance of autopsy despite their religious objection, majority 6 (61.5%) were Muslims. The study shows out of 53 (34.6%) who did not have strong worries on organ removal, Hindu were 46 (40.4%) and out of those who had strong worries 34 (22.2%), Muslims were higher in number 10 (76.9%). This was statically significant p<.05. Out of 45 (29.4%) of respondents who do not believe autopsy would disturb the peace of the family of the deceased, 37 (32.5%) were Hindu. In contrast, out of 40 (26.1%) of respondents who agreed autopsy would disturb the peace of the family of the deceased, more than two third were mainly Muslims 10 (76.9%). This result was statistically significant while using x2 p<0.05. Among the 39 (25.5%) of respondents who strongly disagree that performing autopsy is disrespect to the body, 9 (34.6%) were Christians. And out of 35 (22.9%) respondents who agreed performing autopsy is disrespect to the body, 10 (76.9%) were Muslims. This result was also statistically significant while using x2 p<0.05.

DISCUSSION

The autopsy is an essential entity in medico legal investigations for which there is no substitute. The nature of a medico legal case is that there is not a sufficient clinical picture with which to determine a cause and manner of death. Assessing the size and nourishment while making correct identification of the body, concluding the cause of death, determining the time since death when its able to and required, establishing mode of death, examining and demonstrating internal and external injuries, defects and illness entirely, obtaining samples for analysis including bacteriological and histopathology examination, as well as any additional
and important investigations; retaining pertinent tissues as evidence; obtaining photos and video recordings for evidential and educational purposes, providing a complete written information of the autopsy results; offering interpretation from professionals regarding those results; and in a worthy way possible restoring cosmetic condition in advance of returning the body to the police then to family are objectives of medico legal autopsy4.

In discrepancy to former studies based on knowledge and attitude of public beliefs, our observations suggest that the general public has basic knowledge towards medico legal autopsy but lack understanding of the procedure and process of medico legal autopsy.

The proportion of general population in this study who thought medico legal autopsy would be performed to know the cause of death is similar to that found in a study in England5. In contrast, the reason given to perform medico legal autopsy in our study had good response as compared to a study done in Pondicherry, India which mainly had poor results while both studies demonstrated similar poor responses from the general public for details of procedure for conducting medico legal autopsy6.

We established that in this study the fraction general population who believed autopsy delays funeral arrangements was similar to a study done in Pondicherry, India 6. Studies of public perception of necropsy from England also found similar views. But results of this study were contrary regarding religious and cultural objection, and fear of organ removal during autopsy, which were optimistic when compared to the study in Pondicherry, India6. Contradictory results were also obtained in our study where the fraction of general population strongly disagreed about having fear of disfigurement of the body during autopsy as compared to a study done Shanghai, China7 and Pondicherry, India8. In our study, the general public’s perspective towards medico legal autopsy benefitting the family of the deceased and the deceased was found to be good and similar to that of study done in Bern, Switzerland6. This indicates that the general public’s outlook towards medico legal autopsy is not all negative but slowly progressing to promising positive attitude.

Attitude towards Autopsies seemed to be influenced by cultural and religious views of the public. In our study as well as study done in Pondicherry, India, compared with Hindu and Muslims, Christians were more likely to say that they are willing to consent to autopsy on themselves. Religious objection to autopsy was slightly higher among Muslims8. One reason is that the examination will inevitably delay the burial since it is a religious must that the dead be buried as soon as possible. Secondly, Islamic belief holds that it may perhaps be likely for the dead to perceive8.

Strengthening the interactions between the general public and forensic doctors is essential in further improving public’s knowledge and attitude towards medico legal autopsy. A run-through of the medico legal procedure should be restructured and delivered to the public in a simplest way possible as our goal is to educate all regardless of education status. Information can be delivered and transmitted through Medias, campaigns, educating posters in or around hospitals and through public leaders. The key and easiest tool for reaching the public is through the mass media and a wide range of possible ways and means including print, audial and visual methods have been suggested elsewhere9. Forensic doctors can play a major role by creating awareness opportunities (knowledge based posters and fliers) for part of the public present at the time of autopsy since it is only natural to want to know what happens to their loved ones when autopsy is being performed. Religious and cultural oppositions can be combated by increasing public awareness to the usefulness and importance of autopsy to both general public and medicine. It may be helpful to involve the support of religious organizations in these educating programs. An aggressive attempt to educate not only the general public but medical physicians on the importance of autopsy examination and its value is necessary.

**CONCLUSION**

This study revealed that the public has more or less some awareness of the techniques incorporated in autopsy and to some extent the purpose of medico legal autopsy. Regardless, very few have true concept and understanding of medico legal autopsy. The general public’s attitude towards autopsy is not all discouraging but it is wise to note there is a place for improvement of outlooks towards medico legal autopsy. Public attitude of necropsy could be improved through education. Enhanced mortuary design to generate a more eye-catching surroundings, enhanced public education about
autopsies and their role for the general public, health of impending patients and of the nation are few ways we can attempt to change public’s knowledge and attitude.

ACKNOWLEDGEMENT

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Socio-Demographic Profile of Compression of Neck in Aurangabad, Maharashtra


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ABSTRACT

Major proportion of unnatural deaths resulting from asphyxia is due to fatal neck compression. Pressure on the neck may arise from hanging, manual strangulation, ligature strangulation and other means of strangulation such as direct blows, arm locks. A prospective observational study of post mortem conducted between 1st October 2012 to 31st March 2014 at mortuary of Dept. of Forensic Medicine, Government Medical College & Hospital, Aurangabad, Maharashtra. During this period total number of 3200 autopsies were conducted. Out of them, 198 (6.18%) cases were of asphyxial death and 110 cases (3.43%) of solely due to compression of neck. Of these 110 cases a total 103 cases were of hanging, 6 cases of ligature strangulation and 01 cases of accidental strangulation. Maximum cases i.e. 46 (41.81 %) were observed in age group 21 to 30 years. Male preponderance was observed in all age groups. Married males were 60 (54.54%).

Keywords: Compression of neck, Hanging, ligature mark.

INTRODUCTION

Etymologically the word “asphyxia” means absence of pulsation. Asphyxia is defined as defective aeration of blood due to any cause. However, in forensic medicine use of term asphyxia is restricted to those forms of oxygen lack that results from mechanical interference with respiration.

The use of term asphyxia (Greek meaning: pulselessness) in the forensic field is restricted to those forms of oxygen lack (anoxia, hypoxia) which result from mechanical interference with the process of respiration, that is, anoxic anoxia. The fact that these conditions are associated with violence provides a sound basis to use these terms in such a restricted sense. The usual relevance of asphyxia death in Forensic context is violent asphyxia. The asphyxia caused by mechanical interference to air passage is known as mechanical or violent asphyxia.

Hanging is defined as “that form of asphyxia which is caused by suspension of the body by a ligature which encircles the neck, the constricting force being the weight of the body”. It is one of the common methods of committing suicide and homicidal or accidental hanging is very rare, hence cases of hanging are considered suicidal until contrary is proved.

Strangulation is compression of the neck by exogenous force that may lead to unconsciousness or death by causing an increasingly hypoxic state in the brain. It is important to differentiate between hanging and strangulation from the forensic point of view, if miscarriage of justice is to be avoided.
The purpose of this study is to know the incidence, prevalence, causes and socio-demographic profile in cases of compression of neck.

**MATERIALS AND METHODS**

A study of medico-legal autopsies conducted between 1st October 2012 to 31st March 2014 at Mortuary of Dept. of Forensic Medicine, Government Medical College & Hospital, Aurangabad, Maharashtra. A total number of 3200 autopsies carried out during 18 months of period. Out of total autopsy, 198 cases were of asphyxial death and 110 cases of compression of neck were personally observed and analyzed.

**Inclusion Criterion:** All cases of unnatural deaths due to compression of neck brought for medico legal autopsy to mortuary of Government Medical College & Hospital, Aurangabad. A proforma of information regarding details of cases regarding the age, sex, socio-economic background, occupation, marital status, rural /urban residence status, type of ligature material, manner and supposed cause of death were obtained from police requisition, inquest panchanama and wherever necessary interrogation with relatives of the deceased. The socioeconomic status of the victims was calculated approximately based on Kuppuswamy’s socioeconomic status scale Data thus obtained is tabulated and statistically analyzed

**OBSERVATION AND RESULTS**

**Table No. 1: Sex wise distribution of manner of compression of neck.**

<table>
<thead>
<tr>
<th>Manner of compression of neck</th>
<th>Male (%)</th>
<th>Female (%)</th>
<th>Total (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suicidal</td>
<td>84 (81.55)</td>
<td>19 (18.44)</td>
<td>103 (93.63)</td>
</tr>
<tr>
<td>Homicidal</td>
<td>2 (1.81)</td>
<td>04(3.63)</td>
<td>06 (5.45)</td>
</tr>
<tr>
<td>Accidental</td>
<td>1 (0.90)</td>
<td>00 (00)</td>
<td>01 (0.90)</td>
</tr>
<tr>
<td>Total</td>
<td>87 (79.09)</td>
<td>23 (20.90)</td>
<td>110 (100)</td>
</tr>
</tbody>
</table>

Out of 110 cases of compression around neck, 103 cases are of suicidal neck compression (hanging), 06 cases of homicidal neck compression and 01 case was of accidental strangulation. Of total 110 cases of violent asphyxial deaths, 23 were females and remaining 87 males. Of total 103 suicides cases, 19 were females and 84 were male with female: male ratio 1:3.78.

**Table No. 2 (Figure 2): Age and sex wise distribution of deaths due to compression of neck**

<table>
<thead>
<tr>
<th>Age in years</th>
<th>Males (79.09%)</th>
<th>Females (20.90%)</th>
<th>Total (100%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to10 yrs</td>
<td>00 (00)</td>
<td>00 (00)</td>
<td>00 (00)</td>
</tr>
<tr>
<td>11 to 20 yrs</td>
<td>05 (4.54)</td>
<td>07 (6.36)</td>
<td>12 (10.90)</td>
</tr>
<tr>
<td>21 to 30 yrs</td>
<td>34 (30.90)</td>
<td>12 (10.90)</td>
<td>46 (41.81)</td>
</tr>
<tr>
<td>31 to 40 yrs</td>
<td>21 (19.09)</td>
<td>03 (2.72)</td>
<td>24 (21.81)</td>
</tr>
<tr>
<td>41 to 50 yrs</td>
<td>16 (14.54)</td>
<td>01 (0.90)</td>
<td>17 (15.45)</td>
</tr>
<tr>
<td>51 to 60 yrs</td>
<td>10 (9.09)</td>
<td>00 (00)</td>
<td>10(9.09)</td>
</tr>
<tr>
<td>61 above yrs</td>
<td>01 (0.90)</td>
<td>0 (00)</td>
<td>1 (0.90)</td>
</tr>
<tr>
<td>Total</td>
<td>87 (79.09)</td>
<td>23 (20.90)</td>
<td>110 (100)</td>
</tr>
</tbody>
</table>

46 cases (41.81 %) were observed in age group 21 to 30 years of which 34(30.90) victims were male and 12 were females. 24 cases (21.81 %) were observed in age group 31 to 40 years of which 21 victims were male. Male preponderance was observed in all age groups except 11-20 years age group.

**Locality of victim**

Most of the victims (68.18%) were from urban area.

**Religion wise distribution:** In this study it was observed that most of the victims were Hindus with 73(66.36%) cases followed by Muslim 23 (20.90%) cases, Christian 1 (0.90%) cases and Buddhist 12 (10.90%).

**Marital status in cases of compression of neck**

Most of the victims (68.18%) were from urban area.
Out of total 110 cases, married males were 60 (54.54%) and married females were 17 (15.45), unmarried males and females were 27 (24.54) and 04 (03.63) respectively.

Table No. 3: Occupation of the victims in cases of compression of neck

<table>
<thead>
<tr>
<th>Occupation of victim</th>
<th>Number of cases</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laborers</td>
<td>31</td>
<td>28.18</td>
</tr>
<tr>
<td>Farmers</td>
<td>12</td>
<td>10.90</td>
</tr>
<tr>
<td>Housewives</td>
<td>13</td>
<td>11.81</td>
</tr>
<tr>
<td>Students</td>
<td>26</td>
<td>23.63</td>
</tr>
<tr>
<td>Government Employed</td>
<td>12</td>
<td>10.90</td>
</tr>
<tr>
<td>Unemployed</td>
<td>01</td>
<td>0.90</td>
</tr>
<tr>
<td>Business</td>
<td>14</td>
<td>12.72</td>
</tr>
<tr>
<td>Not known</td>
<td>01</td>
<td>0.90</td>
</tr>
<tr>
<td>Total</td>
<td>110</td>
<td>100</td>
</tr>
</tbody>
</table>

In the present study, common working group died due to compression of neck is laborers which were 31 (28.18 %) and students were 26 (23.56 %).

**Education status:** It was observed that equal number of victims were illiterate and secondary school droppers i.e. 38 (34.54%) followed by primary school droppers i.e. 14 (12.72%).

**Socioeconomic status:** Most of the victims were from the lower middle class 64 (58.18%), followed by the lower class 27 (24.54%), upper middle class 15(13.63%) and higher class 4 (3.63%). Hence in middle class total number of cases were 79 (71.81%).

**Place of occurrence of incidence in relation to sex:** 72.72% of incidence occurred in the home, 12.72% in farm, and 10.90% in open public places, which included open ground. Most common place of occurrence of incidence in both males and females was home followed by farm.

**Type of ligature material used in compression of neck:**

Most common ligature material used by victim for compression of neck was nylon rope in 52.72 % cases followed by Shela (popular Indian neck cloth material used by males, particularly in rural parts) 11.81%.

**DISCUSSION**

Of total 103 suicides, 84 were males and 19 were females with male: female ratio 3.78:1. Findings of this current study are similar to the findings of Batra et al (2003), Naik et al (2005).

Majority of suicidal hanging were males i.e. out of 103 suicidal hanging cases, 84 (81.55) were males and 19 (18.44) females (male: female ratio is 4.42:1). This study coincide with Batra et al (2003) (male to female ratio 1: 0.19), Nikolic et al (2003) (76 % males), Sharma et al (2005) (66.66 % males), Ambade et al (2008), Uzun et al (2007) reported the similar finding. National Crime Record Bureau (NCRB) 2008 reported that male victims outnumbered the female victims in cases of deaths by hanging. Similarly, in this study, it was observed that 81.55% of the victims of hanging were males, while only 18.44% were females.

But, findings of Naik et al. (2005) of S. C. B. Medical College, Cuttack, Orissa, India, who reported higher number of females in hanging as well as strangulation cases; differ from this study finding of male preponderance in hanging cases.

In the present study, maximum cases (46 cases) were observed in 21 to 30 years age group. Common age group in both sexes, i.e. male and females was 21-30 years followed by 31-40 years. Male preponderance was observed in all age groups except 11-20 years age group. This was similar to the findings of study Azmak D et al from Turkey (2006), and also similar to findings from various parts of India in studies reported by Batra et al (2003), Sharma et al (2005), Ambade et al (2008) et al.

According to NCRB 2008, the most common age group committing suicide by hanging is 15-29 years. This can be explained by the fact that the age group of 21 – 40 years is the most active phase in life wherein exposure to anxiety, stress, strain and various adverse circumstances occur.

In this study most of the victims (75 or 68.18%) were from urban area than rural area 35(31.18%). The preponderance to urban area is because of the location of hospital in the city area.

In this study it was observed that most of the victims were Hindus with 73(66.36%) cases followed by Muslim
Most of the victims were Hindu, which can be explained by the fact that the major population is Hindu in the study region.

In the present study, out of total 110 cases, married males were 60 (54.54%) and married females were 17 (15.45), unmarried males were 27 (24.54) and unmarried females were 04 (03.63) present. Each one case was of divorced and widowed respectively. This study coincides with Vijayakumari (2011) and T Saisudheer et al (2012).

Table 3 shows that the common working group died due to compression of neck is laborers which were 31 (28.18 %) and students were 26 (23.56 %). According to NCRB 2008, 13% of total suicide victims were from the group engaged in Farming/Agricultural activities. It is proposed that more number of laborers and students commit suicide due to failure of crops, poverty, bankruptcy, alcohol addiction, and stress & strain. In students break in love, family problems and failure in examination could be the driving force and reason for suicide.

Most of the victims were from the lower middle class 64 (58.18%), followed by the lower class 27 (24.54%), upper middle class 15(13.63%) and higher class 4 (3.63%). So in middle class total number of cases were 79 (71.81%) and it coincides with T Saisudheer (2012). In our study asphyxial death are rare in upper income group. This accordance with the general trend of criminal profile which originates from the root of enviromental and psychological factors.

In the present study out of 110 cases of compression of neck, 72.72% of cases occurred in their home, 12.72% cases occurred in farm. Home was the most common place of hanging (83.33%) reported by Uzun et al. (2007) and which also held true in the present study. Usually victim of hanging prefers any secluded place which suit for his/her purpose and the victim being very well aware of the home and its surroundings, it suits his or her needs before committing suicide by hanging.

In the present study, the most common ligature material used by victim for compression of neck was nylon rope in 52.72 % cases followed by Shela 11.81%(popular Indian neck cloth material used by males, particularly in rural parts).

Nylon rope as the most commonly used ligature material as observed in the present study was also reported by Dixit et al (2001) noted rope as ligature material in 62 % cases, but authors did not further classify the type of ropes. Our finding differ from study by, Sharma et al (2005) where the common ligature material used for hanging were reported as soft daily wear articles of clothing like Sari (32 %) and Chunni (24 %), which account for only 3.57 % and 5.96 % in the present study. Thus, the ligature material used by the victim may be anything available at his/her hand at that moment, which includes any household article or belongings of the victim.

**CAUSE OF DEATH**

In this study out 110 cases 103 cases were of hanging, 6 cases of ligature strangulation and 01 cases of accidental strangulation and none of throttling. The present study coincides with Sadikhusen et al.

**SUMMARY AND CONCLUSIONS**

The present postmortem study has been conducted on 110 cases of compression of neck which were personally observed in the Mortuary of Department of Forensic Medicine and Toxicology of Tertiary care Hospital of Aurangabad.

The most common manner of neck compression is suicidal. Hanging is the most common cause of death due to compression of neck. One case of accidental strangulation and 6 cases of homicidal strangulation was reported. Hanging is one of the preferred methods of suicide by males than females.

The highest number of suicide by hanging was found in the age group 21-30 years, the period of an emotional outlet and outburst. Married Male prefer to commit suicide by hanging is fast developing as a preferential mode, particularly in urban area and women prefer to commit suicide by hanging less than other method like burning, drowning and by poisoning.

Peoples from Hindu religion are most commonly involved in hanging. More number of cases of suicide by hanging was found in laborers and students.

Suicide by hanging is more common in illiterate and lower middle groups. Any secluded place is preferred
to commit suicide by hanging. In our study, the most commonly preferred place of hanging was home. The second most commonly preferred secluded place was farm.

In hanging the commonly used ligature material is nylon rope but it can be any household article or belongings of the victims, which is available at the time of impulse of suicide.

Conflict of interest: none

Source of Funding: Self

Ethical clearance: Local ethical committee of the medical college.

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Natural Variations in Signature on Various Surfaces

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ABSTRACT

A signature is a handwritten depiction of someone’s name, nickname, or even a simple “X” that an individual writes on document as a proof of identity. Signature is an evidence considered as chief part of information in forensic investigation. Signatures are highly individualized and habitual. It is commonly encountered in case like property, murder, suicides, kidnapping etc. The word sign is defined under section 3 (56) of General clauses act 1897 says: “Sign”, with reference to a person who is unable to write his name include “marks”. Natural variation in signature is a problem for signature verifier as it requires to judge whether the variation is the natural difference occurring between different instances of a signature or the variation is significant enough to reject the instances as being an attempted forgery. A genuine signature is the personal mark of an individual. It indicates his or her acceptance of some set of circumstances, or to be the symbol associated with such an agreement. Characteristic of handwriting and signature are similar. The present study is based on the forensic analysis of signature on different surfaces to analyse the natural variation. Signature of a person on various surfaces depends on showing that their degree of variability by some measures likes slant, loop, angle, baseline and strokes etc. In the present study an attempt is made to provide an effective method of study of variation in signatures of same writer written on different surfaces.

Keywords: Signature, Variation, Strokes, Slant, Baseline, Surface.

INTRODUCTION

A signature is a combination of cumulative effect of various facors like muscular co ordination, age, health, frequency of writing, temperature etc. In identification of signaturegeneral principle of handwriting is applicable except certain handwriting characteristic which is no common o classes of writing require special consideration.¹

Manually written signature a standout amongst the most usually for confirmation of individual’s identity. The signature is for the most part a man’s most regular written work act and, in that capacity, is a great extent it is habitual. As there are basically no standards regarding conceiving and creating signature, they are open for being very individualized by every individual’s mental outline. It can be composed as tangled, indecipherable shapes or a progression of plainly decipherable letters that distinctly spell out the individual’s name.

The range of natural variation, as opposed to the qualities themselves, will change steadily with time.² This change legitimizes the need for contempory writing in examination of penmanship. These varieties from mark to signature because of transitory impacts of either an instrinsical or extrinsical nature, yet their general construction remain same. This makes signature profoundly identifiable assuming sufficient standards are available for comparision³, specifically, word arrangement in cursive composition has a tendency to have more individuality and examples than individual state of letters.

Tests of penmanship (including signature) still constitute the dominant part for in the case load of a typical examiner of questioned documents. Although a few sorts of tests are perceived in addressed record writing, for example, disguised or traced samples.³

Handwriting is an acquired skill and clearly one that is a complex perceptual motor task, sometimes referred to as a neuromuscular task.⁴

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Srihari recommended that “by considering finer components, we ought to have the capacity to make this determination with an almost 100 percent certainty that the writer can be identified.” Certain lower-case letters would more frequently targeted for alteration than any other, or which could support the statement made by Alford that the frequency of change to the lower-case letter ‘t’ would increase when it appeared as the last letter of a word. The signature in both studies so that common points of reference could be examined.

The genuine signature that served as a model for the participants to trace was one that has been used previously in an examination of the characteristics of freehand simulations.

Several studies said the expertise of FHEs and proficiency testing, all related to the identification of handwriting authorship. Proficiency in evaluating disguised and simulated signatures and/or handwriting. Signature, a handwritten depiction of someone’s name, gives confirmation of the attribution of the document and the purpose with regard to that document. It is the most common writing act and largely habitual. Signature is often used in legal and financial transactions because unique characteristics in an individual’s handwriting distinguish it from every other handwriting.

The measurement of maturity of signature or handwriting can be helping in forensic investigation. The several characteristics features which go to establish personal signature that may comprise of:

- **Movement in writing:** The manner in which the fingers, hand forearm and whole arm move to produce writing is called writing movement in or movement in writing.
- **Writing Speed:** If any one who is writing his or her own signature will perform the act easily. This is because the person has likely to signed his or her name thousands of times, so the gesture is automatic and harmonious, requiring less thought or concentration.
- **If someone other than the voter took a long time to copy the voter’s signature, the copied signature will not have a natural resemblance to it. Instead, it is slower, deliberate marks. If the forger attempted to create the signature quickly, then it should have various characteristic differences.**

The comparative rate of speed in two sets of signature can be estimated with the help of low magnification or a correctly enlarged photograph.

- **Size:** Size of writing may vary from person to person. In some signature this habit may have but little importance, whereas, in some signatures, the size may play a significant role in determining their genuineness. The signature may vary due to the internal as well as external circumstance of the writing.

- **Alignment:** The relation of the letter of words, signature to an actual or imaginary base line is referred to as alignment. The alignment may be even, arched, garlanded, irregular, ascending or descending depending mainly upon the position of writing arm with respect to line of writing, movement employed at the individual habit of the writer.

- **Slant:** The inclination of letters or their strokes with the actual or imaginary base line is known as writing slant. It is useful in cases of fraudulent addition and alteration because the perpetrator may not be able to align the writing slant of added writing or figures.

- **Tremor:** Unusual departures of the line from its indented course may be termed as tremors, which may be natural or artificial. Tremors may appear in the signature(s) due to several causes such as old age, sickness, infirmity, weakness of sight, illiteracy, forgery and attempt to disguise etc. Natural tremors due to old age or weakness etc. clearly show muscular weakness and writing movement beyond the control of the writer.

- **Abbreviations:** Simplification of signatures is a continuous process. It is possible sometimes to estimate roughly from the simplified pattern the period of signatures, provided admitted signatures are available in a sufficient numbers for an extended period, covering the questioned period.

- **Variation:** No one person writes exactly the same way, even within several repetitions of writings, This is known as natural variation.
MATERIAL & METHODS

Total 70 individual’s signature was collected for this study between the age group 18-50. All the personal details of the examinee is firstly noted down in the white sheet of paper like- Name, Gender, Date of birth of birth, Weight, Education, Occupation and Local address. Following surfaces were selected for studying natural variation in signature due to different surfaces.

- Surface 1 = Wooden board
- Surface 2 = Glass.
- Surface 3 = Wall.
- Surface 4 = Lap.
- Surface 5 = Note copy.

METHODOLOGY

1. A signature chart was prepared for collecting handwriting samples.
2. Personal details of the subject such as name, sex, date of birth, weight, education, occupation, and local address of the subjects were recorded.
3. The individuals were made to sign on different surfaces and the samples were collected keeping the writing instrument same: cello Butter flow (R&D in Germany).
4. The signature samples were analyzed for natural variations due to different surfaces

Analysis Method: Hand Movement-The hand movement was noted while the subject was signing.

RESULT AND DISCUSSION

Variation in Size due to different Surfaces Range (in cm):

Interpretation:

The graph no. 1 shows that there is variation in size on different surfaces. On surface 3 there is high increase in the size length of the signature as comparatively to surface 1, surface 2, surface 4 and surface 5 and in surface 4 there is high decrease in size length as comparatively to surface 1, surface 2, surface 3 and surface 5.

Variation in speed due to different Surfaces:

Interpretation:

- Fast speed On Surface 1-21% signed with fast speed, On S2-24% signed with fast speed, on S3-24% signed with fast speed and on S4-20% signed with fast speed and on S5-23% signed with fast speed.
- Normal speed-On surface 1-75% signed with normal speed, S2-72% signed with normal speed, on S3-72% signed with normal speed, on S4-60% signed with normal speed, on S5-73% signed with normal speed.
- Slow speed-On surface 1-4% signed with slow speed, on S2-4% signed with slow speed, on S3-4% signed with slow speed, on S4-20% signed with slow speed and on S5-4% signed with slow speed. On surface 4 there is high percentage variation in speed was present as comparatively to surface 1, surface 2, surface 3 and surface 4.
Variation in Alignment due to different Surfaces:

Interpretation

- Graph no 3 shows that in comparison to S1 and S2 there is decrease in number of ascending type of signatures in S3, S4, and S5. Descending type of signature is slightly increased in S1 and S3 as comparatively to S2, S4, and S5. There is increase in number of even type of signature on S4 and S5 as comparatively to S1, S2, and S3. Garlanded signature is absent in S1 but present in S2, S3, S4 and S5. On S3 arched type of signature is 3 but only 2 is present on S1, S2, S4 and S5. There is slight variation in the alignment of signature due to difference in surfaces.

Pen Pause (Range) Variation in Pen pauses due to different Surfaces:

Interpretation: The Graph no. 4 shows that there is slight variation in pen pauses. On S1 as comparatively to S2, S3, S4 and S5
**Variation in Pen pressure due to different Surfaces:**

**Interpretation:** Graph no. 5 shows that 70% medium, 30% heavy and 0% light pen pressure are used to sign surface 1.

76% medium, 23% heavy and 1% light pen pressure was used to sign surface 2.

70% medium, 29% heavy, 1% light pen pressure was used to sign surface 3.

40% medium, 9% heavy, 51% light pen pressure was used to sign surface 4.

36% medium, 64% heavy and 0% light pen pressure was used to sign surface 5.

There is a high variation on surface 4 as comparatively to surface 1, surface 2, surface 3 and surface 5.

**Graph No. 5: Variation in Pen pressure due to different Surfaces**

**Variation in spacing due to different Surfaces:**

**Interpretation:** Graph no. 6 slight variation in spacing on entire surface.

**Graph No. 6: Variation in tremor due to different Surfaces**

**CONCLUSION**

After the present study it was concluded that there was no change on the movement of hand due to different surfaces. There was high variation observed in the size of the signature due to difference in the surfaces. Mainly on surface 4 (lap) there was high percentage difference in speed was observed as comparison to surface 1 (wooden board), surface 2 (glass), Surface 3 (wall) and surface 5 (note book). There was slight variation in the alignment of the signature due to different surfaces. The angle of the signature was highly affected due to change in surfaces. Pen pressure showed the variation on signature due to different surfaces. Presence and absence of abbreviation, greater deliberation of starting word, meaningless mark, retouching of strokes, and spacing was slightly affected by the difference in surfaces. There was high variation rate was present on Surface 4. i.e lap signature’s due to change in the surfaces.

**Ethical clearance:** Not Required

**Source of funding:** Self

**Conflict of Interest:** Nil
REFERENCES


Security Features of New Indian Currency

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ABSTRACT

Security features is very important in currency notes. All country has its own security features anti-copying or anti counterfeiting features. This article includes security features of Indian currency. Likewise counterfeiting is a major issue in all country to prevent counterfeiting the bank introduced so many security features in the banknotes. Security feature of Indian currency is became a big issue. As counterfeiting is very common in Indian currencies to prevent counterfeiting the government of India introduced new security features in the currencies. An also introduce new denomination of 2000 and 500 with all new security features as explained in this paper. This paper includes new security features of Indian currency notes and how a person can easily identify a genuine currency with the counterfeit currency.

Keywords: security features, counterfeiting, currency, banknote, denomination

INTRODUCTION

As the govt of India introduced new security features in the currency to break the chain of corruption, black money and terrorism. Counterfeiting plays major role in this all scenario.[1] To prevent from counterfeiting, black money and corruption RBI introduce new denomination of 2000 and 500 banknote as a higher denomination. [2] On 8th November 2016 in the midnight the prime minister of India announced that the five hundred and one thousand currency notes presently will no longer legal and not be used in future as they are banned and hoarded by anti-national and anti-social elements will become just a piece of paper which has no use.[4]

OBSERVATION OF NEW CURRENCY

Counterfeiting of currency is the big issue for the country as to raise the economic condition of the country new security features are added in the banknotes to fight against counterfeiting of currency. The new denomination of 2000 and 500 notes are launched. The 2000 banknotes is the highest denomination and RBI will soon launched more currency as per govt concerned.[3]

The new note of two thousand has so many security features in it such as its magenta colour, mangalyaan motif as India became the 3rd country which shows its success in space on its current currency, security thread which gives fluorescence under UV-light and colour shift windowed security thread with inscription bharat in devnagari, RBI, and 2000 numeral on the thread and colour of the thread changes from green to blue when held at some angle.[2]

Swachh bharat logo on the denomination with slogan, Ashoka pillar emblem, identification mark with raised printing as horizontal rectangle and seven angular bleed lines which help visually impaired person to identify the denomination. See through register with denomination numeral 2000. Latent image with denomination numeral 2000 which can be seen when held at some angle or at eye level. Denomination numeral in devnagari. Portrait of Mahatma Gandhi in the centre of the banknote. Watermark of Mahatma Gandhi portrait and electrotype 2000 watermark.[3]

Micro lettering is done near the portrait of Gandhi “chin” with RBI and 2000 it can be viewed with the help of microscope by increasing the magnification.

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power. The guarantee clause, governor’s signature with promise clause and RBI emblem is printed on the right hand side on the denomination. OVI-optical variable ink with numeral 2000 printed on the banknote which appears green to blue in colour and gives fluorescence under UV-light.[4]

Obverse side 2000 note

![Banknote Image](image)


Security features of Indian new currency 2000 note

1. **See Through Register:** A denominational numeral 2000 can be seen on the left hand side of the denomination when held at some angle. Both the printed portion has back to back registration.

2. **Latent Image:** The latent image with denominational numeral 2000 can be seen when the bank note is held at some angle. Intaglio raised printing is done on it.

3. **Denominational Numeral:** The denominational numeral in printed in devnagari with raised intaglio printing on the left hand side of the banknote.

4. **Portrait:** The portrait of Mahatma Gandhi is printed on the centre of the banknote.

5. **Microlettering:** Micro lettering is done near the portrait of Gandhi “chin” with RBI and 2000 it can be viewed with the help of microscope by increasing the magnification power.

6. **Security Thread:** Color shift windowed security thread with inscription BHARAT in devnagari, RBI and denominational numeral 2000. When the note is tilted the Color of the thread changes from green to blue.

7. **Guarantee Clause:** The guarantee clause, governor’s signature with promise clause and RBI emblem is printed on the right hand side on the denomination.

8. **Watermark:** The portrait of Gandhi and electrotype watermark on the right hand side on the banknote.

9. **Number Panel:** The number panel growing or increasing from small to big on the top left side and on the right side also and which gives fluorescence under the UV-Light.

10. **OVI(Optical Variable Ink):** As the colour of the numeral 2000 and rupee symbol appears green to blue colour changing ink when the banknote is held flat and its gives fluorescence under the UV-Light.

11. **Ashoka Pillar:** On the right hand side the Ashoka pillar emblem is printed in the banknote and
raised intaglio printing is done on the Ashoka pillar emblem.

12. **Identification Mark:** The horizontal rectangle with denominational numeral 2000 is printed on the right hand side on the banknote with raised printing which helps the visually impaired person to identify the denomination.

13. **Bleed Lines:** Seven angular bleed lines on the left and right side of the banknote with raised printing as a identification mark which help the visually impaired person to identify the denomination.\[3\]

**Reverse side 2000 note**

Fig.: 2

14. **Year of Print:** On the top left hand side of the banknote year of printing is done.

15. **Swacch Bharat Logo:** The logo of Swachh bharat with slogan is printed on the left side on the banknote.

16. **Language Panel:** The language panel toward the centre of the banknote.

**Obverse side 500 note**

Fig.: 3

17. **Motif Of Mangalyaan:** This logo reflecting country’s first venture in the interplanetary space symbol.

18. **Colour Scheme:** The overall colour of the banknote is magenta colour and gives fluorescence under UV-Light.\[2\]
security Features of Indian New Currency 500 Note:

1. See Through Register: A denominational numeral 500 can be seen on the left hand side of the denomination when held at some angle. Both the printed portion has back to back registration.

2. Latent Image: The latent image with denominational numeral 500 can be seen when the bank note is held at some angle. Intaglio raised printing is done on it.

3. Denominational Numeral: The denominational numeral in printed in devnagari with raised intaglio printing on the left hand side of the banknote.

4. Portrait: The portrait of Mahatma Gandhi is printed on the centre of the banknote. The orientation and relative position changed.

5. Microlettering: Micro lettering is done near the portrait of Gandhi “chin” with RBI and 500 it can be viewed with the help of microscope by increasing the magnification power.

6. Security Thread: Color shift windowed security thread with inscription BHARAT in devnagari, RBI and denominational numeral 500. When the note is tilted the color of the thread changes from green to blue.

7. Guarantee Clause: The guarantee clause, governor’s signature with promise clause and RBI emblem is shifted on the right hand side on the denomination.

8. Watermark: The portrait of Gandhi and electrotype watermark on the right hand side on the banknote.

9. Number Panel: The number panel growing or increasing from small to big on the top left side and on the right side also and which gives fluorescence under the UV-Light.

10. OVI(Optical Variable Ink): As the colour of the numeral 500 and rupee symbol appears green to blue colour changing ink when the banknote is held flat and its gives fluorescence under the UV-Light.

11. Ashoka Pillar: On the right hand side the Ashoka pillar emblem is printed in the banknote and raised intaglio printing is done on the Ashoka pillar emblem.

12. Identification Mark: The horizontal circle with denominational numeral 500 is printed on the right hand side on the banknote with raised printing which helps the visually impaired person to identify the denomination.

13. Bleed Lines: Five angular bleed lines on the left and right side of the banknote with raised printing as a identification mark which help the visually impaired person to identify the denomination.\[3\]

Reverse side 500 note

Fig.: 4

14. Year Of Print: On the top left hand side of the banknote year of printing is done.

15. Swacch Bharat Logo: The logo of Swachh bharat with slogan is printed on the left side on the banknote.

16. Language Panel: The language panel toward the centre of the banknote.

17. Red Fort: An image of Indian heritage site- with Indian

18. Colour Scheme: The overall colour of the banknote is grey colour and gives fluorescence under

19. Fluorescence: The banknote as well the Indian flag which is on red fort gives fluorescence under the UV-Light.[2]

Security Features Of 500 Note

Security Features Of 2000 Note

Fluorescence Under Uv-Light-(Obverse Side)

![Fig.: 5](image)

Fluorescence Under Uv-Light-(Obverse Side)

![Fig.: 6](image)

RESULT

Hence new currency has the more security features as compared to old currency and it’s very difficult to counterfeit as more anti-copying features are added in the denomination and now every single person can identify or distinguished between genuine and fake (counterfeit) currency.

CONCLUSION

It was found that Introducing new security features in the Indian currency will help in future to prevent from counterfeiting, black money, corruption and anti social activities. Improvements are introduced to make it less prone to counterfeiting. As compared to earlier currency of 1000 and 500 it lacks behind because of less security features and its counterfeiting was easy so that is why government demonetised the old currency and introduced new denomination for the country.

Ethical clearance: Not required

Source of funding: Self

Conflict of Interest: Nil

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A Comparative Study on Security Features of Gulf Currencies

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ABSTRACT

Security features is very important in currency notes. As evenly country has its own security features anti-copying or anti-counterfeiting features. This article includes security features of gulf countries such as Iraq, Qatar, Bahrain and Oman. Likewise counterfeiting is a major issue in all country to prevent counterfeiting the central bank introduced so many security features in the banknotes. As counterfeiting is very common so to prevent counterfeiting new security features are introduced in the currencies. This paper includes security features of gulf currency notes and how a person can easily identify a genuine currency with the counterfeit currency.

Keywords: security features, counterfeiting, currency, banknote, denomination

INTRODUCTION

Banknote is a paper money which has security features embedded in it. Security features are introduced in the banknote to prevent counterfeiting of the currencies all over the world. Every country has its own security features which are issued by the bank as respect to each country such as central bank of Iraq, central bank of Qatar, central bank of Bahrain and central bank of Oman.[1]

Security features can be seen by the help of following instruments such as by magnifying glass, oblique light, transmitted light and with the help of VSC (video spectral comparator), UV-light, IR-light and ESDA (electrostatic detection apparatus).

To stop counterfeiting of currency the bank introduced anti-copying security features every year to year. The security features includes hologram, watermark, print quality, paper quality, raised print, fluorescent inks, security thread, optical variable ink, see through register, identification marks, micro lettering, intaglio printing and so on.[2]

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Security features of Iraqi Dinar

Fig. :1

LEGENDS

Security features of Iraqi dinar: In Iraqi dinar bank introduced new anti-copying features. These all features can be seen on the denomination 50, 250, 500, 1000, 5000, 10000, 25000 and 50,000 dinar that includes spark optical security features, scanner readable guarantee thread in addition to Braille embossing to help visually impaired person.[3] Watermark of horse head, Latent image, Metallic ink printing is used, safety strip, colour changing symbols, raised lettering and writing is only visible in uv-light. Scan features are added in the currency which cannot seen by naked eye but it can seen by the scanner. Unique serial numbers and fluorescence features are added in the currency. These special security features are added in the banknote to prevent it from counterfeiting.[3, 7]
Security features of Qatar currency


Security feature of Qatari riyal: The central bank of Qatar issued banknotes of 1, 5, 10, 50, 100 and 500 riyals as a denomination. Security features are added on the currency to prevent it from such features are coat of arm with dhow, palm, tree and crossed swords. Watermark of falcon head and electrotype denomination. Latent image on the both side of the currency on the front right side in arabic and in back side in English. Micro lettering, windowed security thread, governor’s signature, unique serial number in arabic, identification mark or tactile mark which help Braille or visually impaired person, see through register, intaglio printing done on the currency with raised printing, OVI, uv-fluorescence features on the denomination numeral, coat of arm, CBQ seal and all over the currency, holographic stripe are used, optiks are used anti-copying features are added in the currency.

LEGENDS


SECURITY FEATURES OF BAHRAIN


Security feature of Bahraini dinar: The central bank of Bahrain issued banknotes of ½, 1, 5, 10 and 20 Bahraini dinars as a denomination. Security features are added on the currency to prevent it from such features are spark and motion thread. Watermark of king hamid bin Isa al khalifa and electrotype half denomination. Latent image on the both side of the currency. Micro lettering, windowed security thread with demetallized CBB, governor’s signature, unique serial number in arabic, identification mark or tactile mark which help Braille or visually impaired person, see through register with a floral print or a portrait, intaglio printing done on the currency with raised printing, OVI, UV-fluorescence features on the denomination numeral, coat of arm, CBQ seal and all over the currency, holographic stripe are used, optiks are used anti-copying features are added in the currency.
features all over the currency, spark and hologram, anti-copying features are added in the currency.\textsuperscript{[5,9]}

**Security features of Omani rial**

The central bank of Oman issued banknotes with \(\frac{1}{2}, 1, 5, 10, 20, 50\) rial, 100 and 200 baisa.\textsuperscript{[4,5]} The security features are intaglio portrait used on the note. A three dimensional moulded portrait watermark, perfect crown to see through register, security thread with demetallized color shift and tactile printing which help visually impaired person, a hologram, coat of arm with crossed swords, spark OVIM features (main entrance of central bank of Oman), micro lettering, latent image, governor’s signature, unique serial numbers in Arabic. These special security features are added in the banknote to prevent it from counterfeiting.\textsuperscript{[8]}

**RESULTS**

Hence the Qatar has more security features in its currency and it’s very difficult to counterfeit it as because of anti-copying security features.

**CONCLUSION**

It is found that by comparing all the gulf currencies that Qatar has more security features as compared to rest of the currencies and Bahrain has least security features as its denomination value is more than the rest currencies.

**Ethical clearance:** Not required

**Source of funding:** Self

**Conflict of Interest:** Nil

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A Study of Suspicious Death in Bilaspur District

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ABSTRACT

The investigation of sudden or unexpected death has got immense importance where the vital objective of the investigation is to exclude a suspicious cause of death. Sudden and suspicious death is a death which is not known to have been caused by any trauma, poisoning or violent asphyxia and where death occurs all of a sudden or within 24 hours of the onset of the terminal symptoms. Natural deaths undoubtedly constitute a significant portion of deaths, which undergo autopsy for investigation of death. In most of the natural deaths in such instances, the death has occurred suddenly or unexpectedly without any obvious disease. Total 109 autopsies were performed during January 2016 to March 2016 (3 months), out of which 28 were suspicious death in Bilaspur district of Chhattisgarh. Detailed information such as relevant history and data of various parameters of each case was recorded from the Department of Forensic Medicine and Toxicology, Chhattisgarh Institute of Medical Sciences, Bilaspur, C.G. on the pre-coded Performa. The present study deals with the epidemiological, social and medico-legal aspects of unnatural deaths in male and female. Where we found the ratio of female to male is 19:09 and burn was the most common cause of death found in female followed by poisoning, violent asphyxia, etc. In India there is noticeable increase in unnatural death of female.

Keywords: Death, Suspicious Death, Natural Death, Epidemiology.

INTRODUCTION

A great increase in unnatural deaths in ladies, especially in the first few years of their married life was seen in our society for last few decades. This attract the attention of people and forced the socio-political system for investigating and developing preventive measures[1-3].

The increase of unnatural deaths in newly married females within first few years of their marriage is a black spot on the noble tradition of our society. The most common reason behind these type of deaths are increasing demands of dowry (cash/objects) by their husbands &/or in laws, for which they sometimes kill or torture the bride in such a way that she has committed suicide[4]. Family quarrels due to ill-treatment by in-laws, rash & negligent behavior or extra marital affairs of husbands also plays important role for death.

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Requesting share has turned into a device for men to control their spouses, and, now and again, it prompts a type of deadly abusive behavior at home named “dowry death” or “bride burning.” In contemporary India, dowry deaths are winding up noticeably progressively common[5]. In 2008 alone, more than 8000 dowry death were accounted for to Indian law enforcement [6]. Currently, a normal of seventeen Indian ladies are killed in share related occurrences each day[7]. In India, three principal arrangements frame the group of law intended to combat and prevent dowry deaths. The Dowry Prohibition Act (DPA),[8] as a result since 1961, gave the establishment to consequent against settlement enactment; nonetheless, it is infrequently authorized. Segment 498A, normally alluded to as the “Counter Cruelty Statute,”[9] clarified he definition of dowry related crimes.

As per World Health Organization, India has one of the most elevated suicide rates and India alone adds to over 10% of suicides in the world[10]. According to National Crime Records Bureau, in India the quantity of suicides are 1, 34,799 and rate of suicide rate was 11.0 amid year 2013. Around 46,368 [34.4%] suicide.
casualties were young people in the age gathering of 15-29 years and 289[12.1%] were kids up to 14 years and constitute around 28% of populace in India.[11]

This study deals with the epidemiological, social and medico legal aspects of unnatural death in male and female. Where we found the ratio of female to male is 19:09 and burn was the most common cause of death found in female followed by poisoning, violent asphyxia, etc. Death is suspicious when caused prematurely against the order of nature by injury, position or other means of violence.

METHODOLOGY

Total 109 cases of (hanging, poisoning, burn, road accident and drowning) were studied from month January 2016 to March 2016. Cases of suspicious among all the studied subjects were 28 in number. Data were collected from the Department of Forensic Medicine and Toxicology, Chhattisgarh Institute of Medical Sciences, Bilaspur, C.G. Relevant history taken from police & relatives’ detailed information of each case was recorded on the pre-coded Performa.

Table 1: Case wise Distribution of Total no. of Subjects (N=109)

<table>
<thead>
<tr>
<th>Types of cases</th>
<th>No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTA</td>
<td>36</td>
<td>33.02</td>
</tr>
<tr>
<td>Poisoning</td>
<td>28</td>
<td>25.68</td>
</tr>
<tr>
<td>Burn</td>
<td>22</td>
<td>20.18</td>
</tr>
<tr>
<td>Hanging</td>
<td>18</td>
<td>16.51</td>
</tr>
<tr>
<td>Drowning</td>
<td>05</td>
<td>4.58</td>
</tr>
<tr>
<td>Total</td>
<td>109</td>
<td>100.00</td>
</tr>
</tbody>
</table>

Table 2: P.S. Wise Distribution of Total no. of Subjects (n=28)

<table>
<thead>
<tr>
<th>Types of cases</th>
<th>No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>City Kotwali</td>
<td>05</td>
<td>17.85</td>
</tr>
<tr>
<td>Civil Line</td>
<td>04</td>
<td>14.28</td>
</tr>
<tr>
<td>Tarbahr</td>
<td>06</td>
<td>21.42</td>
</tr>
<tr>
<td>Torwa</td>
<td>01</td>
<td>3.57</td>
</tr>
<tr>
<td>Sarkanda</td>
<td>02</td>
<td>7.14</td>
</tr>
<tr>
<td>Koni</td>
<td>06</td>
<td>21.42</td>
</tr>
<tr>
<td>GRP</td>
<td>04</td>
<td>14.28</td>
</tr>
<tr>
<td>Total</td>
<td>28</td>
<td>100.00</td>
</tr>
</tbody>
</table>

Table 3: Age & Gender wise Distribution of Subjects Concern with Suspicious Death (n=28)

<table>
<thead>
<tr>
<th>Age range (in years)</th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-14</td>
<td>-</td>
<td>-</td>
<td>02</td>
</tr>
<tr>
<td>15-24</td>
<td>04</td>
<td>44.44</td>
<td>09</td>
</tr>
<tr>
<td>25-44</td>
<td>02</td>
<td>22.22</td>
<td>05</td>
</tr>
<tr>
<td>45-64</td>
<td>02</td>
<td>22.22</td>
<td>03</td>
</tr>
<tr>
<td>65 and above</td>
<td>01</td>
<td>11.11</td>
<td>01</td>
</tr>
<tr>
<td>Total</td>
<td>09</td>
<td>100</td>
<td>19</td>
</tr>
</tbody>
</table>

Table 4: Suicide Note Present or Not (n=28)

<table>
<thead>
<tr>
<th>Suicide Note</th>
<th>No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Present</td>
<td>02</td>
<td>7.14</td>
</tr>
<tr>
<td>Absent</td>
<td>26</td>
<td>92.85</td>
</tr>
<tr>
<td>Total</td>
<td>28</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 5: Distribution of Marital Status of the Subject (n=28)

<table>
<thead>
<tr>
<th>Marital Status</th>
<th>No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Married</td>
<td>25</td>
<td>89.28</td>
</tr>
<tr>
<td>Unmarried</td>
<td>03</td>
<td>10.71</td>
</tr>
<tr>
<td>Total</td>
<td>28</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 6: Distribution of number of cases as per Cause of Death (n=28)

<table>
<thead>
<tr>
<th>Cause of death</th>
<th>Age</th>
<th>Gender</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td></td>
<td>No.</td>
<td>%</td>
<td>No.</td>
</tr>
<tr>
<td>Burning</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0-14</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>15-24</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>25-44</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>45-64</td>
<td>01</td>
<td>11.11</td>
</tr>
<tr>
<td></td>
<td>65 and above</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
### FINDINGS AND SUMMARY

The total 109 cases were studied in three months duration i.e. January 2016 to March 2016. Among them RTA cases were found maximum in number those were 36 cases i.e. 33.02%. The second largest group of casualty was poisoning and burn those were found 25.68% and 20.18% respectively. The cases of drowning reported very least in no. bilaspur district i.e. 05. Among 109 total studied cases, the suspicious death was recorded in 28 cases and most of suspicious death cases were concerned with either koni, tarbahar, or city kotwali, civil line. The cases of koni and tarbahar were near about 42.84% whereas the cases of kotwali and civil line are about 32.13%, those were showing maximum intake then other police station such as torwa, sarkanda, etc. As per age and gender wise distribution of subjects concerned with suspicious death it was found most of cases of suspicious death was concerned with females those were 19 in number and it was also noticed that the subjects having the age 15-44 were found maximum i.e. 73.67%. Presence or absence of suicide note at place of incidence is also issue of attention towards the suspicion of death. It was also observed about 89.28% subjects were found married among total suspicious death cases. It was observed that all the studied cases of suspicious death was either suicidal or homicidal in nature. It was observed that overall findings of suspicious death in Bilaspur district indicate that female were found dominating figure as compared to male, those were 19 cases and 09 cases respectively. The cases of burning were found maximum in number those were 42.53% followed by poisoning cases 36.23%. The cases of violent asphyxia death and other weapon injury found almost equal in number i.e. three cases each.

### CONCLUSION

A death is suspicious if it is unexpected and its circumstances or cause are medically or legally unexplained. Unnatural deaths are deaths which are not solely or totally due to disease and or aging process. These deaths may be accidental, suicidal, homicidal or undetermined. Accident applies when an injury or poisoning causes death and there is little or no evidence that the injury or poisoning occurred with intent to harm or cause death. The incidence of unnatural deaths in newly married females within first few years of their marriages is a dark spot on the noble tradition of our society. The cases of suspicious deaths such as Dowry deaths are increasing day by day in our country in spite of enactment of Dowry Prohibition Act 1961. IPC section, 304B (Dowry deaths) and 498A (Cruelty by husband or in laws) has been incorporated in the year 1980. Cr PC 176 deals with the magistrate Inquest. The Present Study of suspicious death i.e. sudden or unexpected death has got immense importance where the vital objective of the investigation is to exclude a suspicious cause of death. Total 109 autopsies were performed during January 2016 to march 2016 (3
months), out of which 28 were suspicious death in Bilaspur district of Chhattisgarh state. Several factors such as age, sex, religion, ethnicity, weapon and others influence the act of homicide. Medico legal autopsies give the cause, origin, and manner of death and also serve the availability of important statistical data. One million people die annually worldwide due to suicides and homicides alone. With growth in the population, day to day frustration, stressful life, competition, and modern needs, the incidence of suicide as well as homicide is on the increase worldwide.

Ethical clearance: Not Required

Source of funding: Self

Conflict of Interest: NIL

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6. Yusha, supra note 48 (stating that 8172 dowry deaths were registered with law enforcement in 2008).

7. Moore, supra note 42.


A Research Study on Deaths Due to Road Traffic Accidents Which were Brought to Govt. Medical College Mortuary, Ananthapuram, Andhra Pradesh During 2016 Year

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ABSTRACT

Road traffic accidents are very common all over the world including India. Death of pedestrians due to road traffic accidents are also increasing day by day due to overcrowding of vehicles. The vehicle drivers do not follow the speed limits and pedestrians not following traffic signals. Drunken driving is one of the commonest causes of road traffic accidents in India. In India, over 1,37,000 people were killed in various road traffic accidents during 2013 and the count raised to 1,46,133 in 2015. It is said that one person is dying due to road traffic accident for every four minutes in India. It is projected globally that deaths due to road traffic accidents will occupy third place when compared with deaths due to global disease burden. This study was conducted on deaths due road traffic accidents in Ananthapuram region of Andhra Pradesh which were brought to Ananthapuram government medical college mortuary for post-mortem examination. This study was done to know the pattern of injuries leading to death, blood alcohol levels in the dead victims, age group affected, statistics of deaths among pedestrians and two wheeler drivers.

Keywords: Road Traffic Accident (RTA), pedestrian, injuries, victim, collision, primary impact, secondary impact etc

INTRODUCTION

Among all traffic accidents, road traffic accidents (RTA) claims largest toll of human life and tend to be the most serious problem world over. Almost 1.2 million people die all over the world each year due to RTA, while 50 million people are injured. A majority of medicolegal autopsies in India are carried out on the victims of vehicular accidents. The trauma sustained in transportation accidents can be classified according to the victim involved into 1. Trauma sustained by pedestrians 2. Trauma sustained by cyclist/motor cyclist 3. Trauma sustained by occupants of the vehicle.¹


Primary impact injuries are caused when the vehicle hits the victim for the first time. These injuries help to detect the offending vehicle as the injuries may bear the design of the part of the vehicle causing the injuries in the form of imprint abrasion or patterned bruise. Secondary

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injuries are sustained by the victim after being knocked down by the vehicle, due to fall and friction or impact with the ground. Injuries include grazed abrasion and stretched lacerations which are caused due to friction with the ground. Secondary impact injuries result when after primary impact, the victim is thrown forward on the ground in front of the vehicle, the vehicle still in motion, its wheels run over the victim. Secondary impact injuries bear the tyre mark of the wheels. Run over injuries may be caused by the front or back wheels. Avulsion laceration is the most frequent injury seen in case of vehicle run over.\(^3\)

Vehicular accidents cause injuries to both pedestrians and the occupants of the vehicle. The pedestrian injuries are dependent on 1. Whether the person is crossing the road or walking in the direction of the moving vehicle 2. The point of impact of the vehicle 3. The nature of the road surface or the ground. The primary impact injuries includes fracture of the bones of the both the legs immediately below the point of impact because of the hit by the bumper. Such fractures are spiral in character due to rotational or torsional forces. The fractures are likely at the level of tibia or fibula. Secondary injuries vary in severity and are determined by 1. Speed of the vehicle 2. Position of the victim 3. The amount of clothes on his body at the time of accident. The commonly found secondary injuries are 1. Bruises and abrasions over the face and behind the ears. 2. Fracture of the skull usually involving parietal and or temporal bone running through the base of the skull. 3. Associated cerebral contusion. Secondary impact injuries includes run over and getting crushed against the road resulting in the fractures of bones and avulsion called as run over or flaying injuries. Head may be injured as a result of striking against the wind screen etc while being lifted on to the vehicle after the primary impact.\(^4\)

Most of the vehicular accidents are frontal collisions causing violent deceleration. The front seat occupants of the vehicle will continue to move forward at the same speed the car was travelling, even though vehicle stopped. The driver knee may hit the bottom of the dashboard causing fracture of patella or distal femur and his abdomen or lower chest strikes the lower edge of the steering wheel. Dislocation at hip joint or fracture of neck of femur may occur. The horn boss may strike the sternum and produce a transverse fracture and crush heart or split the aorta. The steering wheel rim may crush the liver, spleen or kidneys. In some cases, lungs are contused or lacerated due to fractured ribs penetrating the lung tissue. Facial lacerations and fractures of facial skeleton especially nose and maxilla may occur.\(^5\)

Hyperextension of the vertebral column of the cervical region may occur in cases of traffic injuries involving the front seat passenger and driver of a stationary vehicle which is rammed from behind with a great force which may lead either to concussion of spinal cord or bruising and laceration of it including meninges covering it. This called as whiplash injury.\(^6\)

Injuries sustained by occupants of rear seat will be different from those sustained by the front seat occupants. The fore head may strike the back of top of the front seat and the knee to the back of the body of the front seat. If the offended vehicle is struck from behind by a vehicle moving in the same direction, there may be dislocation of the spine.\(^7\)

**MATERIALS AND METHODS**

All the post-mortem examinations conducted in Ananthapuram medical college mortuary on deaths due to road traffic accidents during 2016 year were analysed. The data regarding pattern of injuries leading to death, blood alcohol levels in the dead victims, age group affected, statistics of deaths among pedestrians and two wheeler drivers were collected for analysis. The study was conducted with the permission and help of medical records section and autopsy surgeons who have done post-mortem examination in various cases of deaths due to road traffic accidents.

**OBSERVATIONS AND RESULTS**

There were 234 deaths due to road traffic accidents for which post-mortem examination were done in Ananthapuram government medical college mortuary, Andhra Pradesh during the year 2016.

Pattern of injuries leading to death in pedestrians & motorcyclist: The leading cause of death due to road traffic accidents which occurred in Ananthapuram region of Andhra Pradesh was skull fractures with intracranial haemorrhage due to head injury constituting about 43%. The spinal injuries comprising of 27% constitutes the second leading cause of death. The rupture of liver and or spleen inside the abdomen leading to death due
to internal bleeding is the next leading cause of death constituting 18% of cases. Polytrauma which is a combination of multiple long bone fractures along with the above three mentioned injuries leading to death constitutes in remaining 12% of cases.

Table 1: Pattern of injuries leading to death in pedestrians & motor cyclist

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Cause of Death</th>
<th>Incidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Head Injury</td>
<td>43%</td>
</tr>
<tr>
<td>2.</td>
<td>Spinal Injuries</td>
<td>27%</td>
</tr>
<tr>
<td>3.</td>
<td>Internal Abdominal Injuries</td>
<td>18%</td>
</tr>
<tr>
<td>4.</td>
<td>Polytrauma</td>
<td>12%</td>
</tr>
</tbody>
</table>

Pattern of injuries leading to death in occupants of the vehicles: The cause of death in occupants of vehicle is internal chest injuries accounting in 37% of cases. Death due to cervical vertebral injuries in occupants of the vehicles is seen in 14% of cases and head injury is the leading cause of death in occupants of the vehicles due to impact of head to steering wheel, front or side window glass shields etc.

Table 2: Pattern of injuries leading to death in occupants of the vehicles

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Cause of Death</th>
<th>Incidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Internal Chest Injuries</td>
<td>37%</td>
</tr>
<tr>
<td>2.</td>
<td>Cervical Vertebra Injury</td>
<td>14%</td>
</tr>
<tr>
<td>3.</td>
<td>Head Injury</td>
<td>49%</td>
</tr>
</tbody>
</table>

Month wise distribution of deaths due to RTA: If the month wise deaths are analysed during the year 2016 in Ananthapuram city region of Andhra Pradesh, the months of May (29 cases), December (28 cases), January (26 cases), November (24 cases), August (23 cases) and September (21 cases) witnessed more deaths while February (08 cases) and October (07 cases) months witnessed fewer deaths.

Table 3: Month wise distribution of deaths due to RTA

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Month</th>
<th>Deaths due to RTA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>January</td>
<td>26</td>
</tr>
<tr>
<td>2.</td>
<td>February</td>
<td>08</td>
</tr>
<tr>
<td>3.</td>
<td>March</td>
<td>12</td>
</tr>
<tr>
<td>4.</td>
<td>April</td>
<td>21</td>
</tr>
</tbody>
</table>

Conted…

| 5. | May | 29 |
| 6. | June | 17 |
| 7. | July | 18 |
| 8. | August | 23 |
| 9. | September | 21 |
| 10. | October | 07 |
| 11. | November | 24 |
| 12. | December | 28 |

Age wise distribution of total deaths due to RTA: The incidence of deaths due to RTA among 3 to 10 years age group was 8% while the same was 16% in 11 to 20 years age group. The incidence of deaths due to RTA was highest among 21 to 30 years followed by 26% incidence of deaths in the age group of 31 to 40 years. The incidence of deaths due to RTA was 16% in the age group of above 40 years.

Table 4: Age wise distribution of total deaths due to RTA

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Age Group</th>
<th>Incidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>3-10 years</td>
<td>08%</td>
</tr>
<tr>
<td>2.</td>
<td>11-20 years</td>
<td>16%</td>
</tr>
<tr>
<td>3.</td>
<td>21-30 years</td>
<td>34%</td>
</tr>
<tr>
<td>4.</td>
<td>31-40 years</td>
<td>26%</td>
</tr>
<tr>
<td>5.</td>
<td>&gt;40 years</td>
<td>16%</td>
</tr>
</tbody>
</table>

Sex wise distribution of total deaths due to RTA: While the incidence of deaths due to RTA was more in males accounting for 64%, the incidence was 36% in females.

Table 5: Sex wise distribution of total deaths due to RTA

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Sex</th>
<th>Incidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Males</td>
<td>64%</td>
</tr>
<tr>
<td>2.</td>
<td>Females</td>
<td>36%</td>
</tr>
</tbody>
</table>

Blood alcohol levels in victims who died due to RTA: The victims who died in RTA showed nil blood alcohol in 19% of cases, 12% of cases showed a blood alcohol levels of 100 – 150 mg%, 31% of cases showed a blood alcohol levels of 150 – 200 mg% and remaining 38% of cases showed a blood alcohol levels of 200 – 250 mg%
Table 6: Blood alcohol levels in victims who died due to RTA

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Blood Alcohol (mg%)</th>
<th>Incidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>100 -150</td>
<td>12%</td>
</tr>
<tr>
<td>2.</td>
<td>150 - 200</td>
<td>31%</td>
</tr>
<tr>
<td>3.</td>
<td>200 - 250</td>
<td>38%</td>
</tr>
<tr>
<td>4.</td>
<td>NIL</td>
<td>19%</td>
</tr>
</tbody>
</table>

**DISCUSSION**

The leading cause of death due to road traffic accidents in Ananthapuram city region of Andhra Pradesh was skull fractures with intracranial haemorrhage due to head injury constituting followed by spinal injuries which is followed by internal abdominal bleeding and lastly the polytrauma. The leading cause of death in occupants of vehicle was head injury due to impact of head to steering wheel, front or side window glass shields followed by internal chest injuries and lastly by cervical vertebral injuries. Maximum number of deaths due to RTA was seen during the months of May, December and January months while least number of deaths occurred during February and October. Highest incidence of RTA deaths was seen in the age groups of 21 to 30 and 31 to 40 years of age. The incidence of deaths was seen more in male when compared to females. Blood alcohol levels of 150 to 250 mg% was seen in more number of victims who died in RTA.

**CONCLUSION**

Road traffic accidents are growing day by day throughout the world including India due to increasing vehicle density within the available road limits. Deaths due to RTA are third major cause of mortality globally. RTA is a big yet still neglected issue in India. While other countries are taking steps to reduce RTA, India is still remaining quite without taking any major interventions. Hence there is urgent need to take all the possible necessary steps to reduce and prevent RTA in India to prevent further loss of human life so as to reduce its impact on society and economy.

**Conflict of interest:** Nil

**Source of funding:** Self

**Ethical clearance:** Govt. Medical College Mortuary, Ananthapuram, Andhra Pradesh

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Sex trafficking is a crime that affects nearly every community across our nation; it is an insidious threat that has proven difficult to track and quantify, and exceedingly hard to dismantle. We cannot ignore the networks, pipelines, the victims, or the systems that enable women trafficking. The above definitions highlight the role of coercion and deceit in trapping victims and isolating them from help, transporting them away from family and community networks, and exploiting them for economic or personal gain.

Sex trafficking is a highly underreported crime for a variety reasons, including the fact that “many trafficking victims do not identify themselves as victims. Some suffer from fear, shame, and distrust of law enforcement. It is also not unusual for trafficking victims to develop traumatic bonds with their traffickers because of the manipulative nature of this crime.”[1]

Keywords: Sex trafficking, network, victim, women trafficking, coercion, deceit, trapping, transporting, exploit, underreported crime, law enforcement, trauma, trafficker.

BACKGROUND

The US President Barack Obama said “When a little girl is sold by her impoverished family— girls my daughters’ age— runs away from home, or is lured by the false promises of a better life, and then imprisoned in a brothel and tortured if she resists— that’s slavery. It is barbaric, and it is evil, and it has no place in a civilized world.”

Article 3, paragraph (a) of the Protocol to Prevent, Suppress and Punish Trafficking in Persons defines Trafficking in Persons as the recruitment, transportation, transfer, harbouring or receipt of persons, by means of the threat or use of force or other forms of coercion, of abduction, of fraud, of deception, of the abuse of power or of a position of vulnerability or of the giving or receiving of payments or benefits to achieve the consent of a person having control over another person, for the purpose of exploitation.[2] Exploitation shall include, at a minimum, the exploitation for prostitution or other forms of sexual exploitation, forced labour or services, slavery or practices similar to slavery, servitude or the removal of organs. [3]

The term “sex trafficking” means the recruitment, harbouring, transportation, provision, or obtaining of a person for the purpose of a commercial sex or for the purpose of subjecting to involuntary servitude, peonage, debt bondage, or slavery. [4] Traffickers of young girls into prostitution in India are often women who have been trafficked themselves. As adults they use personal relationships and trust in their villages of origin to recruit additional girls. [5]

Worldwide, false promises are ways in which traffickers bait and enslave their victims— both adults and minors. Indigenous populations and those who live in abject poverty are typically economically and politically marginalized; thus, most lack rights and access to basic services such as education which make them particularly vulnerable to sex trafficking.
Many times, people from these communities are offered false employment opportunities in major cities. Women and young girls may be offered jobs as models, nannies, house maids, sales girls, beauticians, massage girls, waitresses, dancers etc. Some traffickers operate under the guise of agencies that offer cross-country dating services. However, upon arrival, these individuals are abused, threatened and sold in the sex industry.

As a result, when sex trafficking victims are caught, they might be detained and prosecuted for criminal activity (e.g., prostitution). However, a legal charge is only one area of concern. Sex trafficking has devastating consequences for the trafficked individual. Victims may suffer from long-lasting physical and psychological trauma, disease (HIV/AIDS), drug addiction, malnutrition and social ostracism.

So, while there are ongoing legal debates about how to define trafficking, the presence of prostitution networks can indicate high levels of vulnerability, exploitation, and coercion that contributes to trafficking. Thus, we have included research here that surveys the experiences of commercial sex workers. In what follows, we summarize data that describe the prevalence of women trafficking in Hyderabad & Secunderabad, which was studied at Department of Forensic Medicine, Gandhi Medical College, for a period of one year in 2012.

MATERIALS AND METHOD

The study scenario is as follows. On a fortunate day, a police officer at the Secunderabad railway station is approached by a frantic and scared young woman running away from a crowd of young girls, who were being transported to other places. She asks for help and says she is being held against her will. Later, she tells the police that she is being beaten by a pimp who is forcing her to prostitute herself in a flat along with 15 other women. They are brought to the city of Hyderabad by their relatives/friends by luring them towards good jobs and work, so that they can earn better in the city to lead a luxurious life. Later they are handed over to pimps who promise them jobs as sales girls, house maids etc. Then these pimps exploit these girls by forcing them to commercial sex.

The police with the girl’s help secured all the women to a NGO home who give protection to women & children. After registering a case under sex trafficking, they are brought to the department of Forensic Medicine, Gandhi Medical College, Secunderabad for Age Estimation. While taking history, they reveal that they are staying in a four bed room flat in an apartment. They are sexually exploited under the headship of pimps who shift them to other places every 3 months. While in transit, from Hyderabad to another city, this girl runs away from the mob, who later reveals about entire racket.

Hence the present study was taken up after interviewing all the victims. The study is a retrospective cross-sectional study on 75 women who have been brought to the Department of Forensic Medicine, Gandhi Medical College, Secunderabad. It is an interview based study; a proforma was prepared and the answers were recorded after obtaining consent. Detailed history of case scenario was obtained, which includes their past life, family background, sexual history, knowledge on contraceptives & sexually transmitted diseases. The literacy & socio economic status was given special mention. Also psychological evaluation was done.

OBSERVATIONS

Leading sex trafficking researcher and Native scholar, Dr. Sandi Pierce notes that it is no secret that “the selling of North America’s indigenous women and children for sexual purposes has been an ongoing practice since the colonial era. There is evidence that early British surveyors and settlers viewed Native women’s sexual and reproductive freedom as proof of their ‘innate’ impurity, and that many assumed the right to kidnap, rape, and prostitute Native women and girls without consequence.”[6,7,8]

In India, as well as in US & Canada, “there is no data collection/tracking method that provides a complete picture of sexual exploitation or human trafficking.”[1] Most victimization data come from surveys of individuals engaged in prostitution or commercial sexual exploitation. Reliance on prostitution data is somewhat problematic in the context of trafficking. Trafficking occurs where there is coercive control, “but an adult woman is able to consent to engage in illicit activity (such as prostitution).”[9] Therefore, some researchers challenge the use of prostitution data in identifying trafficking trends.[10]

In our study it is found that all of the 75 women interviewed “met a conservative legal definition of sex trafficking, which involves third-party control over the prostituting person by pimps or traffickers. And most
interviewees felt that no [one] really know[s] what they’re getting into when they begin prostituting, and that there is deception and trickery involved”.[11]

Health consequences of trafficking: In addition to understanding how prevalent trafficking is for Native people, it is important to consider the experiences and consequences for victims of trafficking—particularly in the realm of health, as data collected from survivors.

PTSD – Post Traumatic Stress Disorder

1. Psychological Health Issues

These findings show that 9 out of 10 trafficking victims suffer neurological symptoms and depression; that PTSD increases after escaping sex slavery and attempted suicides decrease by half. Regarding reproductive health, one-thirds had contracted a sexually-transmitted disease or infection. When the study asked about the violence experienced by the victims, more than two-thirds reported being punched, beaten, kicked, raped, and threatened with a weapon.

Table 1: EDUCATIONAL STATUS

<table>
<thead>
<tr>
<th>Educational status</th>
<th>number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Never went to school</td>
<td>45</td>
<td>60%</td>
</tr>
<tr>
<td>Below Primary education</td>
<td>24</td>
<td>32%</td>
</tr>
<tr>
<td>Only primary education</td>
<td>6</td>
<td>8%</td>
</tr>
<tr>
<td>Secondary education</td>
<td>0</td>
<td>0%</td>
</tr>
</tbody>
</table>

Table 2: SOCIO ECONOMIC STATUS

<table>
<thead>
<tr>
<th>Socio economic status</th>
<th>frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower class</td>
<td>48</td>
<td>64%</td>
</tr>
<tr>
<td>Lower Middle class</td>
<td>18</td>
<td>24%</td>
</tr>
<tr>
<td>Upper middle class</td>
<td>9</td>
<td>12%</td>
</tr>
<tr>
<td>Upper class</td>
<td>0</td>
<td>0%</td>
</tr>
</tbody>
</table>

DISCUSSION

In our study, the sexually trafficked women are either from broken families or single moms, divorcees, poor, or minor girls who are orphans being brought up by grandparents, health ailments in the other family members which require financial support, or with debts. All these elements made them vulnerable to get easily lured for money by pimps/traffickers.

Vulnerabilities and Risk Factors: According to a research, traffickers seek out persons perceived to be vulnerable. Vulnerability comes in many forms, including age (minors), poverty, homelessness, chemical dependency, prior experiences of abuse, lack of resources and/or support systems, and so forth. Traffickers then use various tactics to control vulnerable persons, including: inflicting sexual, emotional, or mental abuse; luring those struggling with addictions by enabling these addiction(s); withholding money or identifications needed to travel or access help; being physically violent and/or threatening assault.[12]

Communities that experience the following characteristics should be on alert for the presence of human and sexual trafficking:

- Historical trauma and cultural loss
- Significant poverty and/or economic isolation/dependence
- High rates of Adverse Childhood Experiences in the population
- High numbers of homeless and runaway youth
- High rates of family surveillance and involvement with child welfare system
- High rates of exposure to violence (direct and/or indirect, through domestic, intimate partner violence)
- High rates of personal or family/caregiver addiction to substances
Low levels of police or law enforcement presence
Influx of a transient, cash-rich workforce

Sexual violence has a significant negative impact on the health of the population. The potential reproductive and sexual health consequences are numerous—unwanted pregnancy, sexually transmitted infections (STIs), human immunodeficiency virus/acquired immunodeficiency syndrome (HIV/AIDS) and increased risk for adoption of risky sexual behaviours (e.g. early and increased sexual involvement, and exposure to older and multiple partners). The mental health consequences of sexual violence can be just as serious and long lasting. Victims of child sexual abuse, for example, are more likely to experience depression, substance abuse, post-traumatic stress disorder (PTSD) and suicide in later life than their non-abused counterparts. Worldwide child sexual abuse is a major cause of PTSD, accounting for an estimated 33% of cases in females and 21% of cases in males.\[13\]

The trafficking of women and children for prostitution is becoming one of the fastest growing areas of international criminal activity. According to official estimates, somewhere between 1 and 2 million women and children are trafficked each year worldwide for forced labour, domestic servitude or sexual exploitation. Generally speaking, women of lower economic status are more susceptible to sexual slavery, trafficking and sexual harassment.\[14\]

It is also very difficult to establish true incidence rates, and even prevalence estimates, of child sexual abuse, again largely because of problems of underreporting. Child sexual abuse is rarely reported at the time that the abuse occurs, and in many cases is never reported, and most prevalence data come from asking adults about their past experiences.\[15\]

Psychological consequences: Just as there is no typical victim, there is no typical reaction to the experience of sexual violence; psychological effects vary considerably from person to person. Generally speaking, however, sexual abuse should be suspected in individuals who present, particularly repeatedly, with the following health problems:\[16,17,18\]

- rape trauma syndrome
- post-traumatic stress disorder
- depression;
- social phobias (especially in marital or date rape victims);
- anxiety;
- increased substance use or abuse;
- suicidal behaviour.
- cognitive distortions;
- externalized emotional distress; child abuse victims
- interpersonal difficulties, including sexual problems.

Prosecution: The Government of India penalises trafficking for commercial sexual exploitation through the Immoral Trafficking Prevention Act (ITPA), with prescribed penalty of seven years' to life imprisonment. Indian authorities also use Sections 366(A) and 372 of the Indian Penal Code, prohibiting kidnapping and selling minors into prostitution respectively, to arrest traffickers. Penalties under these provisions are a maximum of ten years' imprisonment and a fine. Section 8 of the ITPA permits the arrest of women in prostitution.

**RECOMMENDATIONS**

Trafficking is a clear and present danger—even if it is difficult to identify and quantify. We recommend the following to prevent sex trafficking-

1. Host a community discussion to educate all citizens about recognizing the signs of trafficking and accessing available resources. Community discussions can create essential awareness and deter predators.

2. Equip children and youth to seek help and prevent peer recruitment.

3. Ensure adequate and safe housing options for homeless, runaway, couch-hopping, and pregnant/parenting youth. Short or long-term shelter options with support services, transitional housing, and permanent subsidized housing could all address needs.

4. Equip tribal police departments to investigate networks of sex buyers and gang-related operations. Many tribes already include prostitution activity as part of their criminal codes. It is important to educate law enforcement and other community health workers to be aware of predatory networks.
5. Foster community and school competency in addressing sexual exploitation and youth trauma.

6. Develop cross-community, regional, and/or state networks to share information and resources.

7. Endow with employment & education to the victims & minor girls respectively and counselling regarding health consequences & STIs.

CONCLUSION

The study findings include:

- The study found that gangs are involved which include pimps/sex-trafficking facilitators.
- The clients of commercial sex came from all socioeconomic and ethnic backgrounds.
- The average age of entry into child commercial sexual exploitation was 13 years.
- Most of the victims were though aware of HIV/AIDS, all had no absolute idea about other STIs.
- Barrier methods of contraception (condoms) were used by most.
- If by any chance, anyone conceived, illicit criminal abortions are in vogue.
- 64% are below the Poverty line
- Minor sex trafficking victims constituted 88%
- More than 60% of victims never went to school
- Unfortunately many victims want to continue in the same field, not utilising the services provided by Government or NGOs, as they are used to this easy & quick money.

This study was designed to address seven shortcomings in sex trafficking research:

- Inability to produce credible prevalence estimates of sex trafficking
- Conflation of commercial sexual exploitation with sex trafficking
- Lack of primary data on sex trafficking (studies rely instead on secondary sources)
- Inability to identify networks of sex traffickers
- Understudied extent of gang involvement in sex trafficking
- Overreliance on qualitative methods
- Small sample sizes

Ethical clearance: Obtained from Institute Ethical Committee

Source of funding: Nil

Conflict of interest: Nil

REFERENCES


Study of Pattern of Injuries in Homicidal Deaths

Vinay H. N1, Bheemappa Havanur2

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ABSTRACT

In order to determine the specific pattern of injuries, Present study was carried out over a period of 2 years. From October 2010 to September 2012. A total of 220 cases of homicidal deaths were studied in the Department of Forensic Medicine, Bangalore Medical College and Research institute. Bangalore.

Among 220 cases of homicidal deaths sharp weapon injuries tops in the list (48.6%), head being the most targeted part in homicidal act bearing (31.3%), defence injuries by sharp force constitute (27%), most of the defence injuries present on the hand (35%), sharp pointed weapon constitutes (28.1%) and among blunt weapons stone constitutes (14%).

Keywords: Pattern of injuries, Type of weapon, Medico-legal issues.

INTRODUCTION

Homicide is one of the oldest crimes in human civilization. For every person who dies as a result of homicide, many more are injured. A study of the patterns of homicide in a society is one of the steps in developing strategies to prevent it.1

The incidence of homicide is increasing world wide and the pattern is also changing because of population explosion, changing life style, modern needs of the man and easy availability of various type of weapons.2

Injuries by blunt force like abrasions at time gives indication about the type of offence comititated. Abrasions on the private parts, thighs and breast of a women indicative of sexual assault. Nail marks on the neckindicative of manual strangulation and scratches around the mouth and nose may be indicative of smothering. In case of homicide bruises are common, most frequently situated on head are the result of blows with blunt weapons. Lacerated wounds might point to homicide if situtated on the head. Incised wounds inflicted with a sword, axe or any other heavy weapons point to homicide. A typical cut throat wound is situated below the Adam’s apple. Multiple deep punctured or stab wounds may be located any where on the body but usually near vital parts indicates homicide. Unlike many other countries the fire arm is not a favourite weapon for either murder or suicide in India. This is because the posession of fire arm is strictly regulated here and none but the fairly well to do can afford them.3

MATERIALS AND METHODS

The present study was conducted in the department of Forensic Medicine Bangalore Medical College and Research Institute (Victoria and Bowring and Lady Curzon hospitals) Bangalore, from Oct 2010 to Sep 2012, a period of 2 years.

All the cases brought to the department for medico legal autopsy registered under section 302 IPC with alleged history of homicide and also the cases registered under 174 (3) CrPc which were later registered as homicide were studied.

Detailed information regarding the circumstances of crime was sought from the police, victim’s relatives and friends, visits to the scene of occurrence or deduced by the photographs of the scene of occurrence.
Table 1: Distribution of homicides based on pattern.

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Pattern of homicide</th>
<th>Number</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Sharp weapon injuries</td>
<td>107</td>
<td>48.6</td>
</tr>
<tr>
<td>2</td>
<td>Blunt weapon injuries</td>
<td>64</td>
<td>29.09</td>
</tr>
<tr>
<td>3</td>
<td>Sharp &amp; blunt weapon injuries</td>
<td>06</td>
<td>2.7</td>
</tr>
<tr>
<td>4</td>
<td>Asphyxia death</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(a) Strangulation (19)</td>
<td>19</td>
<td>8.6</td>
<td></td>
</tr>
<tr>
<td>(b) Throttling (02)</td>
<td>02</td>
<td>0.9</td>
<td></td>
</tr>
<tr>
<td>(c) Hanging (03)</td>
<td>03</td>
<td>1.4</td>
<td></td>
</tr>
<tr>
<td>(d) Smothering (08)</td>
<td>08</td>
<td>3.6</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Fire arm</td>
<td>05</td>
<td>2.27</td>
</tr>
<tr>
<td>6</td>
<td>Poisoning</td>
<td>07</td>
<td>3.18</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>220</td>
<td>100</td>
</tr>
</tbody>
</table>

From the above table it is observe that Sharp weapon injuries tops in the list (48.6%). Blunt injuries (29.09 %) most constitute stone. Homicidal asphyxia deaths (14.9%), strangulation tops in list 19 cases. There were 5 fire arm injuries motive being revenge. Homicidal poisoning falls in to dyadic deaths category victims being children.

Table 2: Distribution of homicides based on site involved

<table>
<thead>
<tr>
<th>Site</th>
<th>Number</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Head</td>
<td>69</td>
<td>31.3</td>
</tr>
<tr>
<td>Face</td>
<td>06</td>
<td>2.7</td>
</tr>
<tr>
<td>Neck</td>
<td>35</td>
<td>15.9</td>
</tr>
<tr>
<td>Head &amp; neck</td>
<td>10</td>
<td>4.5</td>
</tr>
<tr>
<td>Face &amp; neck</td>
<td>19</td>
<td>8.6</td>
</tr>
<tr>
<td>Chest</td>
<td>15</td>
<td>6.8</td>
</tr>
<tr>
<td>Abdomen</td>
<td>09</td>
<td>4</td>
</tr>
<tr>
<td>Chest &amp; abdomen</td>
<td>08</td>
<td>3.6</td>
</tr>
<tr>
<td>Multiple</td>
<td>43</td>
<td>19.5</td>
</tr>
<tr>
<td>Others</td>
<td>06</td>
<td>2.7</td>
</tr>
<tr>
<td>Total</td>
<td>220</td>
<td>100</td>
</tr>
</tbody>
</table>

From the above table it is observed that head (31.3%) is listed in top, most target part in homicidal act. Neck injuries (15.9 %). Face and neck injuries (8.6%). Multiple sites constitutes 19.5 % involves head face limbs.

Table 3: Distribution of cases Based on presence or absence of defence injuries

<table>
<thead>
<tr>
<th>Defence injury</th>
<th>Number</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Present</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(a) Sharp</td>
<td>60</td>
<td>27.2</td>
</tr>
<tr>
<td>(b) Blunt</td>
<td>17</td>
<td>7.7</td>
</tr>
<tr>
<td>(c) Both</td>
<td>02</td>
<td>0.9</td>
</tr>
<tr>
<td>2. Absent</td>
<td>141</td>
<td>64</td>
</tr>
<tr>
<td>Total</td>
<td>220</td>
<td>100</td>
</tr>
</tbody>
</table>

Injuries by sharp force constitute (27%) mainly incised injuries, chop wounds. Blunt injuries constitutes (8%) mainly lacerations and contusions.

Table 4: Distribution of defence injuries based on site

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Site of defence injuries</th>
<th>Number</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Hand</td>
<td>28</td>
<td>35</td>
</tr>
<tr>
<td>2</td>
<td>Fore arm</td>
<td>17</td>
<td>21.2</td>
</tr>
<tr>
<td>3</td>
<td>Hand + forearm</td>
<td>23</td>
<td>28.7</td>
</tr>
<tr>
<td>4</td>
<td>Arm</td>
<td>10</td>
<td>12.5</td>
</tr>
<tr>
<td>5</td>
<td>others</td>
<td>02</td>
<td>2.5</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>80</td>
<td></td>
</tr>
</tbody>
</table>

Most of the defence injuries present on hand (35%) followed by hand and forearm (28.7 %) to protect vital organs like head and neck.

Table 5: Distribution of homicides based on the type of weapon used

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Weapon</th>
<th>Number</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Sharp pointed</td>
<td>62</td>
<td>28.1</td>
</tr>
<tr>
<td>2</td>
<td>Sharp heavy cutting</td>
<td>42</td>
<td>19</td>
</tr>
<tr>
<td>3</td>
<td>Sharp + blunt</td>
<td>08</td>
<td>3.6</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>112</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Blunt weapon</th>
<th>Number</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Stone</td>
<td>31</td>
<td>14</td>
</tr>
<tr>
<td>2</td>
<td>Wooden stick</td>
<td>08</td>
<td>3.6</td>
</tr>
<tr>
<td>3</td>
<td>Rod</td>
<td>08</td>
<td>3.6</td>
</tr>
<tr>
<td>4</td>
<td>Wire</td>
<td>07</td>
<td>3.1</td>
</tr>
<tr>
<td>5</td>
<td>Fire arm</td>
<td>05</td>
<td>2.2</td>
</tr>
<tr>
<td>6</td>
<td>Others</td>
<td>39</td>
<td>1.7</td>
</tr>
<tr>
<td>7</td>
<td>Not known</td>
<td>10</td>
<td>4.5</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>108</td>
<td></td>
</tr>
</tbody>
</table>
From the above table sharp weapons (light and heavy cutting) constitutes 47%. Among blunt weapons most common was the stone (14%).

**DISCUSSION**

A total of 220 cases of homicidal deaths were studied, sharp weapon injuries tops in the list (48.6%) due to easily availability. In domestic homicides sharp cutting knives were the weapons of cut throat injuries. In street homicides both sharp light and heavy cutting weapons leads most of the acts are pre planned attacks on vital parts of the body. Blunt injuries (29.09 %) most constitute stone easily available at the time of act in the scene of crime like wooden sticks, bat, wicket, wooden blog. Homicidal asphyxia deaths (14.9%), strangulation tops in list 19 cases, most being weapon of opportunity like sary, viel other cloth materials some cases includes rope, and wires. In Smothering victims being both children and adult females in domestic homicides, pillow being weapon of opportunity. There were 5 fire arm injuries. In our country availability of fire arm to civilians less compared to western countries due to strict law and orders. Homicidal poisoning falls in to dyadic deaths category victims being children. This study is similar to study conducted by, Lee-Gorman et al 4, Shivakumar et al 5, Bhattacharje N et al 6, Mohanty MK et al 7, Scott KWM et al 8, where injuries by sharp weapon were most common. This is contrast to observations made by Mohanty et al 9, Bhupinder S et al 10, Gambhir SO et al 11, where injuries due to blunt weapon were common.

Among 220 cases studied it is observed that head (31.3%) is listed in top, most target part in homicidal act. Sharp weapon injuries are ahead of blunt weapon most being heavy cutting weapons like long, choppers. Blunt injuries to head and face were also in significant number. Neck injuries (15.9 %) most were cut throat injuries others were stab injuries. With respect to blunt injuries asphyxia leads in form of strangulation by ligature. Facial injuries mainly go in favour of smothering includes contusions and lacerations. Face and neck injuries (8.6%) noted in cases of smothering, throttling. Chest and abdominal injuries most were sharp force being stab injuries. Multiple sites constitutes 19.5 % involves head face limbs. This observations similar to study done by, Bhullar et al 12, Eze UO et al 13, Dheraj B et al 14, where both sharp and blunt injuries over head and neck were most targeted parts of the body.

In the study presence of defence injuries by sharp force constitute (27%) mainly incised injuries, chop wounds, Blunt injuries constitutes (8%) mainly lacerations and contusions. These observations supported in study by, Ong BB15, Mittal S et al 16.

Among 220 cases most of the defence injuries present on hand (35%) followed by hand and forearm (28.7 %) to protect vital organs like head and neck, most being sharp force constitutes incised and chop wounds. Other sites being legs, back in cases of victim fell down during the assault. This study similar to observations made by, Ambade VND et al 17 and Hugar BS et al 18, where hand and fore arm had more defence injuries.

In this study, based on the history given by police and presence of weapon in scene of crime, where weapons are not found were recovered in further dates by investigation were also studied. In some homicides more than one weapon were used. In 10 cases type of weapon were not able to asses due to alteration in injuries by decomposition, post-mortem burns etc. Sharp weapons (light and heavy cutting) constitutes 47% as those homicides were predetermined and the assailants were carried the weapons with them. Among blunt weapons most common was the stone (14%) where most of the homicides occurred during night time motive being the arguments under the influence of alcohol and the stone was found in scene of crime. In 5 cases fire arms used motive being the revenge and financial conflicts. This is similar to study by Hugar BS et al 18, Where more sharp weapons used. This is contrast to study by Pranav et al 19, where more blunt weapons used.

**CONCLUSION**

1. A Forensic medicine specialist, being an expert witness should be able to diagnose the medicolegal injuries in their right perspective to help the investigating authorities and the courts of law their legal conclusion.

2. Apart from playing the role of an expert witness, he must also maintain the comprehensive data pertaining to the injured and the injuries for epidemiological records to assist in the surveys pertaining to the crimes on humanity for behavioural treatment of the criminals and the assault victims.
3. Injuries caused by or sustained from sharp edged weapons may be suicidal, homicidal, self sustained or accidental but certain medicolegal parameters definitely help to diagnose the nature or mode of these injuries.

4. Social and political motivation, increase literacy rate and economical growth along with improvement of law and order of the land prevent vast majority from homicides.

Ethical clearance: taken from Bangalore Medical College and Research Institute ethical committee.

Source of funding: Self

Conflict of interest: Nil

REFERENCES


Socio-Demographic Profile of Fatal and Non-Fatal Cases of Sharp Weapon Trauma at S.M.S. Medical College & Hospital, Jaipur During The Year 2015-16

Vinod Kumari Jat¹, Rakesh Kumar Punia²
¹Post Graduate Resident, Forensic Medicine, ²Professor and Head, Forensic Medicine, SMS Medical College, Jaipur. Rajasthan.

ABSTRACT

Injuries resulting from use of sharp edged objects are common and may range from trivial to fatal injuries being homicidal, accidental or suicidal owing to self-inflation to cause self-harm or feign harm. Sharp trauma is caused by means of sharp edged instruments. Such instruments are ubiquitously available as objects of daily use and may cause serious or fatal injuries when used inappropriately. From the medico-legal point of view, every injury recorded must be medico-legal diagnosed in the right perspective to aid in the disbursement of justice.

This was conducted at department of Forensic Medicine of S.M.S. Medical college, Jaipur during the period extending from April, 2015 to March, 2016 to study of all the cases of sharp force trauma, including fatal and non-fatal cases. A total no. of 102 cases of sharp weapon injury were studied to find Socio-demographical profile of sharp weapon injuries in both Fatal and non-fatal cases. The load of cases of sharp injuries during this one year period was 0.78% out of which 0.001% cases proved fatal.

Males were the predominant study population (85.29%) in the present study. Majority of cases were in 21 to 40 years of life (70.59%). Majority of sharp injuries in the present study were inflicted by others (90.2%). Self-inflicted sharp injuries were seen in 09.8% cases. In this study maximum incidences took place on Sunday (21.57%) followed by Tuesday (20.59%). Majority of the sharp injuries occurred during night hours in the present study (56.86%). Majority of cases of sharp injuries were inflicted by others due to personal feud was the most common motive followed by family disputes (27.96%).

Keywords: IPC, Sharp, Incised, Stab, Shock.

INTRODUCTION

Sharp trauma is caused by means of sharp edged instruments. Such instruments are ubiquitously available as objects of daily use and may cause serious or fatal injuries when used inappropriately. It is regarded as an extremely violent manner of killing. If homicidal, it indicates extreme hatred for the dead from the murderer and at many times, the mental instability of the murderers¹. Even with the advent of more modern injury types, such as gunshot wounds, motor vehicle collisions, medical therapy-related incidents, and injury related to alternating current electricity, sharp force injuries have remained relatively common within the world of death and injury investigation.² Under Sections 324 and 326 of Indian Penal Code, 1860 instruments for cutting and stabbing causing sharp injuries on human body have been described as dangerous weapons and the punishments for causing grievous hurt with these weapons is more than that for causing simple hurt or grievous hurt without using dangerous weapons on human body.³ Injuries resulting from use of sharp edged objects are common and may range from trivial to fatal injuries being homicidal, accidental or suicidal owing to self-infliction to cause self-harm or feign harm. The most common manner of injuries associated with sharp force trauma is homicide, followed by suicide. Accidental sharp force injury fatalities do occur but are relatively

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rare⁴ Such vicious means of deaths are indicative of extreme violence; increasing frequency of which leads our attention towards the developing sense of frustration and lack of tolerance, indicative of mental disturbances in individuals.⁵ From the medico-legal point of view, every injury recorded must be medico-legally diagnosed in the right perspective to aid in the disbursement of justice.

**MATERIAL AND METHODS**

This study consist of all the Medico-legal cases of sharp force trauma, including fatal and non-fatal cases except those cases of alleged history of injury by sharp weapons but found to be resulting from blunt trauma which were brought for medico-legal examination or for autopsy in department of Forensic Medicine of S.M.S. Medical college, Jaipur during the period extending from April, 2015 to March, 2016. A total no. of 102 cases of sharp weapon injury were studied to find Socio-demographical profile of sharp weapon injuries in both Fatal and non-fatal cases. The load of cases of sharp injuries during this one year period was 0.78% out of which 0.001% cases proved fatal.

**OBSERVATION**

A total of 22,740 medico-legal cases were catered to in the out-patient and in-patient department of SMS Hospital, Jaipur. Amongst them 179 cases were of sharp force trauma (0.78%) out of which 82 cases were excluded from the study. During the study period 4838 medico-legal autopsies were performed among which there were five cases of deaths due to sharp force trauma. Thus, a total of 102 cases comprised the study population in the present study.

The cases of sharp injuries in the present study ranged from 16-70 years of age with a mean age of 28.37 years. Majority of cases were in 21 to 40 years of life with 70.59% cases followed by 2⁵th and 5⁷th decade. Least number of cases was reported in geriatric age group above 61 years of age with only one case. Males were the predominant study population (85.29%) in the present study with only 14.71% females who sustained sharp force trauma. Males outnumbered females in all the age groups. However, maximum female cases were reported in 2⁴th and 4⁶th decades of life.(Table 1)

<table>
<thead>
<tr>
<th>Age Group (years)</th>
<th>Gender</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Female</td>
<td>Male</td>
</tr>
<tr>
<td>11 to 20</td>
<td>04</td>
<td>10</td>
</tr>
<tr>
<td>21 to 30</td>
<td>03</td>
<td>42</td>
</tr>
<tr>
<td>31 to 40</td>
<td>04</td>
<td>23</td>
</tr>
<tr>
<td>41 to 50</td>
<td>02</td>
<td>09</td>
</tr>
<tr>
<td>51 to 60</td>
<td>01</td>
<td>03</td>
</tr>
<tr>
<td>&gt; 61</td>
<td>01</td>
<td>00</td>
</tr>
<tr>
<td>Total</td>
<td>15</td>
<td>87</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Occupational status</th>
<th>No. of cases</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Private Sector</td>
<td>46</td>
<td>45.11%</td>
</tr>
<tr>
<td>Student</td>
<td>15</td>
<td>14.71%</td>
</tr>
<tr>
<td>House wife</td>
<td>12</td>
<td>11.76%</td>
</tr>
<tr>
<td>Driver</td>
<td>08</td>
<td>07.84%</td>
</tr>
<tr>
<td>Farmer</td>
<td>03</td>
<td>02.94%</td>
</tr>
<tr>
<td>Labourer</td>
<td>07</td>
<td>06.86%</td>
</tr>
<tr>
<td>Businessman</td>
<td>04</td>
<td>03.92%</td>
</tr>
<tr>
<td>Property dealer</td>
<td>02</td>
<td>01.96%</td>
</tr>
<tr>
<td>Domestic help</td>
<td>04</td>
<td>03.92%</td>
</tr>
<tr>
<td>Unknown</td>
<td>01</td>
<td>00.98%</td>
</tr>
<tr>
<td>Total</td>
<td>102</td>
<td>100%</td>
</tr>
</tbody>
</table>

There was a preponderance of Hindu population (57.84%) over Muslim population (41.18%) in the present study. In this study the Hindus made the majority with 57.84%. There was a single case of the Jain community (0.98%). Majority of the victims who sustained sharp injuries in the present study were married (79.41%). One victim in the study population was widow. Majority of the victims of sharp injuries in the present study were working in the private sector (45.10%) followed by students (14.71%), housewives (11.76%) and drivers (7.84%).(Table 2)
witnessed such events in 11.76% and 7.84% respectively. Least number of episodes resulting in sharp force trauma occurred in evenings (1.96%). Majority of cases were injured at an outside place (48.04%) other than home and workplace. Next common place of occurrence were homes (29.41%) and nearby places. Least number of events occurred at workplace (9.81%).

Majority of sharp injuries in the present study were inflicted by others (90.2%). Self-inflicted sharp injuries were seen in 9.8% cases. In the present study majority of cases of sharp injuries were inflicted by others due to personal feud was the most common motive followed by family dispute with 27.96% cases. In one case the motive could not be determined. (Table 3) The most common motive behind self-inflicted harm in the present study was frustrations in life which ranged from failed love affair, marital discord, financial loss and family disputes (77.78%).

### Table 3: Distribution of cases of Sharp Injuries Inflicted by others and Motive of Injury

<table>
<thead>
<tr>
<th>Motive of Assault</th>
<th>No. of Cases</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Family dispute</td>
<td>26</td>
<td>27.96%</td>
</tr>
<tr>
<td>Love affair</td>
<td>12</td>
<td>12.90%</td>
</tr>
<tr>
<td>Personal feud</td>
<td>27</td>
<td>29.03%</td>
</tr>
<tr>
<td>Property dispute</td>
<td>20</td>
<td>21.51%</td>
</tr>
<tr>
<td>Revenge</td>
<td>07</td>
<td>07.53%</td>
</tr>
<tr>
<td>Unknown</td>
<td>01</td>
<td>01.07%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>93</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

In this study majority of cases of injuries inflicted by others were incised with 62 cases (60.78%) followed by stab injury with 16 cases (15.69%). Incised wounds were the only self-inflicted sharp injury in the present study. All stab wounds and multiple sharp injuries were inflicted by others. None of the wound was chop wound in our study. (Table 4)

### Table 4: Distribution of cases according to the Type of Sharp Injury and Manner of Infliction

<table>
<thead>
<tr>
<th>Type of Injury</th>
<th>Manner of infliction</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Infliction by Others</td>
<td>Infliction by Self</td>
</tr>
<tr>
<td>Only Incised Wound</td>
<td>62  60.78%</td>
<td>09  08.82%</td>
</tr>
<tr>
<td>Only Stab Incised Wound</td>
<td>16  15.69%</td>
<td>00  00.00%</td>
</tr>
<tr>
<td>Stab Incised &amp; Incised Wounds</td>
<td>15  14.71%</td>
<td>00  00.00%</td>
</tr>
<tr>
<td>Chop wound</td>
<td>00  00.00%</td>
<td>00  00.00%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>93  91.18%</strong></td>
<td><strong>09  08.82%</strong></td>
</tr>
</tbody>
</table>

73.53% sharp injuries were simple in nature followed by 17.65% grievous injuries. In the present study 8.82% sharp injuries were dangerous in nature. (Photograph 1,2,3)
FIG. 3: Showing Chop Wound

All fatal cases were homicidal in nature. No mortality resulted from self-inflicted sharp injury in the present study. Hemorrhagic shock due to excessive bleeding was the cause of death in all fatal cases. (Table 5)

Table 5: Distribution of Fatal cases of Sharp Injuries according to Manner of Incidence

<table>
<thead>
<tr>
<th>Manner of Incidence</th>
<th>No. of Fatal Cases</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Homicidal</td>
<td>05</td>
<td>100.00%</td>
</tr>
<tr>
<td>Suicidal</td>
<td>00</td>
<td>0.00%</td>
</tr>
<tr>
<td>Accidental</td>
<td>00</td>
<td>0.00%</td>
</tr>
<tr>
<td>Total</td>
<td>05</td>
<td>100.00%</td>
</tr>
</tbody>
</table>

DISCUSSION

This study was undertaken with the aim to study the medico-legal profile of fatal and non-fatal injuries inflicted with sharp force trauma at SMS Hospital, Jaipur during 2015-16 as regards pattern, manner of infliction and sharp weapons used for infliction of sharp injuries.

In the present study males were predominant (87.29%) and 14.71% females. The results of the present study are slightly variable to those of Bhullar DS and Aggarwal KK (94% males and 6% females) but quite similar to that reported by Lockyer A et al. (2013) (85%). Males are the active participants of the society and more commonly engaged in outdoor activities. Moreover, they are more prone to episodes of rage and revenge. This explains the male preponderance in all studies. Also, females are comparatively less likely to be involved in injuries using sharp weapons which occur more commonly in relation to love affairs, sexual jealousy etc and are rarely self-inflicted too.

Mean age of the present study was 28.37 years (Range 16-70 years). In the present study majority of victims were between 21-40 years of age (70.59%) which is slightly higher than that reported by Bhullar DS and Aggarwal KK.

Our results of 13.73% cases of victims less than 20 years is also quite similar to Bhullar DS and Aggarwal KK (2007) who reported 12% cases between 0-20 years. There were 84.32% victims of sharp injuries under 40 years of age in the present study which is similar to the study of Lockyer A et al. (2013) (86.6%). Most of the victims of sharp force trauma in this study were married (79.41%). The marital status of victims did not bear any significant correlation in the present study but increased burden of socio-economic responsibilities and marital discord make people more prone to self-inflicted and assaulted episodes of trauma including injuries with sharp weapons.

In this study the injuries inflicted by others were most common (91.18%) followed by infliction by self (8.82%). The results of the present study are variable with those of Bullar DS and Aggarwal KK (2007) who reported 60% injuries to be caused by others and 34% by self and status unknown in the rest. This variation can be attributed to the variations in study regions, study population and prevalent socio-cultural trends. It also showed male preponderance (86.02%). The preponderance of assault by sharp weapon is explainable as these deadly weapons are generally used in planned manner or more so impulsively in a planned assault. It is very easy to procure such weapons and easy to carry, so, they can be the weapons of choice in fights and assaults. Family disputes and personal feud accounted for majority of cases as motive (56.99%) when injury was inflicted by others. It was followed by age old enemy of human life property dispute (21.51%)

In this study 73.53% injuries were simple in nature followed by 17.65%. Grievous injuries accounted for 17.65% in the present study which is quite similar to study of Bhullar DS and Aggarwal KK (80% cases)

Dangerous to life injuries accounted for 8.82% cases which quite higher (almost 3 times) than the study conducted by Bhullar DS and Aggarwal KK (2007). All dangerous injuries were inflicted by others in this study. All injuries inflicted by self were simple in nature.
because to kill self by means of a dreaded way like sharp weapon needs lot of courage and self-loathing. Sharp injuries were fatal in only 04.91% cases in the present study all of which were homicidal in nature affecting males. These results are dissimilar to those of other studies- Memon A et al. (2015)\(^8\) who reported 65% males and 35% females with mean age of 30.88 years.

**CONCLUSION**

This study found that the problem of sharp weapon violence is most prevalent in the young adult males. The increasing criminal behaviour of the injured, the easy access to courts, as well as easy availability of weapons are responsible for the incremental trends of such episodes. For a better comprehension regarding violence and injury prevention, a more comprehensive and exhaustive review of the circumstances of injuries analysis is required; this study representing a preliminary approach to a phenomenon. Therefore, it is worth taking a closer look at patterns of sharp injuries to assess their nature and manner for legal assistance. Such studies encouraging observation of medico-legal and socio-demographic domains of such heinous injuries is essential as predictors of crime and frustrations prevalent in society which may prove as an aid for curbing such incidences for benefit of individuals and society as a whole.

**Conflict of Interest:** None Declared.

**Ethical Clearance:** Taken from the Research, Review and Ethical Committee of SMS Medical College and Hospital.

**Source of Funding:** Self.

**REFERENCES**


3. Indian Penal Code 1860.


Knowledge on Infection Control Measures among Health Care Workers in Hemodialysis Unit of a Tertiary Care Hospital

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ABSTRACT

Hemodialysis patients as well as the healthcare workers of dialysis unit are vulnerable to contracting healthcare associated infections in view of frequent and prolonged exposure to many contaminants in the dialysis environment.

Objectives: The study aimed to assess the knowledge of practice among healthcare workers regarding infection control measures.

Methods: A quantitative approach with a descriptive design was adopted. The demographic proforma, structured knowledge of practice questionnaire on infection control measures in dialysis unit were used to collect the data in January 2017. A total of 50 healthcare workers were enrolled in the study based on enumerative sampling in the study.

Results: The results showed that majority healthcare workers 39 (78%) had good knowledge of practice on infection control measures in dialysis.

Conclusion: Health care workers in dialysis environment is very much susceptible for contracting infections hence they should possess good knowledge. This study findings also revealed that healthcare workers in the present study setting had good knowledge of infection control measures in dialysis unit.

Keywords: healthcare workers; knowledge; infection control measures; dialysis unit.

INTRODUCTION

Hemodialysis patients as well as the healthcare workers of dialysis unit are vulnerable to contracting healthcare associated infections in view of frequent and prolonged exposure to many contaminants in the dialysis environment. Dialysis patients are more susceptible mainly from resistant bacteria and methicillin resistant staphylococcus aureus for bloodstream infection than other patients. Infection control measures are the strategies used to prevent the direct or indirect transmission of microorganisms to reduce the risk of infection among hemodialysis patients.

The number of patients on hemodialysis are increasing rapidly in India. Multiple patients receive dialysis concurrently in dialysis facility is a very conducive mode for transmission of infection. Transmission of infection directly or indirectly can occur through the hands of healthcare personnel, equipment’s and supplies, contaminated devices or can be through environmental surfaces. Magnitude of these transmission of infection would be mounted up when there is lack of awareness of the infection control measures. Hepatitis B, Hepatitis C, HIV and bacterial infections were the most common among the infections that could be contracted by the patients on hemodialysis (Ministry of Health and Family Welfare). The study was aimed to assess the knowledge on infection control practices among healthcare workers in dialysis unit.

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MATERIAL AND METHODS

Descriptive survey design was adopted. The present study population were health care workers in dialysis unit of a tertiary hospital of Udupi distict. Total of 50 nurses and dialysis technicians were included in the study using total enumerative sampling for the assessment of knowledge on infection control practices.

Data collection: Data collection was done in the month of January 2017 after obtaining Institutional Research Committee permission, Ethical permission, CTRI registration and obtaining the administrative permissions. Data collection instruments were demographic proforma, which consisted of 6 items including age, gender, educational qualification, years of clinical experience, infection control training, and source of information regarding infection control measures in dialysis were collected from health care workers. The instruments were validated by seven experts from the department of nursing, nephrology and microbiology and pretested among healthcare workers. The total reliability (0.95) was established using split half method. Knowledge of practice was assessed using structured knowledge of practice questionnaire on infection control measures in dialysis unit after explaining participant information sheet and obtaining the informed consent. The questionnaire consisted of 30 multiple choice questions from areas like standard precautions, cleaning and disinfection, transmission based precautions, disposal of sharps and infectious waste, infection control measures during reuse of dialysis. The highest possible score was 30 and minimum score was zero. The knowledge score were arbitrarily classified as good knowledge 70-100% (21-30), moderate knowledge 31-69% (11-20), poor knowledge <30% (0-10).

Ethical considerations: Administrative permission obtained from Institutional Research Committee, Head of the Institutions, Institutional Ethical Committee no- IEC 760/2016, and CTRI registration no- CTRI/2017/03/008109. Informed consent was obtained from all the participants included in the study.

Findings: The data were analysed using SPSS version 16. Descriptive statistics were used to analyse the data. Among 50 healthcare workers most 36 (72%) of the healthcare workers were between the age group of 20-25 years, 36 (72%) of the participants had more than two years of experience, 36 (72%) were technicians, 14 (28%) nurses, 29 (58%) were females, 10 (20%) had infection control training for more than four times and source of information for majority of the participants was from internet 28 (56%) and books 23 (46%).

Out of 50 participants, none had poor knowledge <30%, 11 (22%) had moderate knowledge and 39 (78%) had good knowledge. Most of them have correctly answered in the area of reuse of dialysis which had 6 (20%) questions and incorrectly answered in the area of transmission based precautions which had 7 (23.3%) questions.

Mean knowledge of practice score on infection control measures on dialysis is 22.74 and standard deviation is 2.617. Mean knowledge score of nurses were 22.35 and mean knowledge score of technician were 22.88.

Association between knowledge scores and years of clinical experience. The value of the test statistics is 2.166. The corresponding p-value of the test was p = 0.339. Since the p value is greater than chosen significance level (α= 0.05), It was inferred that there was no association found between knowledge scores and years of experience thus the knowledge score was independent of the years of experience in the dialysis unit.

DISCUSSION

In the present study researcher found that 39 (78%) healthcare workers had good knowledge on infection control measures in dialysis unit. These findings contradicts with the findings of descriptive cross-sectional study conducted to assess the knowledge on standard precautions among 17 nurses in the dialysis unit of student university hospital at Alexandria Governorate using a self-administered questionnaire the study resulted that not even half of the nurses (47.1%) correctly knew that they had to wash hands both before and after caring for patients on hemodialysis. The present study findings was supported by the results of descriptive cross-sectional study done in Riyadh, which was to assess the knowledge and self-reported practices of nurses working at haemodialysis units. The study result revealed that majority of participant nurses had good knowledge of the most common blood-borne diseases like Hepatitis C, HIV and 88.4% believed that
hand washing is the most important infection control practice and 50 (82.9%) nurses had received training in infection control. Even though the overall knowledge score was good 39 (78%), it was also alarming to know that participants had scored less in the transmission of infection.

**Implications:** During hemodialysis procedure patients and healthcare workers can contract infections. Knowledge on hemodialysis and infection control guidelines are very essential in controlling infection rates. All the healthcare workers must be trained for the infection control practices in dialysis unit for the prevention of infection in dialysis unit.

**CONCLUSION**

The study highlighted that majority healthcare workers had good knowledge of practice on infection control measures in dialysis unit. Which is contributing factor to prevent healthcare associated infections in the unit as healthcare associated infection which are the biggest cause of avoidable harm and unnecessary death in the health system.

**Funding:** Financial support received from Dr TMA Pai Endowment chair in Antimicrobial Stewardship.

**Conflict of Interest:** There is no conflict of interest with regard to this study.

**REFERENCES**


Dying with Dignity-Physician Assisted Suicide in India: A Critical Review of Legal Facts

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2Saurav K Roy, Student, Indian Law Society’s Law College, Pune;  
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ABSTRACT

Physician assisted suicide is not practiced in India, despite a string of cases which have exposed the grave need for a progressive law on euthanasia. This article seeks to trace the moral and legal development of the concept of euthanasia, through societal discourse and judicial pronouncements, both. To highlight the glaring inconsistencies of India’s law on euthanasia, we present alternative jurisprudences around the world, where physician assisted suicide (PAS) is a state-sanctioned practice. We argue that even though India has a legislation to enable passive euthanasia, only enabling Physician Assisted Suicide would indicate true development and progressive health-care sector law-making.

Keywords: Euthanasia, Physician Assisted Suicide, Judicial Pronouncements.

INTRODUCTION

In the past few decades, modern medicine has achieved feats we would once have considered impossible. Advances in medical science and technology ensure that what once would have meant certain death is now treatable. A wide range of options exist for patients and doctors as they confront disease; from drugs and chemotherapy to ventilators and dialysis. In the fight against death, many questions arise; about end of life care, and what responsibilities doctors have towards patients with terminal illness. We have developed so many ways to extend life, but in the process we have lost the ability to deal with our own mortality.

It is in this scenario that discussions on Euthanasia emerge. The word Euthanasia is derived from Greek, eu meaning good, and thanatos meaning death. The morality of this procedure has been debated for decades. Opponents state that it is against the principles of medicine to assist in death, calling it murder. Another point raised is that it can be misused by relatives who will benefit from a patient’s death.

However alleviating suffering is an important aspect of medical care as well. As for misuse, many medical treatments are prone to malpractice, but various laws and guidelines exist to avoid such outcomes. The same can apply to Euthanasia, with experts drawing up regulations to prevent criminal use.

Euthanasia has many types. Passive euthanasia is the with-holding or withdrawing of treatment necessary to maintain life, while Active euthanasia refers to the physician deliberately acting in a way to end the patient’s life. Physician Assisted Suicide (PAS), on the other hand involves a physician providing lethal drugs or advice that will enable the patient to end his life. While in essence the differences between PAS, Active and Passive euthanasia might seem minor, the ethical and legal distinction is significant.

Current scenario in India: Related Judicial Pronouncements

The practice of euthanasia finds itself entwined and having to navigate itself around a somewhat complicated legal regime in India, in light of various statutes such as:
The Indian Penal Code, 1860;
Medical Treatment of Terminally Ill Patients (Protection of Patients and Medical Practitioners) Bill, 2012; and

Being a country that bases its judicial development on the principles of common law, various judicial decisions in India has played a significant role in shaping the regulations and guidelines revolving around euthanasia.

Before analyzing the legal implications of euthanasia, it is necessary to shed light on some landmark judgments of Indian courts on a related issue viz. attempt to commit suicide (Section 309 of the Indian Penal Code.) There were three landmark judgments that have shaped the ‘attempt to suicide’ discourse in society, before India enacted legislation on the issue.

(a) M.S. Dubal Case: The judicial discussion around the issue of euthanasia first surfaced in the case of Maruti Shripati Dubal vs State of Maharashtra\(^2\), where the Bombay High Court was tasked with interpreting the nature of fundamental rights provided in Part III of the Constitution of India. Ruling in favour of the petitioner, the Court laid down that rights guaranteed under Part III possess positive and negative aspects, both. Section 309 of the Indian Penal Code was struck down and held to be \textit{ultra vires} the Constitution. Hence, the Court had argued that the right to life under Article 21 of the Constitution of India could also be interpreted as the right not to live a forced life.

(b) P. Rathinam Case: Subsequently, the Supreme Court’s interpretation in the matter was seen in the case of P. Rathinam v. Union of India\(^3\). Upholding the view of the Bombay High Court in the \textit{M.S. Dubal} case, the Apex Court held that the argument of suicide being against public policy was “unfounded” and “vague” and thus confirmed that Section 309 was unconstitutional.

(c) Differing Opinion- Gian Kaur Case: Another interesting case that was argued before the Supreme Court was that of Gian Kaur\(^4\), where a Constitution Bench of the Court overruled the P Rathinam case and opined:

[“Protagonism of euthanasia on the view that existence in persistent vegetative state (PVS) is not a benefit to the patient of a terminal illness being unrelated to the principle of Sanctity of life’ or the ‘right to live with dignity’ is of no assistance to determine the scope of Article 21 for deciding whether the guarantee of ‘right to life’ therein includes the ‘right to die’.”]

The Mental Healthcare Act, 2017: Even though the \textit{Gian Kaur} judgment was eventually criticized by various social activists and even the Supreme Court (in \textit{Aruna Shanbaug vs. Union of India}\(^5\)), there was a lack of legislative activity for a vast expanse of time. In what was a welcome move, India, in March 2017, finally did away with ‘institutionalized care’ and took a progressive step by implementing a rights-based approach towards protecting the interests of those suffering with mental illnesses. The Mental Healthcare Act of 2017 is an ambitious step towards a more understanding and accepting society.

The Act effectively lays the debate surrounding the right to attempt suicide to rest, by decriminalizing suicide. The Act overrides Section 309 and states that:

[“Any person who attempts to commit suicide shall be presumed, unless proved otherwise, to have severe stress and shall not be tried and punished under the said Code.”]

Euthanasia- Legal Recognition: As aforementioned, before 2011, when the case was decided, courts across the country delivered varied and contradictory interpretations of the constitution, and whether it allows the ‘Right to die’.

In what will most definitely go down as a landmark judgment on the issue, Justice Markandey Katju penned the \textit{Aruna Shanbaug} judgement, which laid down the law on euthanasia in India.

Aruna Shanbaug was a nurse in KEM Hospital, Mumbai, when she was assaulted and strangulated. She was admitted in 1973, and though she survived her brain sustained permanent damage. After 36 years in a permanent vegetative state, a petition was filed by Pinki Virani, a journalist, to end her suffering and allow her to die by stopping her feeding. However, the KEM Hospital nursing staff were firmly opposed to this, since they had provided an exceptional level of care for the since her admission.
In the case of Aruna Shanbaug, the Court broke new ground by laying down specific and detailed instructions on passive euthanasia, though it did not permit passive euthanasia in the current case, on the basis of dedicated care by the KEM Hospital nurses. However, it did not sanction active euthanasia, making the observation that it could be implemented through an act of legislation subject to appropriate supervision and control.

In 2012, the Law Commission of India released a draft bill, the Medical Treatment of Terminally Ill Patients (Protection of Patients and Medical Practitioners) Bill.

**Comparison with other countries:** Various countries have legalized euthanasia and put laws into place to regulate it. The Netherlands was one of the first countries to do so, with the *Euthanasia Act* passed on April 1st, 2002. It regulates the ending of life by a physician at the request of a patient.

It requires a physician to assess that:

1. The patient’s request is voluntary and well-considered;
2. The patient’s suffering is unbearable and hopeless;
3. The patient is informed about his situation and prospects;
4. There are no reasonable alternatives. Further,
5. Another independent physician should be consulted; and
6. The termination of life should be performed with due medical care and attention.

Under the Act, Review Committees were to forward details to the Public Prosecutor those cases that did not meet the criteria above (criteria for due care).

Along with the Netherlands, other countries that allow Physician Assisted Suicide are Belgium, Switzerland and certain states in the United States of America (“USA”). Switzerland is rare among countries, as non-physicians can also assist in suicide. In the USA, states like Oregon, Montana and Washington have also legalized physician assisted suicide. Almost all of these have drawn up laws similar to those in the Netherlands, to ensure there is no wrong-doing.

The Death with Dignity Act in the state of Oregon requires that the patient should be a resident of the state and older than 18 years of age. It includes various safeguards, such as:

1. The initial request for drug prescriptions has to be in writing and witnessed by two individuals concurring that the patient was competent.
2. At least two physicians have to concur that the patient is suffering from a terminal illness and is likely to die within 6 months.
3. In the event that the patient is thought to be suffering from a psychiatric disorder, the patient must be referred for counseling.
4. Records have to be maintained and submitted annually to the Health Division of the state for review.
5. Two oral requests are required, separated by at least 15 days, before a physician can accept the written request. Once accepted, the prescription cannot be filled for 48 hours after the written request.

As can be seen, almost all legislation related to Physician Assisted Suicide and Euthanasia includes provisions to prevent any misconduct. Table 2 shows the various laws related to Physician Assisted Suicide and Euthanasia in some of the countries that have enacted such laws.

**The Medical Treatment of Terminally Ill Patients (Protection of Patients and Medical Practitioners) Bill:** After the judgement in the case of *Aruna Shanbaug v. Union of India* in 2011, in August 2012 the Law Commission released its 241st report called ‘Passive Euthanasia – A Relook’. The report proposes passing legislation allowing passive euthanasia and a draft bill; *The Medical Treatment of Terminally Ill Patients (Protection of Patients and Medical Practitioners) Bill* was prepared.

In 2016, the Ministry of Health and Family Welfare is contemplating enacting a law on euthanasia, based on the report of the law commission, and is inviting comments on the same.

The bill has various provisions for carrying out passive euthanasia, but no provisions for active euthanasia; Physician Assisted Suicide or advanced directives. Unfortunately, this piece of legislation is the only evidence of parliamentary intent to deal with
euthanasia, and falls short of addressing the key issues of euthanasia.

Passive euthanasia, as mentioned before, is the with-holding or withdrawing of treatment necessary to maintain life. However, it does not always achieve its intended result, which is dignified death devoid of suffering. There are those who suffer from illnesses where discontinuing treatments does not lead to the end of life, and the natural course of the disease is one with a painful death.

An example of this is the case of Mrs. Diane Pretty, who had (and eventually died of) Motor Neuron Disease (MND). MND leads to a progressive paralysis of muscles, until death occurs due to an inability to breathe or swallow. The mental functions of the patient are intact till death. In 2002, Mrs. Pretty appealed to the European Court of Human Rights, claiming that it was within her fundamental rights to be assisted in committing suicide by her husband, so that she could die in a dignified and humane manner. At the time of the appeal, she was paralysed from the neck down. The European Court rejected her application. However a month prior, a Ms. B, who was a competent adult, also paralysed from the neck down, requested that she be taken off the ventilator that was currently keeping her alive. She was fully aware that this would cause her death. She was judged competent and her wishes were carried out.

The only difference between the two cases was that Ms. B was a case of withdrawing treatment, while Diane Pretty’s was an appeal to allow active euthanasia. Only one was allowed to die in a manner of her choosing.

<table>
<thead>
<tr>
<th>Table 1: Timeline of Euthanasia related cases in India</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case Year decided</td>
</tr>
<tr>
<td>Maruti Sripaty Dubal v. State of Maharashtra 1986</td>
</tr>
<tr>
<td>P. Rathinam v. Union of India 1994</td>
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<tr>
<td>Gian Kaur v. State of Punjab 1996</td>
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<tr>
<td>Aruna Shanbaug v. Union of India 2011</td>
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<table>
<thead>
<tr>
<th>Table 2: Euthanasia Laws enacted in different countries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Country Legislation</td>
</tr>
<tr>
<td>Netherlands Active Euthanasia and Physician Assisted Suicide</td>
</tr>
<tr>
<td>Belgium Active Euthanasia and Physician Assisted Suicide</td>
</tr>
<tr>
<td>Switzerland Physician Assisted Suicide, even non physicians can assist in suicide, Active Euthanasia is illegal</td>
</tr>
<tr>
<td>U.S.A Physician Assisted Suicide is legalized in some states such as Oregon, California, Washington; Active Euthanasia is illegal</td>
</tr>
</tbody>
</table>

**CONCLUSION**

India has made great strides in the field of medicine, arguably providing medical care that is one of the best in the world. Medicine, however, is not like any of the other sciences. It is one that is closely linked to the human condition, and therefore has ethical and legal implications for society.

It is in this aspect of medical law, especially with respect to euthanasia, where India is lagging behind. The draft bill on euthanasia is a step forward, but has not yet
been enacted as law. In addition to this it allows only passive euthanasia, and not its active form or physician assisted suicide.

It is our opinion that withdrawing treatment, although established as a method of providing a dignified death to patients, is not adequate in providing a humane end for all those who are terminally ill. We believe that the any law that addresses the treatment of terminally ill patients should also have provisions to allow Physician Assisted Suicide.

Any such legislation should be incorporate adequate safeguards to prevent any malpractice. As the laws of other countries show, this is not an impossible task. We are of the opinion that Physician Assisted Suicide offers a balance between providing a humane response to requests to end life, and protecting vulnerable sections of society. Active Euthanasia, on the other hand has a greater potential for misuse. If it is to be implemented, stricter guidelines and protocols should be established, with a case by case disposal of appeals, handled by committees established for the purpose.

Access to healthcare is considered a human right around the world and is almost non-derogable in nature. Medical practitioners today provide an endless array of treatments to extend life. However, reducing suffering is also a responsibility that physicians have towards their patients. Therefore we must also consider the rights of terminally ill patients, and their right to die in a dignified manner a right as well.

**Conflict of Interest:** Nil

**Source of Funding:** Self

**Ethical Clearance:** Not required

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2. 1987 (1) Bom CR 499. (Maruti Shripati Dubal vs State of Maharashtra)

3. AIR 1994 SC 1844. (P. Rathinam v. Union of India)


5. AIR 2011 SC 1290 (Aruna Shanbaug v. Union of India)


Knowledge and Awareness towards Medical Negligence among General Population Visiting a Tertiary Care Hospital in Northern Indian Region

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ABSTRACT

Background: The present study aims to assess knowledge and awareness towards medical negligence among general population visiting a tertiary care hospital in northern Indian region. Negligence is defined as doing something which reasonably competent people not suppose to do or not doing something which reasonably competent persons suppose to do.

Material & Method: Total 384 people from general population were subjected to pre-tested and pre-validated questionnaire related to medical negligence after obtaining their informed written consent. Questionnaire contain 10 questions related to medical negligence with responses based on Likert’s scale varied from strongly disagree to strongly agree. Responses obtained were tabulated in MS Excel sheet and analyzed via SPSS software.

Results: After the analyzing of response of the people (visiting a tertiary care hospital) towards knowledge of medical negligence, the level of knowledge is found to be satisfactory.

Keywords: Medico-legal awareness, Medical negligence, Cross sectional, Likert’s scale

INTRODUCTION

Lately, Indian society is experiencing a gradually growing awareness regarding patient’s rights towards medical during treatment or intervention. This trend is clearly discernible from the recent spurt in litigation concerning medical professional or establishment liability, claiming redressal for the suffering caused due to medical negligence, vitiated consent, and breach of confidentiality arising out of the doctor-patient relationship¹. In developing countries like India, shortage of organ donors is a fundamental public health problem with medical and legal implications. Improving the awareness, medico-legal knowledge and attitude among medical students who are considered as the future health care providers of the community could help to promote organ donation. The medical profession is considered a noble profession because it helps in preserving life. A patient generally approaches a doctor/hospital based on his/its reputation. Expectations of a patient are two-fold: doctors and hospitals are expected to provide medical treatment with all the knowledge and skill at their command and secondly they will not do anything to harm the patient in any manner either because of their negligence, carelessness, or reckless attitude of their staff². The present study aims to assess knowledge and awareness towards medical negligence among general population visiting a tertiary care hospital in northern Indian region

MATERIAL & METHOD

Present cross sectional study aims to assess knowledge and awareness of general population of
Northern Indian Population towards medical negligence. The study was undertaken at Integral Institute of Medical Sciences & Research Lucknow (IIMS &R). Total 384 study subjects were undertaken by using systematic probability sampling. Initially, all the subjects from different OPDs/IPDs were identified as study population. By the help of medical social workers the utility & scope of this study was explained and subjects were requested to participate in the study.384 study subjects subjected to pre-tested and pre-validated questionnaire related to medical negligence after obtaining their informed written consent. The present study was undertaken after motivating study by Parmar et al.[8]. Sample size was calculated based on formula given by WHO for cross sectional study (sample size determination by S K Lwanga & S Lemeshow, 1991) i.e.

\[ N = \frac{Z^2 \times \alpha/2 \times P \times Q}{\varepsilon^2} \]

- \( N \) = total sample size (number of experimental units)
- \( P \) = Prevalence of metabolic disorder (50 % Taken)
- \( Q \) = 1-\( P \) (50%)
- \( Z_{(1-(\alpha/2))} \) = related to the chosen significance criterion \( \alpha \); can be found in normal distribution tables, (1.96)
- \( \varepsilon \) : relative precision (10 % is taken in the present study).

Above formula gives the requirement of minimum sample size as 384

The attendant of the patients visiting various outpatient departments was enrolled in the study as study subjects. Questionnaire contains 10 questions related to medical negligence with responses based on Likert’s scale varied from strongly disagree to strongly agree. Responses obtained were tabulated in MS Excel sheet and analyzed via SPSS software.

**RESULTS**

The socio-demographic parameters of the study subjects are represented by table 1. The mean age of study subjects was 42.24(±22.60). Total number of male subjects were 224 (58.33 %) whereas female subjects were 160 (41.67 %). Almost 27 % subjects said they have graduation or above degree, the % is 46.88 who reported their education intermediate. Almost 6% study subjects hold below high school education. The total number of subjects from urban part of Lucknow is 130 (33.85 %) whereas as total number of subjects from rural area of Lucknow is 254 (66.15 %). More than half subjects (54.17 %) reported as they are married. To assess knowledge & awareness of study subjects visited a tertiary care hospital (IIMS &R, Lucknow) a set of well designed questions in the form of questionnaire were taken. The patients visiting various outpatient departments was enrolled in the study as study subjects. Questionnaire contains 10 questions related to medical negligence with responses based on Likert’s scale varied from strongly disagree to strongly agree. Out of 384 subjects 210 agreed & 84 subjects strongly agreed that, failure to maintain medical records by hospital is negligence & rest of the study subjects were either not sure of disagree. In another important question regarding doctor, nurse and management staff of hospital – anyone can be liable for negligence, 85 subjects were agreed & 42 strongly agreed while majority were either not sure or disagreed. Maximum subjects were agreed (330) with the opinion of performing operation without informed written consent is negligence. The people opinion on the question treating a patient without his consent was negligence was uniform because of more than half disagreed where as 138 subjects agreed. Almost everyone was aware that carelessly leaving an instrument in patient’s body after operation is negligence. The people opinion on other important issues such as death due to negligence is punishable by court, compensation for negligence can be claimed in consumer court & wrong diagnosis followed by wrong treatment is considered as negligence, was also remarkable because of more than 2/3rd study subjects were agreed that above mentioned issues are under medical negligence & the details of the opinion on 5 point Likert’s scale is given in table 2 & represented graphically by figure 1.

**CONCLUSION**

In the present study the knowledge & attitude towards medical negligence among people were studied. A good population representative sample of size 384 was taken. After the analyzing of response of the people (visiting a tertiary care hospital) towards knowledge of
medical negligence, the level of knowledge is found to be satisfactory. The general population has good knowledge of medical negligence at some edges while people are not aware of some component/issues which are common in medical practice. As we observe that there is a positive role of mass media such as TV, FM, Newspaper & no doubt due to social media people have good knowledge of their rights while getting medical intervention. Since India is a developing country so still the medical legal & medical negligence awareness is not common among the domain of rural population. Health education is very important and should be regular part of formal education.

Table 1: Socioeconomic profile of the study

<table>
<thead>
<tr>
<th>Variable</th>
<th>N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>42.24 (±22.60) years</td>
</tr>
</tbody>
</table>

Table 2: Knowledge & Awareness towards Medical Negligence & medico legal Issues

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Questions</th>
<th>Response of general population N=384</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Failure to maintain medical records by hospital is negligence</td>
<td>SD          : 12  D         : 18  NS    : 60  A       : 210  SA   : 84</td>
</tr>
<tr>
<td>2.</td>
<td>Doctor, nurse and management staff of hospital – anyone can be liable for negligence</td>
<td>SD          : 56  D         : 74  NS    : 127  A       : 85  SA   : 42</td>
</tr>
<tr>
<td>3.</td>
<td>Performing operation without informed written consent is negligence</td>
<td>SD          : 29  D         : 17  NS    : 8  A       : 274  SA   : 56</td>
</tr>
<tr>
<td>5.</td>
<td>Carelessly leaving an instrument in patient’s body after operation is negligence</td>
<td>SD          : 12  D         : 7  NS    : 4  A       : 181  SA   : 180</td>
</tr>
<tr>
<td>6.</td>
<td>Refusing to attend patient in emergency is negligence</td>
<td>SD          : 40  D         : 125  NS    : 68  A       : 109  SA   : 42</td>
</tr>
<tr>
<td>7.</td>
<td>Performing or helping for euthanasia is negligence</td>
<td>SD          : 32  D         : 49  NS    : 131  A       : 136  SA   : 36</td>
</tr>
<tr>
<td>8.</td>
<td>Death due to negligence is punishable by court</td>
<td>SD          : 1  D         : 7  NS    : 43  A       : 275  SA   : 58</td>
</tr>
<tr>
<td>9.</td>
<td>Compensation for negligence can be claimed in consumer court</td>
<td>SD          : 17  D         : 40  NS    : 73  A       : 168  SA   : 86</td>
</tr>
<tr>
<td>10.</td>
<td>Wrong diagnosis followed by wrong treatment is considered as negligence</td>
<td>SD          : 14  D         : 47  NS    : 81  A       : 210  SA   : 32</td>
</tr>
</tbody>
</table>

(SD = Strongly Disagree, D = Disagree, NS = Not Sure, A = Agree, SA = Strongly Agree)

Ethical Clearances: Not required

Source of funding: Self

Conflict of Interest: None

REFERENCES


Age Estimation Based on the Facial Wrinkles among Indonesian’s Adult Population

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ABSTRACT

The emergence of facial wrinkles is a process of skin aging along with advancing age in humans. To estimate age based on facial wrinkles, we conducted a cross-sectional study among Indonesian’s adult population. Sample in this study were Indonesian adult consisted of 35 male subjects and 35 female subjects with age ≥ 20 years old. The facial wrinkles were studied on the forehead-glabella and around the eyes. There were significant differences in forehead-glabella score between male and female (p=0.002), while the score around the eyes and total scores showed no significant difference with p respectively 0.802 and 0.102. Based on the linear regression, age can be estimated from the total scores: estimated age for male = 21.951 + 6.821 (total scores) ± 3.292 and estimated age for female = 20.256 + 6.643 (total scores) ± 3.333.

Keywords: age estimation, facial wrinkle, Indonesian population

INTRODUCTION

One of the most important things to be done in the identification process is to estimate the age of either the individual living or the dead. In addition to personal identification, age determination is also required in legal cases, among other cases of counterfeiting of employment age, marriage, athlete, guardianship, and immigration. Legal proof of age is important to determine whether the individual is still in the child or adult category, due to differences in legal or judicial processes in children.¹⁻³

In estimating age, there are several methods that can be used such as, based on calcification and eruption of teeth, the union of epiphysis with diaphysis of long bones, degree of suture closure on the anterolateral cranium, morphological changes of pubic symphysis, morphological changes in auricular pubis, and facial wrinkle changes. Each method has deficiencies and advantages in determining age. Determination of age of tooth eruption i.e. from molar 3 can only determine whether a person is aged over 17 years or under 17 years. Determination of age based on epiphysis union with diaphysis on long bones can only be used to determine the age of a person from adolescence to young adulthood. Determination of age based on the degree of suture closure on the anterolateral cranium section has a precision with a range of 10 to 30 years and is difficult to do in living people. The determination of age based on the sternal end of the ribs has a high degree of variation.¹⁻⁵

In daily practice, although the age estimate is important to do, but it turns out this is not as easy as imagined. Some methods with a fairly high level of accuracy was difficult to apply to the cases faced. On the other hand, the easiest and most common visual method has a significant error rate, especially in the estimated age of adults. Studies conducted by Burt and Perrett, George and Hole, as well as Sörqvist and Eriksson, which studies the age estimation based on facial appearance, is accurate enough to be used for age determination. From these studies found that along with the age of changes occur in skin tissue, connective tissue, fat tissue, and even facial bones since the age of 20an. By examining the changes in facial appearance there was an estimated

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age with a deviation of between 2.39 and 4 years of age.\footnote{5,6}

The principal aim of this study is to estimate age based on facial wrinkles. This study may add to alternative estimate age methods that are practical, but remain objective and accurate, which can be applied to Indonesian adults.

**MATERIAL AND METHODS**

This cross-sectional study was carried out at Outpatient Clinic Arifin Achmad Hospital, Pekanbaru, Indonesia, May to July 2014. A total of 70 research subjects aged over 20 years, consisting of 35 men and 35 women met the inclusion criteria with purposive sampling method. The exclusion criteria were existing trauma, scar, disease and deformity on face; subjects with facial surgery history, Body Mass Index $< 18$ kg/m$^2$, undergoing rejuvenation therapy, using night cream $> 6$ months and active smokers ($\geq 15$ cigarettes per day for $\geq 15$ years).

Equipment and materials used Camera Canon SX20IS DSLR, cotton wool, measuring scale, facial cleanser (Erha21® exfoliating cleansing scrub and Erhalogy® simply remove-moisturizing cleanser gel). Research procedure: all subjects are given explanation by the researcher and signed informed consent; The subject’s face is cleaned with facial cleanser and cotton wool to remove makeup and dirty; after the face is dry, the facial wrinkles are assessed according to the scoring system; and subject photographs done by researchers by digital camera.

Scoring technique in this research is direct method and indirect method. The direct method is the way of scoring the lines of facial wrinkles by looking directly at the facial wrinkles after the face is cleaned with a facial cleanser. The indirect method in this study is to provide scoring assessments on faces that have been photographed with Camera Canon SX20IS after facial cleansed with facial cleanser. Photo capture subjects conducted with approximately 30 cm from the front in the upright position facing front. Taking pictures done as much as 2 times with the condition of faces without expression and with a smile expression.

The facial wrinkles examine on the forehead-glabela area and around the eyes. The scoring system is divided into:

- **No wrinkles (score 0)** = no visible wrinkle lines, either with or without facial expressions;
- **Light wrinkles (score 1)** = visible thin wrinkle lines, especially with facial expressions;
- **Medium Wrinkles (score 2)** = looks firm wrinkle lines, when expression is neutral and deepened with facial expressions;
- **Heavy wrinkles (score 3)** = visible thick and deep wrinkle lines with or without facial expressions

The total score is the sum of scores from the two areas examined. The score determination was performed by two observers who had been trained with Kappa 0.87. T-test or alternative test was performed to determine the mean relation of score to sex, with significance p <0.05. Linear regression was performed to obtain age estimation formula.
FINDINGS AND DISCUSSION

Out of 70 subjects enrolled this study, 35 (50%) were men and 35 (50%) were women. The highest number of subject was found in age group 31-40 years old, with mean 41.1(11.3), and Batak as the highest ethnic. (Table 1)

Table 1: Distribution of sex, age, job location, ethnic, and smoking behavior

<table>
<thead>
<tr>
<th>Variable</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td></td>
</tr>
<tr>
<td>• Men</td>
<td>35 (50.0)</td>
</tr>
<tr>
<td>• Women</td>
<td>35 (50.0)</td>
</tr>
<tr>
<td>Age, mean(SD), year</td>
<td>41.1(11.3)</td>
</tr>
<tr>
<td>• 20 – 30</td>
<td>15 (21.4)</td>
</tr>
<tr>
<td>• 31 – 40</td>
<td>23 (32.9)</td>
</tr>
<tr>
<td>• 41 – 50</td>
<td>17 (24.3)</td>
</tr>
<tr>
<td>• 51 – 60</td>
<td>9 (12.9)</td>
</tr>
<tr>
<td>• &gt; 60</td>
<td>6 (8.6)</td>
</tr>
<tr>
<td>Work Location</td>
<td></td>
</tr>
<tr>
<td>• Indoor</td>
<td>55 (78.6)</td>
</tr>
<tr>
<td>• Outdoor</td>
<td>15 (21.4)</td>
</tr>
<tr>
<td>Smoking behavior</td>
<td></td>
</tr>
<tr>
<td>• Smoker</td>
<td>21 (30.0)</td>
</tr>
<tr>
<td>• Not smoker</td>
<td>49 (70.0)</td>
</tr>
</tbody>
</table>

aData presented in absolute number (%) except stated otherwise

Age group 31-40 years old was the second step of age milestones, at this stage, fine lines of wrinkles begin to appear, usually on the forehead, the base of the nose, the nasolabial folds, and the outer corner of the eye. The lines appear more clearly and settled with age. The texture of the skin appears to begin to change to be more rough and uneven, especially in males. Based on a study, signs of aging most often appear at this stage so that aging appears to occur drastically.8-10

The pattern of aging is affected by many factors, both internal factors, such as race, genetic factors, and body metabolism, life style as well as external factors, including nutritional intake, exposure to ultraviolet light, and exposure to free radicals.8,11,12 This is demonstrated by several studies, such as Nouveau-Richard et al13 and Wang et al14. In these studies, it appears that changes in the skin take place with different processes and speeds between Chinese and French women. Other study also reported differences in skin aging features in various Asian populations: Japan, Chinese and Thai women.15 In addition, the skin aging process is also affected by skin type based on its reaction to exposure to ultraviolet light (Fitzpatrick’s skin type).16 Therefore, it is necessary to conduct special research on each different population.

According to work location and smoking behavior, there were no significant differences in outcomes in this study. These findings are in accordance with study by O’Hare et al17 who reported the wrinkle score mean for the smokers was greater than for the nonsmokers (55.5 ± 21.7 vs. 51.4 ± 18.9) but the difference was not significant (P= 0.17). Also, the number of total lifetime hours of sun exposure did not differ between smokers and non-smokers 31 256 ± 34 540 versus 28 496 ± 22 840, respectively (P= 0.5).

In our study, there was significant difference in forehead-glabella score with p=0.002 (p<0.05), whereas there was no significant difference in score around eye and total score with p value respectively were 0.802 and 0.102 (p> 0.05). (Table 2)

Table 2: Mean of facial wrinkle score by sex

<table>
<thead>
<tr>
<th>Wrinkle Score</th>
<th>Men</th>
<th>Women</th>
<th>P value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forehead-glabella</td>
<td>1.69 (0.90)</td>
<td>1.09 (0.78)</td>
<td>0.002</td>
</tr>
<tr>
<td>Around the eye</td>
<td>1.54 (0.95)</td>
<td>1.63 (0.77)</td>
<td>0.802</td>
</tr>
<tr>
<td>Total</td>
<td>3.23 (1.72)</td>
<td>2.71 (1.47)</td>
<td>0.102</td>
</tr>
</tbody>
</table>

* Mann-Whitney
Based on the linear regression of the data, the formula is obtained to estimate age based on its total score. The formula estimates the age for male is “Age estimation = 21.951 + 6.821 (total score)” and for women is “Age estimation = 20.256 + 6.643 (total score)”. The next step is to determine the standard deviation between the actual subject’s age difference and the age based on the formula, so the final estimation formula is for men (age estimation = 21.951 + 6.821 (total score) ± 3.292) and for women (age estimation = 20.256 + 6.643 (total score) ± 3.333).

Our study has some limitation, it has not been able to explain other factors that affect facial wrinkles such as nutritional status, economic status, ethnicity and cannot be used on the body corpse. It is therefore advisable to conduct further research with larger samples.

CONCLUSION

The age estimation formula in this study can be widely used, especially in areas with limited facilities and infrastructure in forensic fields.

Conflicts of Interest: None

Source of Funding: None

Ethical clearance: Taken from institutional research committee of Faculty of Medicine, Universitas Riau.

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- Conclusion
- Discussion
- Acknowledgements
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The Effects of Left Breast Cancer Radiation Therapy Dose Reduction on the Lung and Heart Using a Cardiac Shielding Block

Hee-Seok Lee¹, Hong-Ryang Jung², Cheong-Hwan Lim²
¹Research Scholar, ²Professor, Dept. of Radiological Science, Hanseo University, Korea

ABSTRACT

Background/Objectives: In this study, the effects were evaluated on radiation dose reduction in the lung and heart using a cardiac shielding block in 20 breast cancer patients.

Methods/Statistical Analysis: CT images of the radiotherapy patients were transferred through three-dimensional treatment planning, and physical wedges were used to obtain optimal dose distributions using a 6 MV photon beam in a linear accelerator; the prescribed dose was 50.4 Gy. The effects on the heart and lung were compared and analyzed based on the use of a Lipowitz alloy cardiac shielding block.

Findings: The data for the left lung showed decreases of 1.1% in D₅ and 18.41% in V₂₀ from using the heart-shielding material and decreases of 78.9% in D₁₈ and 76.6% in V₁₈ for the heart. Additionally, with the use of the heart-shielding material, the mean dose in the left lung decreased by 11.7%, and that in the heart decreased by 51.7%.

Improvements/Applications: The results of this study show the possibility of minimizing the left breast radiation therapy exposure doses in the left lungs and hearts of breast cancer patients by using a cardiac shielding block in the initial treatment.

Keywords: Radiotherapy, CT, Dose, Breast cancer, Heart-shielding material

INTRODUCTION

In early-stage breast cancer, conservative surgery and postoperative radiation have been widely if not universally used because these treatments can preserve breasts with no difference in survival rate compared with radical surgeries. Breast-conserving radiation therapy generally administers 45–50 Gy of radiation to whole breasts and is a bilateral tangential technique optimized by using a single central-axis isodose distribution. As radiation therapy became widely used following partial-breast resection breast-conserving therapy, it came to play a key role in breast cancer treatment. In recent decades, whole-breast irradiation has become an effective therapy for reducing local recurrence rates and increasing long-term survival after breast-conserving therapy; however, some parts of the heart can also be irradiated when left breast cancer patients are treated with radiation therapy. Because of this radiation impact, it has been reported that left breast cancer patients have a higher risk of cardiovascular disorders and accordingly higher long-term mortality. It was also reported that left breast cancer patients are more likely to die of heart disease after 15 years than are right breast cancer or Hodgkin’s disease patients.

Sarah C. Darby, an Oxford University professor, reported that breast cancer patients who received radiation therapy had higher risk of ischemic heart disease, and 963 of 2,168 breast cancer patients who received radiation therapy from 1958 to 2001 experienced cardiac disorders such as heart attacks. The risk of cardiac disorders was revealed to increase by 7.4% per 1 Gy of radiation dose, resulting in an average increase of 36% in these disorders among patients who received 4.9 Gy of radiation; the risk was reported to be
higher among females who were treated with radiation in their left breasts, it increased within three years, and it lasted for a minimum of 20 years.

**MATERIALS AND METHODS**

**Subjects:** The subjects of this research were 20 female breast cancer patients who were treated with radiation therapy. Those whose removed tumors were close to their chest walls or right below their nipples were excluded from the study in order to utilize individual heart-shielding materials.

**Method:** Radiation therapy was administered at 45–50 Gy following breast-conserving therapy for five to six weeks in order to lower the risk of local recurrence. All patients’ treatments were planned with Eclipse software version 10.0 (Varian Medical Systems, Palo Alto, CA, USA). Three-dimensional conformal radiation therapy is the most widely used radiation therapy for breast cancer because higher curative doses can be used while minimizing normal tissue complications in circumstances not limited to radiation therapy after breast-conserving therapy. For this study, patients were planned to receive 1.8 Gy, using 6MV of photon energy, at a time 28 times per day, for a total of 50.4 Gy per day.

**RT planning method:** Surface outlines of left lungs and breasts were drawn with images transferred from DICOM using a 3D treatment-planning computer, and the boundaries of the irradiation field were the infraclavicular ligament, inside to the midline of body, outside to the latissimus dorsi muscle, and down to 2 cm below the bottom end of the breast tissue.

In order to administer the proper amount of energy for treatment, a Varian 6 MV photon X-ray was used, a physical wedge was used for optimal dose distribution, and Lipowitz (Cerrobend), a fusible metal, was used as the heart-shielding material. For the radiation, a half-beam was used to irradiate 1.8 Gy at a time 28 times per day, for a total of 50.4 Gy per day of bilateral tangential radiation; the prescription doses were between 95 and 109%. Dose-volume histograms and dosimetry analysis were used to compare the whole volumes of the left lungs and hearts in patients before and after receiving the heart-shielding material (Figure 1, Figure 2).

**Analysis Method:** The purpose of radiation therapy planning for left breast cancer patients is to lessen the areas of the heart and left lung affected by high-dose radiation. The dosimetry aimed to compare the target volumes, normal tissue, and minimum doses, which included 5% of the left lung and heart volumes (D5). Doses were calculated as 

\[ V_{20} \] for the volumes of left lungs that received 20 Gy or more of radiation and 

\[ V_{18} \] for the volumes of hearts that received 18 Gy or more of radiation. These values were selected because they can serve as evidence of post-treatment or acute clinical syndrome.

**RESULTS AND DISCUSSION**

**General characteristics of research subjects:** Treatment planning for left breast cancer patients with and without the use of a heart-shielding material was conducted for 20 female patients of average age 52.65 (range: 37–76); by staging, 13 patients were T1N0, 3 were T2N0, 3 were T1N1, and 1 was T2N1 (Table 1). The analyses were conducted based on the optimal treatment plans for each patient.
Table 1: Characteristics of patient’s

<table>
<thead>
<tr>
<th>No. of patients</th>
<th>20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median age (years)</td>
<td>52.65 (34–76)</td>
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</table>

TNM

<table>
<thead>
<tr>
<th></th>
<th>T₁N₀</th>
<th>T₁N</th>
<th>T₂N₀</th>
<th>T₂N</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

Evaluation of Volume and Dose: The analyses and comparisons revealed a decrease in the D₅ value for the heart of 78.9%, from 42.17 ㏉ to 8.90 ㏉, with the use of the heart-shielding material, and the V₁₈ heart value decreased by 76.6% from 70.92 cm³ to 16.60 cm³ with the use of the material (Table 2). The analyses also showed a decrease in the D₅ value for the left lung of 1.1%, from 51.12 ㏉ to 50.56 ㏉, and a decrease of 18.41%, from 182.97 cm³ to 149.29 cm³, in the left lung V₂₀ value with the use of the heart-shielding material (Table 3).

Table 2: Heart doses and volumes before and after using the cardiac shielding block

<table>
<thead>
<tr>
<th></th>
<th>Heart dose &amp; volume</th>
<th></th>
<th>V₁₈ (cm³)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Open¹ (㏉)</td>
<td>Block² (㏉)</td>
<td>Reduction Rate (%)</td>
</tr>
<tr>
<td>Mean</td>
<td>42.17 ±7.52</td>
<td>8.90 ±4.23</td>
<td>78.90 ±7.71</td>
</tr>
</tbody>
</table>

1. Open: Before using the block, 2. Block: After using the block

The dosimetry analyses of the lung and heart volumes showed that the mean dose in the left lung decreased by 11.7% from 10.77 ㏉ to 9.51 ㏉ and that in the heart decreased by 51.7% from 6.21 ㏉ to 3 ㏉ after the use of the heart-shielding material (Table 4).

Table 3: Left lung doses and volumes before and after using the cardiac shielding block

<table>
<thead>
<tr>
<th></th>
<th>Left lung dose &amp; volume</th>
<th></th>
<th>V₂₀ (cm³)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Open¹ (㏉)</td>
<td>Block² (㏉)</td>
<td>Reduction Rate (%)</td>
</tr>
<tr>
<td>Mean</td>
<td>51.12 ±0.71</td>
<td>50.56 ±0.85</td>
<td>1.10 ±0.64</td>
</tr>
</tbody>
</table>

1. Open: Before using the block, 2. Block: After using the block

Table 4: Mean left lung and heart doses before and after using the cardiac shielding block

<table>
<thead>
<tr>
<th></th>
<th>Mean dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heart</td>
<td>Left lung</td>
</tr>
<tr>
<td></td>
<td>Open¹ (㏉)</td>
</tr>
<tr>
<td>Mean</td>
<td>6.22 ±1.04</td>
</tr>
</tbody>
</table>

1. Open: Before using the block, 2. Block: After using the block

**STATISTICAL ANALYSIS**

Matching-sample T-test results for heart D₅ and V₁₈:
The analyses and comparisons of the heart D₅ (㏉) values before and after the use of the heart-shielding material resulted in a T-value of 22.53 (p<.001), indicating that the difference between the averages was statistically significant; thus, the use of the heart-shielding material was revealed to be effective in decreasing heart D₅ (㏉). For heart V₁₈ (cm³), the T-value was 10.14 (p<.001), indicating that the gap between the V₁₈ averages with and without the heart-shielding material was also significant and that the material was also effective in decreasing heart V₁₈ (Table 5).
Table 5: T-test results for heart D5 and V18 values

<table>
<thead>
<tr>
<th></th>
<th>No. of cases</th>
<th>Mean</th>
<th>S.D.¹</th>
<th>t-value</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>D5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>before using the cardiac shielding block</td>
<td>20</td>
<td>42.17</td>
<td>7.52</td>
<td>22.53</td>
<td>0.001</td>
</tr>
<tr>
<td>after using the cardiac shielding block</td>
<td>20</td>
<td>8.90</td>
<td>4.23</td>
<td></td>
<td></td>
</tr>
<tr>
<td>V18</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>before using the cardiac shielding block</td>
<td>20</td>
<td>70.92</td>
<td>33.51</td>
<td>10.14</td>
<td>0.001</td>
</tr>
<tr>
<td>after using the cardiac shielding block</td>
<td>20</td>
<td>16.60</td>
<td>11.15</td>
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1. S.D.: Standard Deviation

Matching-sample T-test results for left lung D5(65y) and V20: The analyses and comparisons of the left lung D5 (65y) values before and after the use of the heart-shielding material resulted in a T-value of 7.49 (p<.001), indicating that the difference between the averages was statistically significant. For left lung V20 (cm³), the T-value was 11.19 (p<.001), indicating that the gap between the V20 averages with and without the heart-shielding material was also significant and that the material was also effective in decreasing left lung V20 (Table 6).

Table 6: T-test results for left lung D5 and V20 values

<table>
<thead>
<tr>
<th></th>
<th>No. of cases</th>
<th>Mean</th>
<th>S.D.¹</th>
<th>t-value</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>D5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>before using the cardiac shielding block</td>
<td>20</td>
<td>51.12</td>
<td>0.71</td>
<td>7.49</td>
<td>0.001</td>
</tr>
<tr>
<td>after using the cardiac shielding block</td>
<td>20</td>
<td>50.56</td>
<td>0.85</td>
<td></td>
<td></td>
</tr>
<tr>
<td>V20</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>before using the cardiac shielding block</td>
<td>20</td>
<td>182.97</td>
<td>41.32</td>
<td>11.19</td>
<td>0.001</td>
</tr>
<tr>
<td>after using the cardiac shielding block</td>
<td>20</td>
<td>149.29</td>
<td>36.10</td>
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1. S.D.: Standard Deviation

Matching-sample T-test results for mean heart and left lung doses (65y): The analyses and comparisons of the mean heart and left lung 65y values before and after the use of the heart-shielding material resulted in T-values of 17.64 for the heart and 13.52 for the left lung, both p<.001. That is, the differences in the mean doses before and after the use of the heart-shielding material were statistically significant, and the material was found to be effective in decreasing mean 65y in both the heart and the left lung (Table 7).

Table 7: T-test results for mean heart and left lung doses

<table>
<thead>
<tr>
<th></th>
<th>No. of cases</th>
<th>Mean</th>
<th>S.D.¹</th>
<th>t-value</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heart</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>before using the cardiac shielding block</td>
<td>20</td>
<td>6.22</td>
<td>1.04</td>
<td>17.64</td>
<td>0.001</td>
</tr>
<tr>
<td>after using the cardiac shielding block</td>
<td>20</td>
<td>3.01</td>
<td>0.53</td>
<td></td>
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</tr>
<tr>
<td>Left lung</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>before using the cardiac shielding block</td>
<td>20</td>
<td>10.77</td>
<td>1.28</td>
<td>13.52</td>
<td>0.001</td>
</tr>
<tr>
<td>after using the cardiac shielding block</td>
<td>20</td>
<td>9.51</td>
<td>1.22</td>
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</table>

1. S.D.: Standard Deviation

**DISCUSSION**

Three-dimensional conformal radiation therapy is currently used to treat breast cancer because higher curative doses can be used while minimizing normal tissue complications in circumstances beyond radiation therapy following breast-conserving therapy. Postoperative radiation therapy is especially important as early therapy for local breast conservation7). Recently, breast cancer therapy including radiation therapy has been rapidly developing along with the increase in the numbers of breast cancer patients9,10,11. Usual radiation therapy was used in these studies, but the additional use of heart-shielding materials such as that used in this study could decrease irradiated volumes and radiation doses in patients' hearts and left lungs12.
Jae Goo Shim reported that left lung $D_5$ values showed nearly no differences in free breathing (FB), exhalation breath hold (EBH), or deep inspiration breath hold (DIBH) and that $V_{20}$ values for left lungs at FB decreased by 5% and 10% at EBH and DIBH, respectively. Heart $D_5$ at FB decreased by 30% at DIBH and increased by 30% at EBH. Heart $V_{18}$, which can cause cardiac disorders at FB, decreased by 25% at DIBH. However, it can be difficult to educate patients or request their cooperation with artificial breath holding during the short irradiation periods of radiation therapy. This study found that heart $D_5$ decreased by 78.9% and heart $V_{18}$ decreased by 76.7%, left lung $D_5$ and $V_{20}$ decreased by 1.1% and 18.41%, respectively, and mean heart and left lung doses decreased by 51.7% and 11.7%, respectively, after the use of a heart-shielding material. These decreases are considerably higher than the results from previous studies on heart doses based on different types of breathing, and these improved findings could be the result of the use of the heart-shielding material rather than organ location changes due to controlled breathing.

Additional research also appears warranted regarding exposure doses to untreated breasts and to the contralateral sides of breasts treated with radiation therapy using breast-shielding materials because research results have asserted that the use of heart-shielding materials in radiation therapy can increase the risk of breast cancer in the untreated sides of breasts by exposing them to low levels of radiation.

**CONCLUSION**

Treatment for 20 left breast cancer patients was planned based on the use or absence of use of a Lipowitz alloy heart-shielding material. The patients’ average age was 52.65 (37–76), and by staging, 13 patients were T1N0, 3 were T2N1, 3 were T1N1, and 1 was T2N1. The results of administering $1.8 Gy$ at a time 28 times per day using $6 \text{ MeV}$ of photon energy, for a total of $50.4 Gy$ per day, were as follows. First, the minimum dose that affected 5% or more of the left lung volume ($D_5$) decreased by 1.1% from $51.12 \text{ Gy}$ to $50.56 \text{ Gy}$ after the use of the heart-shielding material, and the left lung volume that received $20 \text{ Gy}$ or more of radiation ($V_{20}$) decreased by 18.41% from $182.97 \text{ cm}^3$ to $149.29 \text{ cm}^3$ ($p<.001$).

Second, the minimum dose that affected heart $D_5$ decreased by 78.9% from $42.17 \text{ Gy}$ to $8.9 \text{ Gy}$ and the heart volume that received $18 \text{ Gy}$ or more radiation ($V_{18}$) decreased by 76.6% from $70.92 \text{ cm}^3$ to $16.6 \text{ cm}^3$ after the use of the heart-shielding material (both $p<.001$). Third, the mean received left lung and heart doses decreased by 11.7%, from $10.7 \text{ Gy}$ to $9.51 \text{ Gy}$, and by 51.7%, from $6.21 \text{ Gy}$ to $3 \text{ Gy}$, respectively (also both $p<.001$).

**Ethical clearance:** Taken from Hanseo University

**Source of funding:** Self

**Conflict of Interest:** Nil

**REFERENCES**


The Impact of After Hour Work-related Smartphone Uses on Emotional Labor

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ABSTRACT

Background/Objectives: Smartphone, despite its usefulness in many respects, brings about results of extending working hours and put people under pressure to respond to their superiors immediately even after work. This often forces employees to perform emotional labor even in their afterhours.

Methods/Statistical analysis: This study (N = 185 employees) aims to shed light on the relationships among after hour work-related smartphone uses (AWSU), emotional labor to the superior (surface acting, deep acting) and job satisfaction. Exploratory factor analysis, reliability analysis, correlation analysis, regression analysis and PROCESS macro by Hayes (2013) were performed by using SPSS 18.0 software program to test hypotheses.

Findings: The findings of this research, AWSU increases surface acting to the superior and both AWSU and surface acting diminishes job satisfaction. Additionally, surface acting to the supervisor mediates between AWSU and job satisfaction. These suggest that AWSU affects that the subordinate suppress and fake their emotions that satisfy supervisors’ expectation during after regular work hours. As a result, faking emotion caused by AWSU impacts on dropping job satisfaction. This study contributes to seeing AWSU from the emotional labor perspective for the first time while in previous studies in terms of work-related smartphone use generally researched blurring boundaries, work-home conflict and work-life conflict. Moreover, there is value in adding to this literature by confirming relationships between information and communications technology (ICT) use and emotional labor that contribute to emotional labor overly. AWSU may be looked an attractive way to ordering and performing job anywhere, anytime in the near term; however, it could be a poison that leads to constant working without proper rules, too.

Improvements/Applications: In the future research, it is significant to understand emotional labor could be performed anywhere, anytime. Also a diverse outcome of AWSU is needed to study from the organizational view.

Keywords: after hour work-related smartphone uses, emotional labor, surface acting, deep acting, job satisfaction

INTRODUCTION

With a spread of smartphone, it changes business environment, especially workers’ life in general. For example, smartphone offers flexibility in completing work-related tasks, however, it also makes blur boundary between work and life thereby workers are overworked and feel pressure that they have to respond from their work 24/7. Whether this bill passes or not, this situation informs that using smartphone for work-related tasks afterhours is common in our modern society and it affects workers’ high stress by increasing work activities after hours.

According to research, it indicates working late night by using smartphone at home impacts on increasing supervisors’ expectation that the employee would work outside of regular work hours although using smartphone for work after hours at home does not
influence on improving productivity\textsuperscript{1}. Employees work even after work hour to satisfy superiors’ expectation\textsuperscript{2}. When a superior works, subordinates think they have to work either. Regardless of supervisor’s intention that expecting quick response or just noticing before he/she forgot, emailing after work affects extending subordinates’ working hours 24/7\textsuperscript{2}. It is reported that employees want to ensure their free time after work, over 30\% of respondents say that they are willing to accept lower paycheck if there is no obligation to respond to work-related requests via smartphone afterhours\textsuperscript{4}. In sum, employees feel their working hours are extended and personal life is invaded because of after hour work-related smartphone use\textsuperscript{5}.

In light of these, subordinates may have negative emotions about using smartphone for work-related activities during free time. However if subordinates express their negative feelings honestly to their superiors, then it could ruin not only their relationship but also performance\textsuperscript{6}. Besides, it is really hard to express negative emotions to superiors since superiors usually have the authority to evaluate subordinates performance and control personnel matters. Therefore, when superiors ask to process work-related task via smartphone during free time, subordinates may perform emotional labor to their superiors even after work. Emotional labor is essential to perform job, however, it impacts on significant factors for organization management as job stress, job burnout, job satisfaction, job engagement, organization performance and turnover intention etc.\textsuperscript{5,7,8}. Furthermore emotional labor is a factor which should be managed properly.

**LITERATURE REVIEW**

**After Hour Work-related Smartphone Uses:** Before smartphone is prevalent, workers rely on an ecosystem of mobile technology as laptop, PDA and mobile phone to connect with the work when they are outside of office because of on business trip, vacation and attending a seminar. Smartphone is a relatively recent addition to this ecosystem, it is optimized to support productivity of tasks as emailing, accessing and editing documents, searching and sharing information etc. beyond the basic functions such as calls and SMS\textsuperscript{9}. After all, smartphone provides advantages that usefulness, efficiency, autonomy to business environment\textsuperscript{10}. These advantages are supposed to help employees to make better work environment instead of changing organization culture into “always available”. As following findings from previous studies with smartphone use for work, it has led to an organization culture that employees are always expected to be reachable after work hours therefore, it affects increasing working hours during free time and intruding on personal life that causing work-life conflict, work-home conflict, work-nonwork interference, work overload and lack of sleep\textsuperscript{5,11,12,13}.

Main problem of using smartphone for work-related tasks after hours is that influences on ruin work-life balance eventually\textsuperscript{5}. Organizations do not have clear rules or standard of regarding smartphone use to perform work-related tasks during employees’ free time\textsuperscript{4}. More specifically, even during personal time if smartphone rings from work whether it is urgent or not, employees feel pressure that they have to respond as fast as possible\textsuperscript{5,12}. Thus employees’ priority becomes work even after office hours, although they need to release stress and tension after work. Breaking work-life and work-home balance impacts on employees’ low job satisfaction, high job stress, burn out and turnover intention\textsuperscript{5,12,13,14}.

Besides after hour work-related smartphone uses interrupts personal life suddenly in which may occur unwanted multitasking and work overload\textsuperscript{13}. Additionally it affects individuals’ condition. Smartphone use for work at night brings about interfering energy recovery in free time and decreasing quantity of sleep\textsuperscript{11,14}. Consequently, the employee’s fatigue symptoms appear as daily exhaustion, cynicism and less work engagement\textsuperscript{11,14}.

**Emotional Labor:** Consider these circumstances, after hour work-related smartphone uses can make employees’ feeling negatively. However, emotional labor-related jobs are several; professional job, technical job, sales job, office job, service job and housekeepers therefore there is emotional labor among supervisors, colleagues, subordinates in the office job, particularly on the relationship between superiors and subordinates\textsuperscript{15,16}. Moreover it is confirmed that compare to emotional labor in people work, office work (manager) also carries out emotional labor as similar intensity\textsuperscript{7}.

If the organization controls employees’ emotion expression, employees drop their internal motivation and fake their emotion\textsuperscript{7}. Additionally it causes multiple negative consequences such as low work engagement, job satisfaction and increase burnout, turnover.
intention\textsuperscript{6,8}. Regulating emotions of surface-level and deep-level have different patterns of relationships\textsuperscript{6}, as we saw, surface acting made negative results in contrast with deep acting that impacted on positive outcomes such as increasing job satisfaction and decreasing burnout\textsuperscript{6}. Based on previous researches, the following hypotheses are posed:

**Hypothesis 1a (H1a):** After hour work-related smartphone uses will be related to surface acting.

**Hypothesis 1b (H1b):** After hour work-related smartphone uses will be related to deep acting.

**Job Satisfaction.** In terms of job satisfaction, it is significant with employees’ condition such as job attitude, performance, work engagement and turnover intention. Employees who have high job satisfaction are confident and accomplish high performance while employees who have job dissatisfaction tend to be passive, lethargic and stressed\textsuperscript{17}. In previous researches, using information and communications technology (ICT) like smartphone for work purpose at night related to low job satisfaction indirectly through mediate factors such as work-life conflict and work-home conflict\textsuperscript{5,12,17}. In sum, based on all the researches, the following hypothesizes are posed and the research model is in Figure 1.

**Hypothesis 2a (H2a):** Surface acting will be negatively related to job satisfaction.

**Hypothesis 2b (H2b):** Deep acting will be positively related to job satisfaction.

**Hypothesis 3 (H3):** After hour work-related smartphone uses will be negatively related to job satisfaction.

**Hypothesis 4a (H4a):** Surface acting will mediate the effect of after hour work-related smart-phone uses on job satisfaction.

**Hypothesis 4b (H4b):** Deep acting will mediate the effect of after hour work-related smart-phone uses on job satisfaction.

### Table 1: Correlation matrix for all variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>AVE</th>
<th>AWSU</th>
<th>Surface acting</th>
<th>Deep acting</th>
<th>Job satisfaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>AWSU</td>
<td>4.0141</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surface acting</td>
<td>2.8851</td>
<td>.199**</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deep acting</td>
<td>3.3659</td>
<td>-.049</td>
<td>-.018</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Job satisfaction</td>
<td>3.3849</td>
<td>-.160*</td>
<td>.157*</td>
<td>.464**</td>
<td>1</td>
</tr>
</tbody>
</table>

*p < .05, **p < .01
Multiple regression analysis indicates that the regression model is constructed to test these hypotheses \( (F = 28.218, p < .000, \text{adjusted } R^2 = .229, \text{Durbin-Watson} = 1.988) \). As predicted, surface acting is negatively related to job satisfaction which is consistent with previous studies thatfaking emotion makes job satisfaction low \( (t = -2.299, \beta = -.149, p < .05) \). In case of H2b, it states that deep acting goes higher with job satisfaction \( (t = 7.110, \beta = .462, p < .001) \). Therefore both H2a and H2b are significant.

H3 states that smartphone use for work purpose outside of work hours rises, employees perceive negatively about their job. Statistical evidence is significant that the result of a single regression analysis \( (\beta = -.160, F = 4.799, t = -2.191, p < .05, \text{adjusted } R^2 = .020) \), supporting H3. All regression analysis results are shown in Figure 2.

The relationships among after hour work-related smartphone uses, emotional labor (surface acting, deep acting) and job satisfaction analyzed by PROCESS macro by Hayes (2013)\(^{18}\). In general, if there is no 0 between CI(low) and CI(high), then it is understood as statistically significant. As following the consequences, surface acting mediates between after hour work-related smartphone uses and job satisfaction \( (\beta = -.0250, p < .05, \text{Bias-corrected CI} = -.0684 \sim -.0027) \), H4a is supported. Meanwhile deep acting does not mediate between after hour work-related smartphone uses and job satisfaction \( (\beta = -.0219, p < .05, \text{Bias-corrected CI} = -.1084 \sim .0579) \). In sum, there is partial mediate effect of this research model as shown in Table 3.

This paper is proposed to highlight the need of limitation of smartphone use for work outside of regular
work hours as finding out negative effect of after hour work-related smart-phone uses. We think after hour work-related smart-phone uses would be significant concern for employees and organizations in our modern society since the boundaries between work and personal time are blurring sharply in inverse proportion to more people want to enjoy their personal life. Using smart-phone for work afterhours looks like attractive way for high performance due to no negative visible consequences yet, however, it costs as indirect forms of declining job satisfaction, decreasing work engagement and increasing turnover intention from the organizational perspective. Therefore work-related smart-phone use during personal time results in more faking emotions between supervisors and subordinates, and this lead us to drop job satisfaction. The result of relationships between surface acing and job satisfaction, deep acting and job satisfaction were supported previous studies.

CONCLUSION

Concept of after hour work-related smart-phone uses is relatively new in business world, more side effects of work-related smart-phone use are needed to figure out. Our findings suggest after hours work-related smartphone uses may interfere personal time and increases hours that individuals have to regulate their emotion for work. Thus, repeating this situation drops job satisfaction and it could impact on burnout and turnover intention in the long term perspective. With development of smart devices such as smart-phone and smart watch (wearable devices), using those for work after regular work hours would be more frequent. Furthermore the result of this study indicates that organization should regard after hour work-related smart phone uses in a serious light out of thinking that work request just need for a few minutes in the near term.

Ethical Clearance: Taken from Chungbuk National University

Source of Funding: Self

Conflict of Interest: Nil

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Relationship between Stress and Happiness in Middle School Students: Dual Mediation Effect of Growth Mindset and Self-Esteem

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ABSTRACT

Background/Objectives: The objective of this study was to investigate the dual mediation effect of growth mindset and self-esteem on the relationship between stress and happiness of 467 middle school students.

Methods/Statistical analysis: For data analysis, SPSS Win.21.0 and SPSS MACRO process were used. Reliability analysis, descriptive statistics, correlation analysis, mean comparison analysis, path analysis, and bias correction bootstrap analysis were performed.

Findings: Results of the study are as follows. First, stress had negative correlations with growth mind, self-esteem, and happiness. However, growth mindset was positively correlated with self-esteem and happiness. Second, results of macro PROCESS analysis showed that stress negatively affected growth mindset, self-esteem, and happiness. Growth mindset had positive effect on self-esteem and happiness. Self-esteem also had positive effect on happiness. Third, bootstrap analysis showed that stress affected happiness through a dual mediated pathway of growth mindset and self-esteem.

Improvements/Applications: Results of this study could be used to improve happiness of students through reducing stress, improving growth mindset, and increasing self-esteem.

Keywords: Stress, Happiness, Growth mindset, self-esteem, Dual Mediation Effects, SPSS macro PROCESS

INTRODUCTION

Happiness is both the greatest goal of life and the standard of self-evaluation for human. Happiness has started from ancient philosophy. It has been actively studied in the field of social science recently. Happiness is mixed with terms such as well-being, psychological well-being, subjective well-being, satisfaction, and quality of life. Definition of happiness varies according to fields and perspectives of researchers. Happiness is a subjective assessment of an individual’s life. It is a subjective expression of how happy a person is in his daily life. This definition has the same meaning as subjective wellbeing because happiness is best known to oneself. It cannot be objectively evaluated by others. Studies on happiness have been mainly focused on adults. However, it is necessary to pay attention to the happiness of adolescents because adolescence is the period when self-identity is formed. Adolescence is also the period with rapid physical and mental growth. Experience of happiness during this period can have profound impact on their lives in the future.

Self-esteem is a typical variable that can increase happiness. Self-esteem is the degree of self-respect, and of considering oneself being worth, and is a positive or negative evaluation of self. It is defined as the degree to which one believes in his or her own ability, success, and value. Several research studies have shown that self-esteem and happiness have positive relationships. Therefore, self-esteem of youth might have positive effect on happiness.
On the other hand, positive psychology can lead to the emergence of various positive psychological variables related with human beings, including happiness. Growth mindset as a new causal variable of happiness and success is gaining popularity among researchers. Based on brain science theory, growth mindset is a belief that intelligence is malleable. Therefore, mindset can be changed through effort. Abilities of human beings can be explained by two theories: entity theory and incremental theory. With the entity theory, it is believed that human beings have fixed mindset. It believes that intelligence is fixed and congenital. Effort cannot change intelligence. With the incremental theory also known as the growth mindset, it is believed that intelligence is malleable and acquirable. Effort can change it. Growth mindset research is still in its infancy. There is a lack of accumulated data. However, it has been reported that growth mindset is positively correlated with happiness. Therefore, growth mindset might affect happiness.

While self-esteem and growth mindset are variables that can increase happiness, there are also variables that can reduce happiness. Stress is a typical example that can reduce happiness. Stress is a mental state when a worthy goal is threatened or lost or when one cannot have the environment to achieve his goal. A study has reported that daily stress has negative effect on the happiness of adolescents. The causal relationship between stress and happiness of adolescents has been demonstrated by previous studies. These studies have proved that there is a close relationship between stress and happiness. Therefore, the happiness of Korean adolescents who are experiencing stresses from university entrance-oriented educational environments might vary depending on their perceived stress level.

Although self-esteem, growth mindset, and stress have been found to have effects on happiness, no study has reported the relationships among stress, growth mindset, self-esteem, and happiness among adolescents. In other words, we should concentrate on how youth can feel happier and can have happier experiences. In particular, Child Happiness Index and life satisfaction reports have shown that Korea has the lowest happiness among OECD countries. For this reason, an empirical study on role of variables such as growth mindset and self-esteem in promoting happiness of Korean youth is very urgent.

Therefore, the objective of this study was to investigate the dual mediating effect of growth mindset and self-esteem on the relationship between stress and happiness in middle school students. To achieve this goal, we have the following research questions: 1) What is the relationship among stress, self-esteem, growth mindset, and happiness? 2) What is the path coefficient between each variable? 3) Do growth mindset and self-esteem have dual-mediating effect in the relationship between stress and happiness?

METHODS

Research Model: The main analytical method used in this study was double-mediated effect analysis of model 6 of the MACRO process. The conceptual study model is shown in [Figure 1].

![Figure 1: Conceptual Research Model](image)

Survey subjects and methods of data collection: A total of 467 students who attended D city middle school in Chungcheongnam-do were enrolled for this study survey. The survey was conducted for one month (from April 15, 2016 to May 15, 2016). Regarding the general characteristics of these survey subjects, there were 263 (56.3%) males and 204 (43.7%) females. A total of 296 (63.4%) students reported that ‘both parents were working’. The remaining 171 (36.6%) students reported that their parents were ‘not both working’. A total of 244 (51.3%) subjects answered that they have ‘normal lives’. A total of 353 (75.6%) students were ‘living with both parents’ while 52 (11.1%) students were living with ‘single parents’.

RESEARCH TOOLS

Stress: To measure stress in adolescents, the Korean Version of Brief Encounter Psychosocial Instrument (BEPSI-K) was used. This instrument consisted of 5 items measured in 5-point Likert scale. The higher the score, the higher the stress level. In this study, the reliability of the stress scale had a Cronbach’s α value of 0.881.
Happiness: To measure happiness, the shortened happiness scale developed by Seo et al.\(^{21}\) was used in this study. This scale consisted of three items to measure the satisfaction of individual aspects (personal accomplishment, personality, health, etc.), relational aspects (such as relationships with others), and collective aspects (my group-workplace, community, etc.). These three items were measured in a 7-point Likert scale ranging from “not at all” (1 point) to “very much” (7 points). In addition, six questions about feelings during the past month were asked. They were also evaluated with a 7-point Likert scale from ‘not agree at all’ (1 point) to ‘agree very much’ (7 points). The higher the score, the higher the level of happiness. The reliability of the happiness scale used in this study had a Cronbach’s \(\alpha\) value of 0.873.

Growth mindset: The growth mind measure developed by \(^{10}\) and adapted by Lee et al.\(^{13}\) was used in this study. This scale consisted of four items measuring beliefs about intelligence change in and four items measuring beliefs about personality change. These items were measured in a 5-point Likert scale. The higher the score, the higher the growth mindset. The reliability of this growth mindset scale used in this study had a Cronbach’s \(\alpha\) value of 0.796.

Self-esteem: Self-Esteem Scale (RSES) developed by Rosenberg\(^{5}\) was used in this study. This scale was composed of 5 positive items and 5 negative items. These items were measured with a 5-point Likert scale ranging from ‘not at all’ (1 point) to ‘highly agree’ (5 points). The higher the score, the higher the self-esteem. The reliability of this self-esteem scale used in this study had a Cronbach’s \(\alpha\) value of 0.840.

Data Analysis: In this study, SPSS Win. 21.0 and SPSS macro PROCESS (http://www.afhayes.com) proposed by Hayes\(^{22}\) were used. For reliability analysis, descriptive statistics, and correlation analysis, SPSS Win. 21.0 was used. The SPSS macro protocol was used to analyze dual-mediating effect. Indirective effect was verified by bootstrapping analysis.

RESULTS AND DISCUSSION

Correlation and Descriptive Statistics: Results of Pearson’s correlation analysis to identify correlations among variables are shown in [Table 1]. Stress was found to have negative correlations with growth mindset, self-esteem, and happiness. Growth mindset had statistically significant correlation with self-esteem and happiness. Self-esteem and happiness had a correlation coefficient of 0.607. Growth mindset and self-esteem had a correlation coefficient of 0.365. Growth mindset and happiness had a correlation coefficient of 0.290. Correlation coefficients of growth mindset with other variables ranged from -0.162 to -0.507. The correlation coefficient between self-esteem and happiness was the highest. In other words, the higher the stress, the lower the growth mindset, self-esteem, and happiness. Happiness is increased when growth mindset and self-esteem are higher. These results are consistent with results of previous studies showing negative correlation between self-esteem and stress\(^{23}\) but positive correlation between self-esteem and subjective happiness\(^{24}\). It has been reported that growth mindset has negative correlation with parenting stress\(^{13}\).

Mean scores of stress in these students did not exceed the median (3 points). However, scores of growth mindset, self-esteem, and happiness in these students all exceeded the median.

<table>
<thead>
<tr>
<th></th>
<th>Stress</th>
<th>Growth mindset</th>
<th>Self-esteem</th>
<th>Happiness</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stress</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>2.6907</td>
<td>.99150</td>
</tr>
<tr>
<td>Growth mindset</td>
<td>-.162**</td>
<td>1</td>
<td></td>
<td></td>
<td>3.4701</td>
<td>.68916</td>
</tr>
<tr>
<td>Self-esteem</td>
<td>-.442**</td>
<td>.365**</td>
<td>1</td>
<td></td>
<td>3.5459</td>
<td>.65275</td>
</tr>
<tr>
<td>Happiness</td>
<td>-.507**</td>
<td>.290**</td>
<td>.607**</td>
<td>1</td>
<td>5.0549</td>
<td>1.16906</td>
</tr>
</tbody>
</table>

**p<.01

Effects of path: Coefficient of each path was verified statistically. Stress negatively affected growth mindset (\(\beta=-0.113, p < 0.001\)), self-esteem (\(\beta=-0.261, p < 0.001\)), and happiness (\(\beta=-0.3462, p < 0.001\)). However, growth mindset had statistically significant effect on self-esteem (\(\beta=0.282, p < 0.001\)) and happiness (\(\beta=0.135, p < 0.05\)). Growth mindset had statistically significant effect on self-esteem (\(\beta=0.282, p < 0.001\)) and happiness
Self-esteem also had statistically significant effect on happiness ($\beta = 0.793, p < 0.001$). This study is supported by such findings that the daily stress of children and adolescents negatively affects happiness\textsuperscript{15}, and the higher the self-esteem, the higher the happiness\textsuperscript{25}, and parents’ parenting stress has a negative impact on the growth mindset\textsuperscript{13}.

In order for growth mindset and self-esteem to be established as mediators, both the effects of independent variables on dependent variables and the effects of independent variables on mediators should be statistically significant, and also when mediators are added, the influence of independent variables on dependent variables must be reduced\textsuperscript{26,27}. This study showed that the effect of stress on happiness ($\beta = -0.346$, \textit{p} < 0.001) was reduced when stress and happiness were added ($\beta = -0.593$, \textit{p} < 0.001). Therefore, the relationship between stress and happiness was mediated by the growth mindset and self-esteem. [figure 2]

**Verification of Dual Mediation Effect:** Results of bootstrapping analysis using SPSS macro PROCESS to verify the double mediating effect of growth mindset and self-esteem on the relationship between stress and happiness are shown in [Table 2].

The SPSS macro developed by Preacher & Hayes\textsuperscript{28} is useful for verifying multiple and dual-mediating models by suggesting indirect path between independent and dependent variables. It can elaborate the mediating effect\textsuperscript{28,29,30}.

In this study, 5,000 bootstrapping tests were performed to determine whether there was a double mediation effect of growth mindset and self-esteem on the relationship between stress and happiness with 95% confidence interval (CI).

As shown in Table 2, the mediating effect size was $-0.2470$ (95% CI: $-0.3205$ $- 0.1816$). There was no 0 in the 95.0% confidence interval. Thus, the mediating effect was significant. As a result of simple mediating effect, M1 ($X \rightarrow M1 \rightarrow Y$) was -0.0152 (95%CI: -0.0396 $- 0.0028$) and M2 ($X \rightarrow M2 \rightarrow Y$). Since there was no 0 value in the confidence interval of 95%, the mediating effect was significant.

### Table 2: Dual Mediation Effect of growth mindset and Self-esteem

<table>
<thead>
<tr>
<th>classification</th>
<th>Dual mediation effect</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
</tr>
<tr>
<td>Stress(X) $\rightarrow$ Growth mindset(M1) $\rightarrow$ Happiness(Y)</td>
<td>-0.0152</td>
</tr>
<tr>
<td>Stress(X) $\rightarrow$ Self-esteem(M2) $\rightarrow$ Happiness(Y)</td>
<td>-0.2065</td>
</tr>
<tr>
<td>Stress(X) $\rightarrow$ Growth mindset(M1) $\rightarrow$ Self-esteem(M2) $\rightarrow$ Happiness(Y)</td>
<td>-0.0253</td>
</tr>
<tr>
<td>Total Indirect Effect</td>
<td>-0.2470</td>
</tr>
</tbody>
</table>

**CONCLUSION**

This study was conducted to investigate the dual mediating effect of self-esteem and growth mindset on the relationship between stress and happiness among middle school students. Results of this study are shown below.

First, stress had negative correlations with growth mindset, self-esteem, and happiness. Growth mindset was positive correlated with self-esteem and happiness.

Second, as a result of macro PROCESS analysis, stress negatively affected growth mindset, self-esteem, and happiness. Growth mindset positively affected self-esteem and happiness. Self-esteem had statistically significant effect on happiness.

Third, as a result of bootstrap analysis, growth mindset and self-esteem had dual mediating effect on the relationship between stress and happiness. In other words, stress in middle school students directly affected their happiness. It affected their happiness through a dual mediating path of growth mindset and self-esteem.
This study confirmed that effective mediators could enhance the happiness of Korean adolescents. In order to promote the happiness of the youth who will lead the society in the future, it is necessary to develop and apply an integrated program to improve their growth mindset and self-esteem. This study has limitations in that there is a lack of accumulation of previous studies. In addition, it aimed at middle school students in one city in Chungcheongnam-do. Nevertheless, this is meaningful that the relationship between the stress and happiness of middle school students revealed the double mediated effect of growth mindset and self-esteem.

**Ethical Clearance:** Taken from Hanseo University committee

**Source of Funding:** Self

**Conflict of Interest:** Nil

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Employment Stress and Wellbeing of University Students in Korea: The Mediating Effects of Growth Mindset, Grit, and Hope

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ABSTRACT

Background/Objectives: This study aimed to verify the effects of employment stress on the wellbeing of university students and the mediating effects of growth mindset, grit, and hope on 364 university students.

Methods/Statistical analysis: We used SPSS Win.21.0 and SPSS MACRO for all statistical analyses. Reliability analysis, descriptive statistics, correlation analysis, mean comparison analysis, path analysis, and bias correction bootstrap analysis were performed.

Findings: The results of the study are as follows. First, there were significant positive correlations among hope, growth mindset, and wellbeing, but those variables were negatively correlated with employment stress. Second, employment stress of university students significantly negatively predicted wellbeing, growth mindset, grit, and hope. However, growth mindset, grit, and hope significantly positively predicted wellbeing. Third, we found that growth mindset, grit, and hope partially mediated the relationship between employment stress and the wellbeing of students.

Improvements/Applications: These results can be used as basic data for reducing the stress of university students and promoting employment.

Keywords: Employment stress, Growth mindset, Grit, Hope, Wellbeing

INTRODUCTION

Employment stress is the most serious type stress experienced by college students. In particular, the unemployment rate in Korea is 8.4%¹, and the unemployment rate among new college graduates was 40.4% in 2014².

In this context, employment stress experienced by university students is defined as mental stress, physical stress, or psychological suffering as a result of repeated employment failures or prolonged unemployment³. It has been reported to adversely affect university students as it is significantly related to depression⁴, directly affects the suicide rate⁵, and increases despair overall⁶. Therefore, techniques for reducing employment stress are necessary.

On the other hand, wellbeing is synonymous with life satisfaction, goodwill, happiness, and a positive quality of life, and reflects satisfaction with current life as a cognitive factor that is part of subjective happiness⁷. Also, wellbeing is divided into subjective wellbeing ⁸, which focuses on self-evaluation of an individual’s life from a hedonistic point of view, and psychological wellbeing, which is related to individual development and maturity and leading a meaningful life in terms of happiness ⁹,¹⁰.

Wellbeing is a useful predictor of success. In other words, happy, satisfied, etc. individuals can to some extent decide whether or not they succeed on their terms, which is a very important concept because success is a common goal. In this study, we use the success of youth as a variable to indicate wellbeing.
The purpose of this study is to investigate the direct effect of employment stress experienced by university students on wellbeing, as well as to identify variables that mediate these relationships. The mediator is a mindset that includes hope, grit, and growth.

First, hope is the driving force of life. A person cannot live without hope. “Hope” was used in the past as a synonym for vague dreams, wishes, etc. However, Snyder defined hope by developing it into a measurable concept. Snyder et al. define hope as a positive motivator of successful agency and pathways that are organized in an interactive manner, and consist of pathway thinking that operates through various means to achieve desired goals. A person with hope faces challenges, focuses on success rather than failure, perceives many possibilities to achieve his/her goals, and maintains a positive emotional state, whereas those with low levels of hope do not try their best, focus on failures, focus on the possibility of failure and achieve it in a self-fulfilling prophecy, and maintain negative emotional states.

Second, recently, Duckworth and colleagues defined grit as the ability to predict successes in life. In other words, grit is defined as perseverance and passion toward long-term goals. This concept is based on the effort put forth and interest invested in work that takes several months or more to come to fruition. Grit is also defined as an internal and psychological ability that expresses a willingness to persevere through long-term attention to and passion for a subject, and to overcome frustration and disabilities. Those with a high level of grit approach success and achievement like marathon runners, and their strength is stamina. On the other hand, a person subject to disappointment and boredom changes or abandons their orbit, while a person with a more grit does not change his or her orbit in the face of minor setbacks.

Ultimately, grit is the ability to reach long-term goals using patience and enthusiasm, and serves as a predictor of success.

Meanwhile, Dweck of Stanford University proposed a growth mindset as a predictor of success in academics, interpersonal relationships in various life domains, and emotional and physical health. A mindset is a belief about oneself and one’s temperament, and can be divided into a growth mindset and a fixed mindset. A growth mindset is defined as the belief that one’s intelligence can change if one learns and works hard. On the other hand, a fixed mindset refers to the opposite belief. Thus, the belief that “intelligence, ability, and motivation are fluid” is linked to the growth mindset (incremental theory) and, conversely, the belief that these qualities are “fixed” is linked to the fixed mindset (entity theory).

While those with the former believe that it is possible to increase their level of intelligence, those with the latter mindset do not believe that intelligence can increase; most adults hold the latter viewpoint.

In previous studies, theories of the growth mindset have been shown to be effective in various fields. For example, education on the growth mindset for students in relation to academic achievement has been reported to induce motivation for learning and improve academic achievements.

When we examine the relationship between the variables mentioned above, it is to be expected that the employment stress of university students will decrease their wellbeing, while a mindset that includes hope, grit, and growth will promote wellbeing through the mediation process. The mediating role of hope in many studies has been verified, and the mediating roles of grit and growth can be analogized by considering their definitions as well. However, the results of such studies are rare require further inquiry.

Therefore, the purpose of this study is to identify the roles of a mindset that emphasizes hope, growth, and grit in relation to employment stress and wellbeing in university students, and to find ways to increase wellbeing while reducing employment stress.

**METHODS**

**Research model:** Based on previous studies and the assumptions suggested by the researcher, the research model was set as follows.

Figure 1: Conceptual research model
Participants: This study conducted purposive sampling on university students in Chungnam province. A total of 364 students who were selected from H university in Seosan City and D college in the Daejon metropolitan city participated in the study.

RESEARCH TOOLS

Employment stress: In order to measure the employment stress of university students, a scale which Hwang developed based on the Connell Medical Index of the University and which was revised by Kang was used. The employment stress test consists of subscales of employment-related personality stress, family-related environmental stress, academic stress, school environment-related stress, and employment-related anxiety, each of which is a graded using a 5-point Likert scale. The higher the score, the higher the level of employment stress. The Cronbach’s α value for reliability of employment stress was 0.895

Hope: In order to measure hope, we used the Korean version of the hope scale (K-DHS), which was adapted and validated by Choi et al. from the original form developed by Snyder et al. Hope is composed of four items of agency thinking that measure goal setting and four items on pathways that measure thinking on how to reach those goals. Measurements were done on a 5-point Likert scale. The higher the score, the higher the hope level. Cronbach’s α value for hope reliability was 0.754.

Grit: The grit (Grit-O) scale developed by Duckworth & Quinn was used in this study. The sub-areas for this scale include consistency of interest and persistence of effort. The scale consists of 12 questions in total. The measurements are recorded on a 5-point Likert scale, and the higher the score, the higher the level of grit. Cronbach’s α value for grit reliability was 0.807.

Wellbeing: We used the Subjective Happiness Scale developed by Lyubomirsky and Lepper to measure wellbeing. The scale consists of 4 items graded on a 7-point Likert scale. The higher the score, the higher the level of wellbeing. The Cronbach’s α value for wellbeing reliability was 0.782.

Data analysis: Correlation analysis and descriptive statistics were conducted among the variables before verifying the research model. Then, we used SPSS macro PROCESS as suggested by Hayes, which is able to test for mediating effects, moderating effect, and moderated mediating effects in a single model.

RESULTS AND DISCUSSION

Correlation analysis and descriptive analysis were conducted to investigate the correlation between variables and their general tendencies, as shown in Table 1. Employment stress was negatively correlated with wellbeing, growth mindset, grit, and hope, which were significant at the level of a 5% confidence interval. Wellbeing, growth mindset, grit, and hope were positively and significantly correlated each other. The relationship between employment stress, wellbeing, growth mindset, grit, and hope was significant in that employment stress was related to these variables, and there is a possibility of reducing employment stress by analyzing the relationship between each of these variables.

Table 1: Correlation and descriptive statistics between the major variables

<table>
<thead>
<tr>
<th></th>
<th>Wellbeing</th>
<th>Growth mindset</th>
<th>Grit</th>
<th>Hope</th>
<th>Employment stress</th>
<th>M</th>
<th>SD</th>
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</thead>
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<td>.401**</td>
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<td>.329**</td>
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<td></td>
<td></td>
<td>3.1635</td>
<td>0.52431</td>
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<tr>
<td>Hope</td>
<td>.591**</td>
<td>.414**</td>
<td>.414**</td>
<td>1</td>
<td></td>
<td>2.9337</td>
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<tr>
<td>Employment stress</td>
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<td>-.382**</td>
<td>1</td>
<td>2.3009</td>
<td>0.68265</td>
</tr>
</tbody>
</table>

**p<.01
The effect sizes of each path are shown in Figure 2. Employment stress of university students negatively and significantly predicted wellbeing ($\beta = -0.4633, p < 0.001$), which is the dependent variable, and growth mindset ($\beta = -0.2408, p < 0.001$), grit ($\beta = -0.1182, p < .01$), and hope ($\beta = -0.2244, p < 0.001$). However, growth mindset ($\beta = -0.2110, p< 0.05$), grit ($\beta = -0.2000, p< 0.05$), and hope ($\beta = -0.9905, p < 0.001$) positively and significantly predicted wellbeing. The total effect of employment stress on wellbeing was -0.7600 ($p < .001$) and the direct effect of employment stress on wellbeing was -0.4633 ($p < 0.001$). These results indicate that employment stress directly affects the wellbeing of university students and affects wellbeing through variables related to success, such as hope, growth mindset, and grit. Therefore, in order to relieve stress on college students preparing for employment, it is necessary to promote hope, a growth mindset, and grit.

Using SPSS MACRO PROCESS, we verified the mediated effects of hope, growth mindset, and grit in the relationship between employment stress and wellbeing. The results are shown in Table 2. The mediating effects of growth mindset did not include 0 in the 95% confidence interval (-.1047 ~ -.0083), and 0 was not included in the 95% confidence interval of either grit or hope. Therefore, the mediating effects of these three variables were verified. These results are in line with those of previous studies. The implications of the analysis so far are that university students may be able to avoid a decline in their level of wellbeing if they are ready to work in preparation and promote hope, growth mindset, and grit.

CONCLUSION

The purpose of this study was to examine the mediating effects of hope, growth mindset, and grit on the relationship between employment stress and wellbeing among university and college students. The results showed that employment stress was negatively correlated with wellbeing, and that hope, growth mindset, and grit showed were statistically correlated with wellbeing. Pathway analysis revealed that employment stress had a significant effect on wellbeing, and the effects of employment stress on mediating variables were all significant. The effect of mediating variables on wellbeing was also significant. Finally, analysis of the effects of mediation using bootstrap techniques showed mediation by hope, growth mindset, and grit. This result implies that university students with a degree of employment stress can maintain their wellbeing by preparing for employment and improving their levels of hope, growth mindset, and grit.

Ethical Clearance: Taken from Hanseo University committee

Source of Funding: Self

Conflict of Interest: Nil

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Human Rights Victimization and Self-esteem of University Students in Korea: The Mediating Effect of Hope

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ABSTRACT

Background/Objectives: The objective of this study was to determine whether hope mediates in the relationship between human rights victimization experience and self-esteem of university students.

Methods/Statistical analysis: SPSS Win.21.0 and SPSS macro PROCESS for all statistical analyses were used. Descriptive statistics, Reliability analysis, correlation analysis, mean comparison analysis, path analysis, and bias correction bootstrapping analysis were performed.

Findings: First, correlation analysis showed that human rights victimization experience had negative correlations with hope and self-esteem, while hope and self-esteem showed positive correlation. Second, path analysis showed that human rights victimization negatively affected self-esteem and hope while hope positively affected self-esteem. Third, bootstrapping analysis verified that there was a mediating effect of hope in the relationship between human rights victimization experience and self-esteem of university students.

Improvements/Applications: This result will be used for maintaining self-esteem when university students experience human rights victimization.

Keywords: Human rights victimization experience, Self-esteem, Hope, SPSS macro PROCESS, Mediating effect

INTRODUCTION

Human rights can be defined as ‘the concept of freedom and rights to enjoy as a human being, together with freedom and rights to be exercised as citizens of the nation’¹. According to reports by the National Human Rights Commission², there were 10,915 cases of human rights violations in 2014, including 8,699 human rights violations, 2,198 discriminatory acts, and 18 other cases. The number of cases of human rights violations in 2014 was slightly increased compared to that in 2013 (10,338 cases). Compared to 1,852 cases in 2001 when the survey was started, this number was increased by 589.4% in 2014. Such trend suggests that more people are aware of human rights.

Research on human rights for the weak is accumulating to some degree. However, no research has reported about human rights or discrimination experienced by college students.

Self-esteem might be related to human rights victimization. Self-esteem is an indicator of mental health. It is defined as subjective assessment of self-respect, self-respect, worthiness, and degree of self-esteem. Self-esteem has been identified as a vital component in the achievement of ego-identity status, the cornerstone of successful psychosocial development in adolescent period. Those with high self-esteem can control themselves and remain stable compared to those who do not have high self-esteem. In addition, people with high self-esteem are more sensitive to negative evaluations than those who are not affected by external evaluations when performing tasks assigned to them. Therefore, self-esteem might be protective factor of human rights victimization experience.
On the other hand, hope is defined as a belief in a certain degree of likelihood that good outcome will occur. Such hope depends on the perception of resources that individuals possess. Such definitions are vague and unmeasurable. Therefore, Snyder et al. have introduced a new cognitive and motivational model called the hope theory and validated that hope is a measurable variable. According to Snyder et al., hope is defined as self-referential thoughts on the motivation to find various paths to achieve desired goals and utilize these paths. A hopeful person likes challenges. He or she will focus on successes rather than failures. He or she perceives a lot of potentials when achieving goals. They also maintain positive emotional state. On the other hand, those who have low hope do not do their best. They focus on failures and the possibility of failure. They maintain negative emotional state.

When reviewing relationships among variables of human rights victimization, very few studies have been conducted on the relationship between victimization experience and self-esteem. No research has been conducted on university students. Therefore, the relationship between victimization experience and self-esteem was derived from similar papers. The self-esteem of adolescents has been reported to have significant impact on human rights attitudes. Self-esteem of workers in social welfare facilities has been reported to be a factor affecting human rights consciousness. In addition, it has been shown that teachers with high self-esteem will take human rights behaviors to guarantee student’s learning rights by demonstrating human rights sensitivity. And it has been reported that higher perception of infant human rights is associated with lower job stress and higher self-esteem. On the other hand, self-esteem does not appear to have statistically significant effect on cyber-victimization. Since human rights in cyber environments do not agree with other results regarding self-esteem, it is necessary to study the relationship between victimization and self-esteem. Studies on relationship between human rights victimization and hope have shown that hope and loneliness are negatively correlated with each other. Hope can be seen as a resource to overcome loneliness and alienation resulting from human rights victimization. When facing stresses of everyday life, the most powerful resource is hope. Such hope can lead to personal experience with positive results regardless of the situation. In addition, hope can strengthen physical and mental defenses as an element of effective response to stressful and meaningful crises under stressful situations. Results of these previous studies suggest that hope is a protective factor against victimization of human rights.

It has been reported that hope is strongly correlated with self-esteem. Hope is directly related to self-esteem in elementary school students. Kim has shown that the hope of elementary, middle, and high school teachers is highly correlated with their self-esteem. In a longitudinal study of college students over a six-year period, a hope-training program has resulted in improvement in self-esteem. These studies suggest that hope might be a mediator in the relationship between victimization experience and self-esteem. However, no such study has been reported.

Therefore, the objective of this study was to determine whether hope mediates in the relationship between human rights victimization experienced by college students and self-esteem. In order to accomplish the purpose of this study, the following research questions were addressed: 1) What is the correlation between variables? 2) Does hope mediate in the relationship between victimization experience and self-esteem?

METHODS

Research model: The research model for this study is shown in Figure 1. Based on previous research studies, the following research model was proposed: human rights victimization would negatively predict self-esteem and hope while hope would positively predict self-esteem.

Subjects and data collection: A total of 233 university students who took part in this survey were enrolled through purposive sampling. Their universities were located in S city, Chungcheongnam Province and in M city, Jeonnam Province in the Republic of Korea. Of these students, 149 (63.9%) were females and 84 (36.1%) were males. Their mean age was 22.6 years (range, 19 to 30 years). Of these 233 students, 106 (45.5%) lived in
metropolitan city, 88 (37.8%) lived in urban city, and the rest 39 (16.7%) lived in rural area.

TOOLS

Human rights victimization: The scale used by National Human Rights Commission was used. The original scale had 25 questions about victimization and discrimination. Of these 25 questions, 15 items suitable for college students were used in this study. Each question was measured in a 5-point Likert scale. Higher scores indicate higher human rights victimization. In this study, the reliability of human rights victimization scale used in this study was high with Cronbach’s α value of 0.935.

Statistical analysis: In order to measure hope, the Korean version of hope scale (K-DHS) developed by Snyder et al. and adapted and validated by Choi et al. was used in this study. The scale had four items of agency thinking to measure goal setting and four items of pathways thinking to measure how to reach the goal. Each item was measured in a 5 point Likert scale. The higher the score, the higher the hope level. The reliability of hope scale used in this study was good with Cronbach’s α value of 0.878.

Self-esteem: To measure self-esteem, the scale developed by Rosenberg was used in this study. The scale consisted of 10 items, positive or negative. Each item was measured with a 5-point Likert scale. Higher scores indicate greater self-esteem. The reliability of self-esteem scale used in this study was good with Cronbach’s α value of 0.854.

Data analysis: SPSS PC + and SPSS macro PROCESS proposed by Hayes were used for data analysis. Frequency analysis, reliability analysis, and path analysis were performed. Bootstrap method was used to determine the mediating effect.

RESULTS AND DISCUSSION

Pearson correlation analysis was performed. Results are shown in Table 1. There were significant correlations among human rights victimization, hope, and self-esteem. Specifically, human rights victimization showed negative correlations with hope (-0.324, p < 0.01) and self-esteem (-0.452, p < 0.01), while hope and self-esteem showed positive correlation (0.601, p < 0.01).

Results of descriptive statistics showed that human rights victimization fell below the middle level of the scale while hope and self-esteem exceeded the middle level. In other words, the level of human rights victimization in college students was low while their hope and self-esteem were generally high.

Table 1: presents the descriptive statistics and correlation matrix

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Human rights victimization</td>
<td>1</td>
<td></td>
<td></td>
<td>2.0616</td>
<td>0.73486</td>
</tr>
<tr>
<td>2. Hope</td>
<td>-0.324**</td>
<td>1</td>
<td></td>
<td>3.4319</td>
<td>0.54682</td>
</tr>
<tr>
<td>3. Self-esteem</td>
<td>-0.452**</td>
<td>0.601**</td>
<td>1</td>
<td>3.4773</td>
<td>0.57224</td>
</tr>
</tbody>
</table>

**p<.01

Testing of the proposed model: As a result of path analysis using SPSS macro PROCESS, it was found that all variables had significant effects as shown in Figure 2. Specifically, human rights victimization negatively affected self-esteem and hope while hope positively affected self-esteem. These results indicate that human rights victimization can directly affect self-esteem. However, self-esteem can also influence human rights victimization through mediating variables. In addition, the effect of human rights victimization on self-esteem was decreased from -0.3517 (p < 0.001) to -0.2234 (p < 0.001) through mediation of hope. The mediating effect of hope was verified through bootstrapping. Results are shown in Table 2. The verification result showed that β value was -0.1283. After bootstrapping analysis, the value was changed from -0.1791 to -0.0882. It did not include 0 between them. Therefore, the mediating effect of hope was verified.

Results of this study had two implications. First, human rights victimization might damage self-esteem. This is a very serious problem because impaired self-esteem is often linked to secondary problems such as suicide. Second, although high hope of agency thinking and pathways thinking does not completely eliminate human rights victimization, it can mitigate human rights victimization at some degree. Therefore, if college students increase their usual level of hope, they might be able to prevent self-esteem damage and secondary serious accidents caused by human rights victimization.
CONCLUSION

Human rights victimization can decrease self-esteem. For college students who are still adolescents (legal age of 9 to 24 years), it is very important to develop self-esteem. Results of this study show that victimization of human rights can help reduce the possibility of more serious youth problems such as suicide. Therefore, social attention is needed to prevent victimization of human rights in adolescence. Based on results of this study, hope can mediate between human rights victimization and self-esteem, thus mediating the effect of human rights victimization on the reduction of self-esteem. As a result, hope might play an important role in protecting self-esteem. It can prevent serious problem caused by reduced self-esteem due to victimization of human rights. Therefore, it is important to promote hope and prevent self-victimization damage. In order to promote hope, various programs should be developed.

Results of this study also suggest that continuing related studies using various youths in future studies will help protect vulnerable youths from human rights victimization and maintain their self-esteem, thus preventing more serious youth problems.

Ethical Clearance: Taken from Koguryeo University committee

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Depression and Subjective Happiness of Adolescents in Korea: Effect of Self-Esteem and Moderating Effect of School Violence Victimization Experience

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¹Research Scholar, Department of Child and Adolescent Welfare, ²Professor, Department of Lifelong Education, Hanseo University, 31962 Korea

ABSTRACT

Background/Objectives: The purpose of this study was to investigate the mediating effect of self-esteem and the moderating effect of school violence victimization experience on the relationship between depression and subjective happiness in 467 middle school students.

Methods/Statistical analysis: For the analysis, SPSS Win.21.0 and SPSS MACRO program were used. Reliability analysis, descriptive statistics, correlation analysis, average comparison analysis, path analysis, bias correction bootstrap were performed.

Findings: First, depression has a negative correlation with subjective happiness and self-esteem, while it has a positive correlation with school violence victimization experience. Subjective happiness was positively correlated with self-esteem, but negatively correlated with depression and school violence victimization experience, respectively. Second, as a result of the SPSS macro PROCESS analysis, depression influenced negatively on the self-esteem, and school violence victimization experience had a negative effect on self-esteem. Third, as a result of the bootstrap analysis, the path from depression to self-esteem was moderated by the school violence victimization experience, and the moderated mediation effect of self-esteem and school violence victimization experience was verified in relation to depression and self-esteem.

Improvements/Applications: This result suggests that the interaction of adolescent depression and school violence victimization experience will be used as a new model to improve subjective happiness through self-esteem.

Keywords: Depression, School violence victimization experience, self-esteem, Subjective happiness, Moderation effect, Moderated mediation effect, SPSS macro PROCESS

INTRODUCTION

Human happiness is the goal of life itself. The study of human happiness has been begun since ancient Greek philosophy and has been active after the publication of an empirical study on the happiness of the American economist¹,² in 1973³. The terms used in combination with happiness include subjective well-being, welfare, and life satisfaction. However, in academic terms, it is generally expressed as subjective happiness, and it is common that it is expressed as happiness in public⁴.

Happiness is defined as the general area of the subjective well-being rather than the constitutive construct⁵. In other words, emotional response, domain satisfaction, and life satisfaction are all included⁶. In other words, subjective happiness is defined as the general and integrative subjective judgment of life through human experience⁷. The subjective happiness experienced in adolescence is very important because it affects the satisfaction of life in adulthood. However, the subjective well-being of Korean adolescents is the lowest among OECD countries⁸, and so the voice of concern about future Korean society is increasing.
Self-esteem is defined as a positive and negative assessment of self and a degree of self-esteem and respect. Adolescents with low self-esteem showed depression, anxiety, and low achievers. On the other hand, positive self-esteem is the most predictive variable of happiness with perceived control, extroversion, optimism, and positive interpersonal relationship. Self-esteem affects the subjective happiness of adolescents.

Depression with negative relationship with self-esteem are generally nervous breakdown with symptoms of excessively sad and helplessness. According to the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV), depression is characterized by mood disorders, depressed emotional states and complex mental and physical symptoms. It has been reported that depression is not only a deterioration of individual ability and motivation but also a major cause of difficulty in realistic adaptation and the most important factor causing occupational maladjustment worldwide.

Studies on school violence have begun in Scandinavia in the 1970s and have recently been actively conducted in Korea and other Asian countries. School violence is a category of aggressive behavior caused by a force imbalance, which means that a student is repeatedly and consistently subjected to negative behavior from one or more students. In general, experiencing violence increases existing anger, aggression, drug use, depression, and post traumatic stress disorder (PTSD) and lowers self-esteem.

In the previous studies on depression, subjective happiness, self-esteem, and school violence victimization experience, the effects of school violence experience on subjective happiness were influenced by victimization type and both type of school violence experience, and self-esteem is a causal variable that has the greatest effect on subjective well-being. Depression has a negative correlation with self-esteem and happiness, and there is a study that there is a relationship between self-esteem and happiness.

Thus, this study was conducted to investigate whether the relationship between depression and subjective happiness is mediated by self-esteem and whether the mediating effect of self-esteem is controlled by school violence victimization experience in depression. To achieve this goal, research questions were set as follows. First, what is the correlation between depression, school violence victimization experience, self-esteem, and subjective happiness? Second, what is the path coefficient between each variable? Third, does the school violence victimization experience moderate the relationship between depression and the mediating self-esteem?

**MATERIALS AND METHODS**

**Research Model:** The main analytical method of this study is the moderated mediation effect analysis of model 7 of the MACRO process, and the conceptual study model is shown in [Figure 1].

**Survey subjects and methods of data collection:** The questionnaire was distributed to 467 middle school students in D city, Chungcheongnam-do from April 15, 2016 for the convenience of survey. Except for the unfair questionnaire, 456 data were used in the actual analysis. The subjects were 56.3% men and 43.8% women. The economic levels of the households were in the order of ‘normal’ 51.3%, ‘general’ 30.7%, ‘very generous’ and ‘insufficient’ 7.9% and ‘very insufficient’ 2.2%. 63.4% of the parents were working at all, and 36.6% of them were not. 52.9 percent of the respondents said they were middle in academic achievement, 25.5 percent were low, and 21.6 percent were high.

**RESEARCH TOOLS**

**Depression:** This study used a subscale of SCL-90 for depression translated by Choi. This study used a subscale of SCL-90 for depression translated by Choi (1992). The scale consisted of 10 items, and was 5 point Likert scale. The higher the score, the higher the degree of depression. The overall reliability of Cronbach’s $\alpha$ in this study was very high at .936.

**Subjective Happiness:** This study used the shortened subjective happiness scale developed by Seo et al. to measure happiness. The three items that measure the satisfaction of the individual aspects (personal...
accomplishment, personality, health, etc.), relational aspects (such as relationships with others), and collective aspects (my group - workplace, community, etc.) were measured by a 7 point Likert scale ranging from ‘not at all’ (1 point) to ‘very much’ (7 points). The higher the score, the higher the level of happiness. The reliability of well-being in this study was Cronbach’s α = .873.

Self-esteem: This study used the Self-Esteem Scale (RSES) developed by Rosenberg 9 to measure self-esteem. This scale is a total of 10 questions, consisting of 5 points Likert scale from ‘not quite at all (1 point) to’ very agree (5 points). The higher the score, the higher the self-esteem. The overall reliability Cronbach’s α in this study was .840.

School violence victimization experience: This study used a scale consisting of a total of 7 items, with Cho 22 constructing the types of violence and damage of school violence by type and adding cyber violence related items. The measure was a 5 point Likert scale from ‘not at all (1 point) to ‘always (5 points).’ Higher scores mean more school violence victimization experience.

Data Analysis: In this study, SPSS Win. 21.0 and SPSS macro PROCESS which was proposed by Hayes 23 were used. Reliability analysis, descriptive statistics, and correlation analysis were performed by using SPSS Win. 21.0, and the moderated mediation effect was analysed using SPSS macro PROCESS.

Table 1: Correlation and Descriptive Statistics

<table>
<thead>
<tr>
<th></th>
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<th>Subjective happiness</th>
<th>Self-esteem</th>
<th>school violence victimization experience</th>
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<td>school violence victimization experience</td>
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<td>.36873</td>
</tr>
</tbody>
</table>

**p<.01

MODEL VERIFICATION

Depression as an independent variable had significant negative impact (a1) on the mediating self-esteem (β= -.433, P <.001), and the school violence victimization experience had a significant negative impact on self-esteem (b1 = -43.3, p <.001) (B = -0.283, p <.001) as shown in Table 2. Depression, an independent variable, and the school violence victimization experience, a moderating variable, interacted with each other and had a positive effect (a3) on the mediating self-esteem (β=0.149, p<.01). This means that as the level of school violence victimization experience increases, the negative impact of depression on self-esteem increases further.

RESULTS AND DISCUSSION

Correlation and Descriptive Statistics: Table 1 shows the results of Pearson’s correlation analysis to identify correlations among variables. Depression was negatively correlated with happiness and self-esteem, whereas it was positively correlated with school violence victimization experience. Happiness had a significant positive correlation with self-esteem, but there was a significant negative correlation with depression and school violence victimization experience, respectively.

In detail, the correlation coefficient between depression and self-esteem was the highest at -.632, depression and happiness was -.615, happiness and self-esteem were .607, school violence victimization experience and depression were .322 correlation coefficient respectively. These results are similar to those of Kim 19, in which depression has a negative correlation with self-esteem and happiness, and self-esteem has a positive correlation with happiness. In addition, these results are supported by the previous study 24 which the school violence stress was negatively correlated with self-esteem, had a positive correlation with depression, and self-esteem and depression had negative correlations.

The mean of the variables was not more than the middle point (3 points) for depression and school violence victimization experience, but both self-esteem and subjective happiness exceeded the median.
Depression was found to have a negative influence on subjective happiness ($\beta = -0.493, p < .001$), and self-esteem had a statistically significant effect on subjective happiness ($\beta = 0.654, p < .001$). These results are in general similar to the results of experiencing violence when anger, aggression, drug use, depression, and post traumatic stress disorder (PTSD) are elevated while self-esteem is lowered $^{16}$. In addition, self-esteem is a causal variable that has the greatest effect on subjective well-being $^{18}$. Especially, the report that self-esteem is a key factor that has a strong influence on life satisfaction $^{25}$ supports the results of this study. The case study is done is to understand impulsivity, reward and loss sensitivity in decision making using Iowa Gambling Task and investigate how impulsivity affects decision-making using BIS/BAS scale$^{26}$. The result displayed that participants who were low on impulsivity fared worst on IGT task compared to the participants who were high on impulsivity$^{26}$.

As a result of the conditional effect of the independent variables on the dependent variable in the specific value of the moderating variable, the simple slope of depression on self-esteem was significant at the level of school violence victimization experience of 0.83 (M-1SD) to 1.57 (M + 1SD).

Table 2: Moderating Effect of school violence victimization experience

<table>
<thead>
<tr>
<th>Variables</th>
<th>$\beta$</th>
<th>SE</th>
<th>$t_{\alpha}^\ell$</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mediating variable model (DV: self-esteem)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>3.5208</td>
<td>0.024</td>
<td>146.6796</td>
<td>0.0000</td>
</tr>
<tr>
<td>Depression (a1)</td>
<td>-0.4327</td>
<td>0.033</td>
<td>-13.105</td>
<td>0.0000</td>
</tr>
<tr>
<td>school violence victimization experience (b1)</td>
<td>-0.2833</td>
<td>0.0663</td>
<td>-4.2702</td>
<td>0.0000</td>
</tr>
<tr>
<td>Depression × school violence victimization experience (a3)</td>
<td>0.1492</td>
<td>0.0557</td>
<td>2.6779</td>
<td>0.0077</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Dependent variable model (DV: subjective happiness)</strong></th>
<th></th>
<th></th>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Constant</td>
<td>2.74</td>
<td>0.3344</td>
<td>8.194</td>
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</tr>
<tr>
<td>self-esteem</td>
<td>0.654</td>
<td>0.0942</td>
<td>6.9422</td>
<td>0.0000</td>
</tr>
<tr>
<td>Depression</td>
<td>-0.493</td>
<td>0.0674</td>
<td>-7.3117</td>
<td>0.0000</td>
</tr>
<tr>
<td><strong>Direct effect</strong></td>
<td>-0.493</td>
<td>0.0674</td>
<td>-7.3117</td>
<td>0.0000</td>
</tr>
<tr>
<td>Conditional indirect effect</td>
<td>$\beta$</td>
<td>Boot Se</td>
<td>BootLLCI</td>
<td>BootULCI</td>
</tr>
<tr>
<td>M-1SD (0.83)</td>
<td>-0.3029</td>
<td>0.0477</td>
<td>-0.3993</td>
<td>-0.2113</td>
</tr>
<tr>
<td>M (1.20)</td>
<td>-0.283</td>
<td>0.0445</td>
<td>-0.3718</td>
<td>-0.1964</td>
</tr>
<tr>
<td>M+1SD (1.57)</td>
<td>-0.2468</td>
<td>0.0425</td>
<td>-0.3355</td>
<td>-0.1679</td>
</tr>
<tr>
<td>Moderated mediation effect</td>
<td>Index</td>
<td>Boot SE</td>
<td>BootLLCI</td>
<td>BootULCI</td>
</tr>
<tr>
<td></td>
<td>0.0976</td>
<td>0.0414</td>
<td>0.0202</td>
<td>0.1862</td>
</tr>
</tbody>
</table>

Boot LLCI = boot The lower bound of the indirect effect within the 95% confidence interval

Boot ULCI = boot The higher bound of the indirect effect within the 95% confidence interval

**Verification of Moderation Effect:** The study was to analyze the moderated mediation effects of self-esteem and school violence victimization experience in relation to depression and subjective happiness in adolescents using SPSS macro PROCESS. Table 3 presents the significance areas by the Johnson-Neyman method for the entire range of school violence victimization experience.
As the value of school violence victimization experience increased, the effect of depression on subjective happiness increased gradually, but the effect of depression on subjective happiness was no longer significant in the area of school violence victimization experience value greater than –0.1831. The significant proportion of these effects was 99.35% of all respondents and 0.65% of the respondents did not.

<table>
<thead>
<tr>
<th>school violence victimization experience value</th>
<th>β</th>
<th>SE</th>
<th>t value</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>-0.2036</td>
<td>-0.4645</td>
<td>0.0363</td>
<td>-12.8021</td>
<td>0.0000</td>
</tr>
<tr>
<td>-0.0751</td>
<td>-0.4452</td>
<td>0.0337</td>
<td>-13.2179</td>
<td>0.0000</td>
</tr>
<tr>
<td>0.0535</td>
<td>-0.426</td>
<td>0.0325</td>
<td>-13.1223</td>
<td>0.0000</td>
</tr>
<tr>
<td>0.1821</td>
<td>-0.4067</td>
<td>0.0328</td>
<td>-12.4111</td>
<td>0.0000</td>
</tr>
<tr>
<td>1.5964</td>
<td>-0.1946</td>
<td>0.0892</td>
<td>-2.1815</td>
<td>0.0297</td>
</tr>
<tr>
<td>1.6731</td>
<td>-0.1831</td>
<td>0.0932</td>
<td>-1.9651</td>
<td>0.05</td>
</tr>
<tr>
<td>1.7249</td>
<td>-0.1753</td>
<td>0.0959</td>
<td>-1.829</td>
<td>0.0681</td>
</tr>
<tr>
<td>1.8535</td>
<td>-0.156</td>
<td>0.1026</td>
<td>-1.5213</td>
<td>0.1289</td>
</tr>
</tbody>
</table>

As the moderating effect of the school violence victimization experience was statistically significant, the moderating effect was visualized to confirm the form, as shown in Figure 2. In order to identify patterns of significant interaction, school violence victimization experience was classified into low and high groups, and the change of the mean was examined.

**Figure 2: The moderating effect of school violence victimization experience**

**CONCLUSION**

The purpose of this study was to investigate the moderated mediation effect of self-esteem and school violence victimization experience on the relationship between depression and subjective happiness in middle school students.

First, depression has a negative correlation with subjective happiness and self-esteem, while it has a positive correlation with school violence victimization experience. Subjective happiness was positively correlated with self-esteem, but negatively correlated with depression and school violence victimization experience.

Second, as a result of the macro PROCESS analysis, depression as an independent variable influenced negatively on the self-esteem as a mediating variable, and school violence victimization experience had a negative effect on self-esteem.

Third, as a result of the bootstrap, the path from depression to self-esteem is moderated by the school violence victimization experience, and thus the moderated mediation effect of self-esteem and school violence victimization experience was verified in the relationship between depression and self-esteem.

This study confirms the variables directly or indirectly affecting happiness by identifying the relationship between happiness and depression, school violence victimization experience, self-esteem, and happiness in Korean adolescents.

Suggestions for follow-up research are as follows.

First, in view of the fact that school violence has become more serious in society as a whole beyond the youth problem, I hope that research on the perpetrators as well as victims of school violence will be actively pursued.
Second, in order to prevent youth depression and school violence victimization experience, home, school and social attention and support should be supported. In addition, a new self-esteem program should be developed to improve self-esteem when adolescents experience depression and school violence.

Nevertheless, this study found that depression was a causal variable, and a new view of happiness and related variables was applied, unlike previous studies using depression as a result variable. In the relationship between happiness and depression, it is significant that the moderated mediation effects of self-esteem and school violence victimization experience were identified.

**Ethical Clearance:** Hanseo University

**Source of Funding:** N/A

**Conflict of Interest:** Nil

**REFERENCES**


A Case Study of an Occupational Activity Program Following the Great East Japan Earthquake and Tsunami and the Restoration of Roles

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ABSTRACT

Background/Objectives: This study provided an occupational activity program to the victims of the 2011 Great East Japan Earthquake and Tsunami, who lived in temporary dwellings after losing their homes and livelihoods, and examined the effects of the program on their emotional healing and the restoration of their roles in the community.

Methods/Statistical analysis: The program began in March 2012 to help the victims who lived in the temporary dwellings in Watarijjo, Miyagi Prefecture. Given that most of the participants had been engaged in strawberry farming, the program was organized in accordance with seasonal characteristics, including valuable activities such as planting and growing flowers. The health-related quality of life in the subjects who participated in the program for at least six months was evaluated using the Short Form-8 (SF-8), and other changes were described through personal interviews. This study highlights the cases of A and B, who experienced positive changes.

Findings: The participants may have had their roles restored by their performing personally meaningful occupational activities and thereby improved their quality of life. A’s total quality of life score improved from 338.07 points before participating to 415.15 points after, and A showed the largest changes in the sub-domains of general health and role limitations due to emotional problems. B’s total quality of life score also improved, from 386.15 to 454.54 points. In fact, B showed improvement in every domain of the SF-8, but B’s quality of life in the sub-domain of general health showed a particularly large improvement.

Improvements/Applications: The development and spread of occupational activity programs that can help interactions based on restoring people’s roles in their communities are essential to the recuperation of the victims of disasters. This program development requires active and professional preparation by occupational therapists who understand the lives and social roles of individuals and know the value of work.

Keywords: community, gardening, nature disaster, role, SF-8

INTRODUCTION

The 2011 Great East Japan Earthquake and Tsunami caused over 15,000 deaths and destroyed over 390,000 homes. As a result, the survivors had to reside in temporary dwellings. Natural disasters are traumatic events that cause widespread destruction and pain in communities. Because of their uncontrollable characteristics, they negatively affect the lives of their victims. 
Even if disaster victims have no external injuries, they experience emotional shocks, fear, anxiety, and depression, and physical problems such as weight changes. Moreover, victims experience limited activities and social participation because they become separated from their daily work and familiar environments. These limited activities lead victims lose their roles in their communities, eventually depriving them of their identities, social relations, and organizational power in daily living. Therefore, the recovery process for victims of disasters should include restoring their roles and reestablishing their daily tasks. This study aimed to offer therapeutic gardening to the tsunami victims with a focus on their familiar occupational activities and then to examine the changes in their quality of life through the restoration of their roles.

MATERIALS AND METHOD

Subjects: The subjects were the residents of temporary dwellings in Watarijjo following the Great East Japan Earthquake and Tsunami; the dwellings had been installed in five areas in the region: Kokyozone, Kogotanchi, Kyukan, Tateminamo, and Miyamae. The activity that was offered to the residents was a therapeutic gardening and indoor occupational activity program. The study highlights two participants in particular, A and B, who showed improvements in their quality of life after continuous participation in the program for over six months.

Occupational activity program: Before the occupational activity program was introduced, trained volunteers had been sent to the community in June 2011, and they built relationships and trust with the residents by providing meals and daily necessities, serving refreshments, and cleaning houses. In March 2012, the program commenced guided by the local tradition of strawberry farming and the local residents’ daily occupational routine of farming in the fields. The program was conducted to enable the participants’ psychological recovery and to restore their roles in daily life by having them move their bodies, feel the vitality of plants, and become community members while creating flower gardens.

Given that most of the participants in the program had been engaged in strawberry farming, the program was organized in accordance with seasonal characteristics, including activities such as planting and growing flowers; in addition, the program was conducted in a manner that allowed indoor activities during the winter (December to April). The program ran for 42 months between March 2012 and August 2015, and an average of 15 residents (five to 25 per temporary dwelling) participated in each activity. The researcher ran the program by visiting the temporary dwellings in the five areas one to three times every month between April 2012 and August 2015; because there were different numbers of residents in the different dwellings, the numbers of visits to each dwelling were also different. The main activities were sowing seeds to create group and individual flower gardens, growing moss-topped pots, weeding, reaping sweet potatoes, and gathering favorite plants (Figures 1 to 8).
Evaluation tool: This study used the Short Form-8 (SF-8) to assess changes in the participants’ quality of life; the SF-8 is a health-related quality of life instrument and a shortened form of the SF-36. It consists of questions that represent the eight sub-domains of the SF-36: general health perception, physical functioning, role limitations due to physical problems, bodily pain, vitality, social functioning, mental health, and role limitations due to emotional problems. The SF-8 score is calculated following the guidelines established by its developer, and higher sub-domain scores indicate greater quality of life in that sub-domain.

RESULTS AND DISCUSSION

Case 1: Although 76-year-old A had been engaged in strawberry farming with a son, the son had died in the tsunami, and the strawberry farm was also destroyed; therefore, A moved into a temporary dwelling. With the shock of losing the son, A spent a harrowing time with a sense of loss for six months during which she could hardly smile. After moving into the temporary dwelling, A could not even walk properly due to weakened leg muscles caused by little exercise and changes in the rhythm of life.
Given that A liked flowers and the soil, and had farmed, she carried out familiar activities such as sowing seeds to create a flower garden, pulling weeds, and reaping. While A was planning and creating together with other participants, he/she made new friends and showed a brighter face. At present, A has regained his/her role as a community member by purchasing a small truck and growing vegetables in his/her own small field.

A’s total SF-8 quality of life score increased from 338.07 points before the participation to 415.15 points afterward. Notably, A’s quality of life scores in every sub-domain were higher after the participation, as shown in Table 1; in particular, his/her general health score improved from 46.43 to 59.45 points, and the role limitations due to emotional problems score improved from 38.09 to 52.42 points. These results suggest that A’s participation in the occupational activity program had positive effects on his/her quality of life.

Case 2: Separately, 78-year-old B had experienced a tremendous sense of emptiness and loss after the death of her first son and his wife, with whom B had lived and on whom B had relied; because everything had been destroyed, B also stayed in a temporary dwelling. B, who liked growing flowers, was enrolled in a group-based occupational activity program; his/her favorite part of the program was the environment that allowed sharing sympathies with other residents while working jointly. In particular, B said that when looking at the sky and flowers in the therapeutic garden, she felt positive that his/her own life would also go well.

In the therapeutic garden, B carried out activities such as reaping sweet potatoes, creating his/her own flower garden, and gathering and planting her favorite plants. B said that while he/she felt uneasy in the small temporary dwelling, activities in the therapeutic garden became a great comfort.

B’s total quality of life score improved from 386.15 points before his/her participation in the program to 454.54 points after. As shown in Table 1, B’s quality of life score for every SF-8 sub-domain increased; in particular, the general health score showed the largest change. B recovered from the sense of loss through the activity of growing his/her favorite flowers and interacting with other residents and regained his/her roles while caring for a brother-in-law who was mentally retarded.

<table>
<thead>
<tr>
<th>SF-8 Subscales</th>
<th>A</th>
<th></th>
<th>B</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre</td>
<td>Post</td>
<td>Pre</td>
<td>Post</td>
</tr>
<tr>
<td>General health perception</td>
<td>46.43</td>
<td>59.45</td>
<td>38.41</td>
<td>59.45</td>
</tr>
<tr>
<td>Physical functioning</td>
<td>40.07</td>
<td>48.33</td>
<td>40.07</td>
<td>54.05</td>
</tr>
<tr>
<td>Role physical</td>
<td>38.71</td>
<td>46.92</td>
<td>53.98</td>
<td>53.98</td>
</tr>
<tr>
<td>Bodily pain</td>
<td>47.67</td>
<td>53.35</td>
<td>53.35</td>
<td>60.77</td>
</tr>
<tr>
<td>Vitality</td>
<td>45.16</td>
<td>55.62</td>
<td>55.62</td>
<td>61.83</td>
</tr>
<tr>
<td>Social functioning</td>
<td>40.41</td>
<td>49.47</td>
<td>49.47</td>
<td>55.25</td>
</tr>
<tr>
<td>Mental health</td>
<td>38.09</td>
<td>52.42</td>
<td>45.66</td>
<td>52.42</td>
</tr>
<tr>
<td>Role emotional</td>
<td>41.53</td>
<td>49.59</td>
<td>49.59</td>
<td>56.79</td>
</tr>
<tr>
<td>Total score</td>
<td>338.07</td>
<td>415.15</td>
<td>386.15</td>
<td>454.54</td>
</tr>
</tbody>
</table>

The occupational activity program applied in this study was focused on activities that were based on the participants’ abilities, the work they considered important, and their satisfaction doing the work. Specifically, the program consisted of various activities related to strawberry farming and sales, which the participants had engaged in before the storm, with a focus on their personal values and interests. The process of running the program also emphasized the participants’ selection of activities, interests, and roles and functions, thereby inducing their active participation in the activities. The occupational activity program was based on the Model of Human Occupation®, which is human-centered and stresses helping participants to restore, reorganize, and maintain their functions and lifestyles. In this study, the program participants may have felt their roles restored as they carried out their personally meaningful occupational activities, which may have eventually helped improve their quality of life.

Previous studies reported that individuals’ participation in activities improved their quality of life.
and helped reduce their sense of depression by having them help others and experience mutual support through sharing interests and roles with others\textsuperscript{10,11}. Thus, the group-based occupational activities in this study may have helped the participants to reduce their sense of depression and eventually contributed to improving their quality of life.

Individuals should continue social activities that take into account not only daily activities but also factors such as physical environment (e.g., awareness of surrounding circumstances) and social environment (e.g., interactions with families and neighbors) in order to maintain their functions and roles even in environments that have been changed by disasters\textsuperscript{6}. Therefore, in this study, offering group activities in a manner that combined functional training such as strawberry farming, which was familiar to the participants, and social exchanges such as strawberry sales may have helped change their quality of life.

Recuperative power is the most important element in coping with disasters; this is the ability to reduce negative results and facilitate recovery, and community leadership and resources are important components. In other words, it is helpful to have community gatherings that can establish effective ways to cope with disasters before they occur, build mutual community monitoring systems, and run mutual support programs\textsuperscript{12}. Thus, developing and spreading occupational activity programs that help disaster victims restore their roles in their communities are urgently required to increase their post-disaster recuperative powers. In the future, occupational therapists are needed who understand individuals’ lives and social roles and know the value of work, and they should be professionally prepared to help disaster victims.

**CONCLUSION**

For the victims of this natural disaster, providing them with opportunities to participate in their previous occupational activities helped them to improve their quality of life by recovering their pre-disaster daily routines and restoring their roles in the community. In addition to continuous psychological support and administrative services for the victims of natural disasters, systematic support for occupational activities is necessary as well that includes occupational activity experts who can support an environment that maintains victims’ humanity.

**Ethical Clearance:** Hanseo University

**Source of Funding:** N/A

**Conflict of Interest:** Nil

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Pitching Analysis of Body Variables According to Ball Velocity in Amateur Baseball Pitchers Using Gyro Sensor

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ABSTRACT

Background/Objectives: The purpose of this study was to examine the correlation of ball velocity with body variables in eight amateur baseball pitchers.

Methods/Statistical analysis: Eight amateur baseball pitchers (over-arm pitchers) participated in the study. Body variables were measured using wearable gyro sensors while they were fastball pitching. MVN system can measure kinematic of whole body using inertial sensor. The velocity of the ball was measured using a speed gun. The Pearson correlation coefficient was used to analyze the correlation between pitch velocity and body variables. Significance levels were set at p<0.05.

Findings: Ball velocity significantly correlated with the horizontal abduction and abduction of shoulder, trunk rotation angular velocity, stride length (p<0.05). However, no significant correlations were observed in trunk rotation angle (anterior and posterior), foot direction (p>0.05). Greater shoulder horizontal abduction during pitching motion has effective pre-stretch, stored elastic energy and tendons may be utilized during arm cocking and arm acceleration phase of pitch. As increased trunk rotation angular velocity, levels of trunks action develop more advanced and led to increases in energy transfer to the pitching arm. For stride length, it is regarded a not only critical kinematic factor for determine the timing of kinetic chain events but also transitioning energy to the pitching arm from lower extremity. In this study, we can compare with previous studies on pitching motion kinematics. Also previous studies on pitching motion analysis were mainly 3D camera based techniques. In this study, it is meaningful to analyze the pitching motion by using Gyro sensor which complements the limitation that 3D camera technique can have.

Improvements/Applications: Horizontal abduction and abduction of shoulder, trunk rotation angular velocity and stride length should be considered to increase the ball velocity, which is an important ability of the pitcher.

Keywords: MVN(Xsens, Gyro sensor), BaseballPitcher, Kinematics of pitching motion, Biomechanics, Motion analysis, Overhead throwing

INTRODUCTION

Motion capture system with video cameras has long been used to examine the kinematic analysis of the baseball pitching motion in an indoor laboratory. However, these motion capture systems have some limitations. Firstly, actual baseball is mainly used outdoors, but it can only be used in controlled environments. Second, the researcher must consider the capture range of the camera for the experiment. In addition, Chalmers PN et al. points out that variables such as variations in laboratory setup, sampling rate, marker placement, calibration, software assumptions and synchronization can produce errors in the results of the study. Some studies have used the inertial sensors in a manner to compensate for these limitations of the motion capture system for obtaining kinematic data.
this reason, inertial sensors (gyro sensor) were also used in our study to measure body variables during pitching performance. Linear acceleration, magnetic field strength and angular velocity can be collected through this wearable sensor.

Measuring the body variables during six phases (windup phase, stride phase, arm cocking phase, arm acceleration phase, arm deceleration phase, follow through phase) of pitching motion is an important factor in pitching, including velocity of ball for pitchers. The wind-up is a step in preparation for generating force, lifting the lead leg and bringing both hands together in the middle. Stride is a linear movement that starts to make velocity. The arm is positioned in the cocking position. The pelvis rotates in the direction of the home plate. In the cocking phase, the shoulder receives energy from the lower body and the torso. At this time, the shoulder externally rotates. The energy of the pelvis is delivered to the torso. The acceleration phase is the step of transferring the energy of the body to the ball. The following actions occur: internal rotation of shoulder, extension of elbow and flexion of wrist. In the deceleration phase, the deceleration of the arm movement starts from the release of the ball. The shoulders continue to rotate internally. The Follow-through phase is the step back to the original posture.

The maximum velocity of the ball in the pitching element is reported as one of the ability of the pitcher. Accordingly, many studies have examined relationships between ball velocity and body variables in baseball pitchers. These studies provide the factors that affect pitcher’s ball velocity such as body height, arm length, kinematic and kinetic parameter of body. In previous study, pitchers divided the subjects into two groups (high velocity group and low velocity group) according to the velocity of the ball. A motion analysis three-dimensional atomic digitizing system was used to compare the kinematic parameters of the two groups. As they reported, there were significant differences in the four kinematic parameters (lead knee flexion (extension) angular velocity at the instant of ball release, maximum shoulder external rotation and forward trunk tilt at the instant of ball release). In another study, the relationship between velocity of ball and pitching mechanism was investigated for the collegiate baseball pitchers. This study also reported a significant correlation with ten variables including maximum shoulder external rotation, maximum shoulder angular velocity, and maximum elbow extension angular velocity. These studies are important not only to improve the pitcher’s ability by increasing the velocity of the ball but also the appropriate pitching mechanics to prevent injury to the pitchers.

Knowledge of kinematic factors the correlate with velocity baseball pitchers could provide therapist and pitching coaches with areas on which to focus in training and pitcher development. However, studies on the correlation between velocity of ball and body variables are not sufficient and most studies use motion capture systems. Therefore, this study was conducted to examine the relationship between velocity of ball and body variables using wearable sensors and compare with previous studies.

**MATERIALS AND METHOD**

**Participants:** Eight amateur baseball pitchers (over-arm pitchers) participated in the study after understanding and agreeing to the study. We examined the general characteristics of all subjects; Pitchers had a mean age of 18.38±0.52 years, height of 182.22±2.59cm and weight of 79.88±6.31kg. Also all subjects were right-handed. The exclusion criteria for this study were: Those who have undergone surgery for upper extremities or lower extremities within 6 months, those who have had rehabilitation treatment due to injury, severe pain, or those who have difficulty throwing ball for other reasons. Side-arm pitchers and underhand pitchers (submarine) were excluded because they had different pitching mechanics than over-arm pitchers.

**Procedure:** Body variables were measured using wearable gyro sensors (MVN, Xsens technologies B.V., Enschede, the Netherlands) while they were fastball pitching. MVN system can measure kinematic of whole body using inertial sensor as shown in figure 1. Various data such as segment information, joint angle data, and mass center are measured. The velocity of the ball was measured using a speed gun (Sport radar, 34.7 GHZ, SP 78585, APPLIED CONCEPTS, INC., USA.)

Body variables included range of motion of shoulder (horizontal abduction and abduction) at arm cocking, trunk rotation angular velocity, trunk rotation angle range (posterior), trunk rotation angle range (anterior), foot direction and stride length. Body variables refer to the following; Trunk rotation angle range (posterior) is
After finishing the usual warm-up, including stretching of the extremities and pitching training, the pitcher was asked to pitch 10 to 15 fastballs. The subjects had a rest for about 20 to 30 seconds until they threw the ball once and threw the next ball. As a result, one hundred fifteen pitching data of eight amateur pitchers were collected.

**DATA ANALYSIS**

Means and standard deviation of all data was analyzed. The Pearson correlation coefficient was used to analyze the correlation between pitch velocity and body variables. Significance levels were set at \( p<0.05 \). All data analyses were performed using SPSS statistical software (version 22.0; IBM Corp, Armonk, NY).

**RESULTS AND DISCUSSION**

Correlations between ball velocity of pitchers and body variables were analyzed and the results are shown in Table 1. The mean and standard deviation of the one hundred fifteen pitching data of subjects were 28.48±4.27 m/s. According to result, ball velocity significantly correlated with the horizontal abduction and abduction of shoulder, trunk rotation angular velocity, stride length \( (p<0.05) \). However, no significant correlations were observed in trunk rotation angle (anterior and posterior), foot direction \( (p>0.05) \).

**Table 1: Correlation of body variables with ball velocity**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shoulder horizontal abduction (°)</td>
<td>0.524*</td>
</tr>
<tr>
<td>Shoulder abduction (°)</td>
<td>0.343*</td>
</tr>
<tr>
<td>Trunk rotation angle (posterior) (°)</td>
<td>0.142</td>
</tr>
<tr>
<td>Trunk rotation angle (anterior) (°)</td>
<td>-0.142</td>
</tr>
<tr>
<td>Trunk rotation angular velocity (°/s)</td>
<td>0.719*</td>
</tr>
<tr>
<td>Food direction (°)</td>
<td>-0.031</td>
</tr>
<tr>
<td>Stride length (% height)</td>
<td>0.684*</td>
</tr>
</tbody>
</table>
This study investigated the correlation between ball velocity and body variables in amateur baseball pitchers. Ball velocity was affected by horizontal abduction and abduction of shoulder, trunk rotation angular velocity and stride length.

In many studies, motion capture cameras are being used as a method for analyzing biomechanics in various fields as well as baseball. Nonetheless, some of these limitations are constantly being reported. The motion capture system is expensive and can be used only when there is space for camera setting. Therefore, research is mainly carried out indoors. In addition, kinematic elements including position, velocity, and acceleration can be measured but do not include kinetic information and require much preparation time to set up the camera, calibrate, and attach markers. Due to these limitations, recent biomechanical studies have been conducted using inertial sensors. In this study, body variables were measured using wearable inertial sensors. Although inertial sensors are currently being studied actively, studies for comparing and analyzing inertial sensors and motion capture system data through the same subject should be further developed.

In our study, there was a significant correlation between ball speed and horizontal abduction. This means that as the angle range of horizontal abduction increases, the velocity of the ball increases. Rafael Escamilla et al. also reported a significant relationship between horizontal abduction and velocity of ball. In their study, the external rotation range of the shoulder as well as the horizontal abduction was significantly correlated with the velocity of the ball. As the shoulder range increases, the anterior muscles of the shoulder are stretched, and the effect of this stretching is that the elastic energy is stored in the muscle. As a result, the pitcher was able to throw the ball faster by using the energy stored in the muscle or tendon when the ball was thrown. Our results also suggest that there is a significant relationship between ball speed and shoulder range of motion due to such a principle of mechanism. Similarly, other studies have reported a significant correlation between velocity of ball and external rotation of the shoulder. They found that the high velocity group had greater shoulder external rotation in the arm-cocking phase than the low velocity group. It is reported that when the external rotation is greater, stronger shoulder contraction may occur due to the action of stored elastic energy, the myotatic reflex, and a greater rate of force production during pre-stretched and contracting muscles during arm acceleration phase. It has already been reported that the greater the elastic energy stored in the tendons or fascia, the greater the force. The study of external rotation was excluded from the variables of this study because much of it has already been studied.

Also, trunk rotation angular velocity is important for velocity of ball. As increased trunk rotation angular velocity, levels of trunks action develop more advanced and led to increases in energy transfer to the pitching arm. Considering that trunk rotation angle (posterior) and trunk rotation angle (anterior) were not significantly related to ball velocity, we could confirm that the faster ball can be thrown through the faster angular velocity even if the motion of the torso is not large.

For stride length, it is regarded as a not only critical kinematic factor for determine the timing of kinetic chain events but also transitioning energy to the pitching arm. Terrance et al. also reported that each increase in stride length by 10% of the subject’s height was associated with a 1.9±0.4 mph increase in velocity. As a result, pitching coaches should focus on stride length to increase the ball velocity of the pitcher.

There are some limitations to the study. Our study does not generalize the results because of the small number of subjects. And research was done only on amateur pitchers. If professional baseball pitchers were the subjects of the study, they might have produced a different result. In addition, since only the kinematic elements of the shoulder were measured in this study, the strength of the individual, which could affect velocity of ball, was not considered. Therefore, in future research, the pitching kinematics of professional baseball pitchers as well as amateur athletes should be studied using inertial sensors, and more variables should be measured. Furthermore, clarifying the body variables that change with the injury mechanism will be of great help to pitchers and coaches.

**CONCLUSION**

In conclusion, horizontal abduction and abduction of shoulder, trunk rotation angular velocity and stride length should be considered to increase the ball velocity, which is an important ability of the baseball pitcher in training and rehabilitation. The study uses inertial sensors to collect data, and more diverse data via inertial
sensors must be collected and compared with various biomechanical analysis instruments before that.

**Ethical Clearance:** Taken from Sun Moon University

**Source of Funding:** Self

**Conflict of Interest:** Nil

**REFERENCES**


A Study on Difference in Perceived Satisfaction of Physical Environment of Dragon Boat Festival at Waterfront by the Levels of Participation and Nationality

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ABSTRACT

Background/Objectives: The aim of this study was to identify differences in perceived satisfaction of physical environment of Dragon Boat festival at waterfront according to the levels of participation and nationality.

Methods/Statistical analysis: A total of 261 respondents who participated in International Dragon Boat festival in Korea were selected by convenience sampling method. The instrument for data collection was a questionnaire, and instruments of physical environment factors to measure perceived satisfaction of Dragon Boat festival were adapted from previously validated scales. Principle Component Analysis (PCA), descriptive analysis, One-way ANOVA, and T-test were conducted to analyze the data by using SPSS 21.0.

Findings: The findings showed that international level’s participants indicated more satisfaction with venue adequacy and accessibility than domestic and citizen level’s participants. For cost-benefit, international level’s participants were also happier than domestic level’s participants. It implied that different levels of approaches considering the levels of participants are required, and therefore multidimensional strategies reflecting various elements should be established to increase overall quality of the festival. It would be helpful for organizers to consider key elements, such as venue adequacy and accessibility more important, as the participants tend to be considered them more sensitive than other factors. Moreover, foreign participants were happier with accessibility, venue adequacy, and cost-benefit among the physical environment factors than Korean participants. It might be a consequence due to providing them with different service during the festival. Also, the Korean participants might be unfriendly to differentiated marketing strategies between the Korean and foreign participants. Therefore, the organizers should seek to improve overall service quality of the event and establish long-term planning for satisfying the Korean participants.

Improvements/Applications: The organizers should continually come up with systematic operating process considering the participants’ characteristics and improve the physical environment factors reflecting regional characteristics nearby the waterfront.

Keywords: Dragon Boat festival, sport event management, physical environment, waterfront, satisfaction

INTRODUCTION

A waterfront is a place in which local residents or visitors can enjoy their leisure time and sports activities. Animated discussion over the waterfront utilization planning has become increasingly important as the waterfront facilitates various recreation programs, festivals, and development plans1. Dragon Boat festival is one of water-based leisure events reflecting...
its characteristics of the waterfront, which was mostly developed in China. Similarly, in Korea, the Dragon Boat festival mainly takes place in the waterfront, such as the Han River in Seoul, the Gyeongin Ara waterway in Incheon, and the Suyeong River in Busan, and has become a new form of leisure sports. In particular, sporting events held in the waterfront can greatly contribute to local development in that the waterfront is a distinctive location where urban and nature live in harmony.

In spite of environmentally friendly benefits, however, the festival is highly likely to be neglected by spectators and participants if the nature of the festival or participants is overlooked, and therefore requires suitable component parts considering the nature of the participants and festival. In light of utilizing the waterfront, especially, physical environment factors of a venue and event factors for the characteristics of the festival are considered very important. In other words, a variety of physical environment and event factors that satisfy needs of the spectators and participants are important elements, leading to a successful festival and further local development.

To sum up, this study aimed at reflecting the needs of the participants and spectators through analyzing differences in the physical environment factors of Dragon Boat festival considering the nature of the event place by the levels of participation and participants' nationality. By doing so, the study sought to suggest more satisfactory environment factors of the festival by identifying the physical environment factors which are suitable for the festival at the waterfront by the characteristics of the participants.

MATERIALS AND METHODS

Participants: A survey was conducted by convenience sampling method among non-probability sampling techniques, and a total of 261 respondents who participated in 2016 the Minister of Oceans and Fisheries's Cup Dragon Boat festival in Gyeongin Ara waterway were used for the sample of the study. As table 1 shows, among 261 respondents, 141 (54%) were male and 120 (46%) were female. In terms of age group, 101 (38.7%) were between 10s and 20s. Ages between 30 and 39 were 104 (39.9%), 56 (21.4%) were over 50 years old. The levels of the participation were consisted of international level division (N=124, 47.5%), domestic level division (N=64, 24.5%), and citizen level division (N=73, 28%). Also, 146 (55.9%) of the respondents were Korean, and 115 (44.1%) were foreign participants.

DATA ANALYSIS

For construct validity, Principle Component Analysis (PCA) was conducted with varimax method, identifying eigenvalues exceeding 1.0. The varimax method is a common way of orthogonal rotation, which can be useful to minimize the number of variables having high loadings on each factor. Consequently, the physical environment factors satisfying the participants were largely divided into five factors. Items with more than .50 was considered a statistically significant level, and as shown in table 2, the physical environment factors were consisted of ‘service responsiveness’,

The Kaiser-Meyer-Olkin (KMO) value measures adequacy of the sample used for the analysis, and Bartlett’s Test of Sphericity can identify the factorability of the correlation matrix. As a result, KMO was .930, which exceeds above the recommended .60 level, and the values of Bartlett’s Test were $df = 153$ and $p = .001$, suggesting that all items are suitable for the factor analysis. Also, five factors explained 73.89%, indicating that it has enough explanation ability toward the total variables with good convergent validity. Five dimensions of Cronbach’s alpha coefficient for internal reliability were between .723 and .909, which had relatively high reliability, as they exceed .70 suggested by DeVellis. Lastly, One-way Analysis of Variance (ANOVA) and T-test were carried out to analyze the data by using SPSS 21.0.

### Table 2: Results of Principle Component Analysis (PCA)

<table>
<thead>
<tr>
<th></th>
<th>Service responsiveness</th>
<th>Experience</th>
<th>Accessibility</th>
<th>Cost-benefit</th>
<th>Venue adequacy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service responsiveness 1</td>
<td>.778</td>
<td>.381</td>
<td>.240</td>
<td>.110</td>
<td>.138</td>
</tr>
<tr>
<td>Service responsiveness 2</td>
<td>.769</td>
<td>.299</td>
<td>.201</td>
<td>.121</td>
<td>.172</td>
</tr>
<tr>
<td>Service responsiveness 3</td>
<td>.760</td>
<td>.115</td>
<td>.153</td>
<td>.362</td>
<td>.219</td>
</tr>
<tr>
<td>Service responsiveness 4</td>
<td>.721</td>
<td>.408</td>
<td>.182</td>
<td>-.005</td>
<td>.209</td>
</tr>
<tr>
<td>Service responsiveness 5</td>
<td>.673</td>
<td>.101</td>
<td>.193</td>
<td>.377</td>
<td>.195</td>
</tr>
<tr>
<td>Experience 1</td>
<td>.279</td>
<td>.801</td>
<td>.141</td>
<td>.156</td>
<td>.179</td>
</tr>
<tr>
<td>Experience 2</td>
<td>.263</td>
<td>.791</td>
<td>.208</td>
<td>.211</td>
<td>.118</td>
</tr>
<tr>
<td>Experience 3</td>
<td>.220</td>
<td>.706</td>
<td>.265</td>
<td>.318</td>
<td>.110</td>
</tr>
<tr>
<td>Experience 4</td>
<td>.362</td>
<td>.510</td>
<td>.198</td>
<td>.236</td>
<td>.356</td>
</tr>
<tr>
<td>Accessibility 1</td>
<td>.235</td>
<td>.177</td>
<td>.814</td>
<td>.149</td>
<td>.277</td>
</tr>
<tr>
<td>Accessibility 2</td>
<td>.248</td>
<td>.240</td>
<td>.775</td>
<td>.203</td>
<td>.202</td>
</tr>
<tr>
<td>Accessibility 3</td>
<td>.197</td>
<td>.253</td>
<td>.704</td>
<td>.371</td>
<td>.085</td>
</tr>
<tr>
<td>Cost-benefit 1</td>
<td>.082</td>
<td>.232</td>
<td>.199</td>
<td>.766</td>
<td>.197</td>
</tr>
<tr>
<td>Cost-benefit 2</td>
<td>.280</td>
<td>.321</td>
<td>.199</td>
<td>.721</td>
<td>.094</td>
</tr>
<tr>
<td>Cost-benefit 3</td>
<td>.324</td>
<td>.138</td>
<td>.297</td>
<td>.595</td>
<td>.284</td>
</tr>
<tr>
<td>Venue adequacy 1</td>
<td>.075</td>
<td>.134</td>
<td>.182</td>
<td>.234</td>
<td>.767</td>
</tr>
<tr>
<td>Venue adequacy 2</td>
<td>.191</td>
<td>.086</td>
<td>.252</td>
<td>.056</td>
<td>.750</td>
</tr>
<tr>
<td>Venue adequacy 3</td>
<td>.321</td>
<td>.204</td>
<td>.020</td>
<td>.152</td>
<td>.683</td>
</tr>
</tbody>
</table>

Kaiser-Meyer-Olkin = .930, $df = 153$, $p = .001$

**RESULTS AND DISCUSSION**

**Results:** In the study, the physical environment factors satisfying the participants were identified, and One-way ANOVA and T-test were performed to determine whether there are significant differences in the physical environment factors according to the levels of participation (international, domestic, and citizen level division) and their nationalities (Korean and foreigner).
Physical environment factors of the Dragon Boat festival: In order to explore the overall level of awareness with regard to the physical environment factors of the Dragon Boat festival at the waterfront, the mean and standard deviation values were identified. As shown in Table 3, experience (M = 3.80, SD = .83) had slightly higher mean score than the other four factors: venue adequacy (M = 3.79, SD = .78), service responsiveness (M = 3.76, SD = .83), cost-benefit (M = 3.74, SD = .81), and accessibility (M = 3.60, SD = .90).

Table 3: Physical environment factors (N=261)

<table>
<thead>
<tr>
<th>Factors</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service responsiveness</td>
<td>3.76</td>
<td>.83</td>
</tr>
<tr>
<td>Experience</td>
<td>3.80</td>
<td>.77</td>
</tr>
<tr>
<td>Accessibility</td>
<td>3.60</td>
<td>.90</td>
</tr>
<tr>
<td>Cost-benefit</td>
<td>3.74</td>
<td>.81</td>
</tr>
<tr>
<td>Venue adequacy</td>
<td>3.79</td>
<td>.80</td>
</tr>
</tbody>
</table>

Tests of differences in the Physical environment factors by participation part

Test of differences in the physical environment factors by the levels of participation

One-way ANOVA test for perceived differences in the physical environment factors by the levels of participation was presented in Table 4. It was found that there were significant differences in venue adequacy (F = 13.040, p = .001) and accessibility (F = 10.460, p = .001) among the levels of participation. As a result of Post-Hoc test, perceived satisfaction of the international level’s participants was significantly higher than that of domestic and citizen level’s participants. Also, the finding showed that the participations in international level division were happier with cost-benefit (F = 5.134, p = .01) than those in domestic level division.

Table 4: Perceived differences in the physical environment factors by the levels of participation

<table>
<thead>
<tr>
<th>Factor</th>
<th>Participant level</th>
<th>M</th>
<th>SD</th>
<th>F</th>
<th>p</th>
<th>Post-Hoc test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service responsiveness</td>
<td>International level</td>
<td>3.83</td>
<td>.79</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Domestic level</td>
<td>3.67</td>
<td>.74</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Citizen level</td>
<td>3.73</td>
<td>.94</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experience</td>
<td>International level</td>
<td>3.91</td>
<td>.66</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Domestic level</td>
<td>3.73</td>
<td>.79</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Citizen level</td>
<td>3.69</td>
<td>.90</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Accessibility</td>
<td>International level</td>
<td>3.79</td>
<td>.65</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Domestic level</td>
<td>3.18</td>
<td>1.04</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Citizen level</td>
<td>3.64</td>
<td>1.03</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost-benefit</td>
<td>International level</td>
<td>3.85</td>
<td>.73</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Domestic level</td>
<td>3.47</td>
<td>.86</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Citizen level</td>
<td>3.79</td>
<td>.85</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Venue adequacy</td>
<td>International level</td>
<td>3.95</td>
<td>.71</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Domestic level</td>
<td>3.38</td>
<td>.67</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Citizen level</td>
<td>3.38</td>
<td>.86</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Test of difference in the physical environment factors by the nationality: T-test for perceived differences in the physical environment factors by the nationality was presented in Table 5. It was found that foreign participants were happier with accessibility (t = -3.634, p = .001), venue adequacy (t = -3.352, p = .01), and cost-benefit (t = -1.969, p = .05) than Korean participants.

Table 5: Perceived differences in the physical environment factors by nationality

<table>
<thead>
<tr>
<th>Factor</th>
<th>Nationality</th>
<th>M</th>
<th>SD</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service responsiveness</td>
<td>Korean</td>
<td>3.71</td>
<td>.84</td>
<td>-1.051</td>
<td>.294</td>
</tr>
<tr>
<td></td>
<td>Foreigner</td>
<td>3.82</td>
<td>.81</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

DISCUSSION

Regarding the physical environment factors for perceived satisfaction of the Dragon Boat festival,
international level’s participants indicated more satisfaction with venue adequacy and accessibility than domestic and citizen level’s participants. For cost-benefit, international level’s participants were happier than domestic level’s participants. The findings implied that different levels of approaches considering the levels of participants are required. In other words, multidimensional strategies reflecting participants’ performance and expectations to the festival should be established to increase the quality of the festival. In this regard, it has been argued that the higher level of the participants tend to be influenced by the overall levels of service quality and performance of those more sensitive. In most cases, International Dragon Boat festival has sought various approaches to provide foreign players with convenience and benefits. Key elements, such as venue adequacy and accessibility, however, should be recognized as significant environmental factors that the participants considered them more sensitive than other factors. By contrast with high levels of participation, citizen level for amateur is thought to have a different expectation level toward the festival, as the participants in the level might engage in the festival as part of leisure activities. Therefore, it would be necessary for festival organizers to use differentiated marketing strategies like scheduling and time management by the level of the participants, in order to satisfy everyone within each level during the festival.

Moreover, foreign participants were happier with accessibility, venue adequacy, and cost-benefit among the physical environment factors than Korean participants. It can be inferred a consequence occurred by providing different service between the Korean and foreigner during the festival. The foreigner participants, for example, were supported diverse tangible and intangible benefits, such as transportation, catering, and accommodations by the organizer, which could result in higher satisfaction. In addition, the Dragon Boat festival at the waterfront has been vigorously developed in and around China, while it has recently sprung up, and has just been a type of water sports which was held in certain locations of Korea. Actually, the environment for participating in Dragon Boat in Korea has some limitations to expand its base as sport for all, except for a few club-based activities. In other words, there have been a variety of restrictions on engaging in the festival. As a result, this implies that the Korean participants from a long distance away were not relatively satisfied with the physical environment factors, such as accessibility and cost-benefit, and further may be unfriendly to differentiated supporting strategies between the Korean and foreign participants. In addition to planning and managing the festival, therefore, organizers should also seek to establish long-term planning with competent authority for improving service quality which the Korean can satisfy and expanding its base.

Lastly, different kinds of the festival have their own characteristics, and therefore organizers need a close proactive analysis to make sure needs and preferences of the participants participating in festival. These efforts can help improve the festival’s awareness through appropriate service quality and physical environment, which lead to re-participation in future. Thus, it would be apparent that the organizers’ expertise, well-organized system, and selection and training programs of staff for the effective management and pleasant service offer should be considered to strengthen the overall service quality of the festival. VLSI Based Mixed-Radix 8-2 Butterfly FFT with Bit Reversal for 802.11a explained in 17.

**CONCLUSION**

The study explored appropriate physical environment factors for satisfaction of the Dragon Boat festival at the waterfront, and then conducted analysis of difference in the factors by the levels of the participants and nationality.

The findings articulated that the higher level of the participants highly perceived cost-benefit, venue adequacy, and accessibility, and the foreign participants were happier with accessibility, venue adequacy, and cost-benefit among the factors than Korean participants. Based on the result, organizers should come up with systematic operating process considering the participants’ characteristics, such as level and nationality in the future. Also, it would be necessary to improve and create the physical environment factors reflecting each event within the festival and regional characteristics nearby the waterfront.

The study solely explored the difference analysis by the levels of the participants and nationality. Therefore, further research needs to understand more diverse environment factors and then investigate the difference in the factors by the levels of participation experience. Lastly, it would be essential to expand the research field on the relationship among the Dragon Boat festival at the waterfront, regional suitability, and expected effect from hosting festival.
Ethical Clearance: Taken from Baekseok University

Source of Funding: Self

Conflict of Interest: Nil

REFERENCES


Effects of Adolescents’ Academic Stress on School Life Adjustment: Focusing on Mediator Effect of Resilience

In Kim, Woong-soo Kim, Seong-chan Bae

1Research Scholar, 2Professor, Dept. Social welfare, Hanil University, Korea

ABSTRACT

Background/Objectives: Academic stress produced in adolescence can make students lose interest in school life and it can lead to maladjustment in school or problematic behavior.

Methods/Statistical analysis: Therefore, this study is executed to provide evidences required for intervening method which can improve adolescents’ school life adjustment. This study was conducted targeting 1200 students attending 12 elementary schools and 14 middle schools which are located at Jeollabuk-do province, Korea.

Findings: Determinants which affect adolescents’ school life adjustment are resilience, academic stress, classes of schools, economic levels. It turned out that the higher the adolescents’ academic stress, the lower the school life adjustment. Moreover, the academic stress turned out to has mediator effect of resilience in effects of academic stress to school life adjustment.

Improvements/Applications: These results mean that adolescents have high resilience can deal with and overcome problematic situation better. In adolescence, creative field works like psychomotor which can improve spontaneity and self-confidence, have to be carried out in school activities.

Keywords: youth welfare, adolescent, academic stress, school life adjustment, resilience

INTRODUCTION

School significantly affects to adolescents’ growth and development during life. Adolescents acquire skills required for improvement in life and prepare social adjustment through academic achievement. However, Korean adolescents are having serious mental and emotional stress due to college entrance focused study and punishment focused instruction, and experiencing severe maladjustment in school because these phenomena were intensified. Moreover, due to these realities, many adolescents’ problems were intensified and are becoming causes of educational pathology phenomenon.

In spite of continuous growth of the number of adolescents, adolescents about fifty to sixty thousands of adolescents are ceasing their study, and the number of children excluded from school are estimated two hundred and eighty hundred, according to Ministry of Gender. Ceasing study can make adolescents be exposed to various dangers and losing opportunities and acquiring skills required in development in life. Moreover, many problematic behaviors are appearing related to school life due to increase of school violence and conflict with teachers. Adolescents who are not adapted to school are likely to lack confidence along with anxiety, despair and alienation and it can lead to psychologically and emotionally problematic behaviors. Serious maladjustment turns up into refusing to go to school, running away from home, abusing drugs and violating behavior and causes emotional problems which are not expressed well such as disobedience, anxiety, impatient, demotivation and depression. In these situations, we should pay attention to adolescents’ adjustment in school. School is a significant place for adolescents’ growth and development and a place for improving resilience.
Adolescence requires physically, mentally and socially proper development and maturity. It is a period when one’s identity is not fully established and is a period of transition when people experience confusion and wandering because of various internal, external challenges and changes. Especially, variety of stress which adolescents experience might impede healthy growth and development, supports are needed to deal with them properly. Among stress adolescents experience, academic stress is representative and it causes mental pressure, tension, depression, and restlessness, which brings about psychological anxiety, because of school work or grades.

About 70 percent of Korean adolescents consider suicide because of academic stress and it appears that they are having hard time psychosocially adapting in daily lives due to academic stress. Moreover, related to academic stress, grades and career problems in grade focused school system are bringing about students heavy stress and maladjustment. If adolescents’ academic stress does not be relieved, it leads to academic slump and damage physical and mental function that causes complex problems like behavior and mental handicap. Considering previous studies about academic stress, highest percentage of stress for Korean adolescents is academic stress. Academic stress brings about negative outcome in academy and affects variety of negative health problems including depression, anxiety and physical symptoms. Furthermore, academic stress becomes other stresses and acts as another cause of every stresses that appears in adolescents’ lives. As a result, excessive academic stress in adolescence can lead to problematic behavior and it can ultimately threat school adjustment. Problematic behavior related to academic stress leads to school maladjustment, and school maladjustment is a behavior to escape from school to relieve anxiety caused by frustration and conflict during school adjustment.

Serious academic stress makes school adjustment difficult, so it requires study about factors that can buffer negative effects and solutions to relieve academic stress and improve school adjustment. Therefore psychological mechanism is required that can efficiently handle the stress by finding positive meaning in spite of conflicting with academic stress and resilience can take this role. Resilience acts as a protective factor that supports adolescents to deal with problematic situations flexibly. Especially, resilience is crucial in improving the adjustment skills caused by anxiety and stress. It is because resilience is an individual skill that can successfully solve difficult situations or crisis. Thus, active reaction to solve stressful condition actively without avoiding it can act significantly to adolescents experiencing serious academic stress. Adolescents with high resilience can improve school adjustment by developing adjustment and problem solving skills even in stressful condition. Actually we can see that adolescents’ stress and resilience are important factors affecting at decreasing mental problems and academic stress and resilience have close relationship. Adolescents’ resilience increases adjustment skills to react healthily to academic stress, and if they have high resilience, they have ability to adjust and control their emotions positively so that they can regulate academic stress in psychologically stable status.

However previous studies are insufficient that proving relationship between academic stress, resilience and school adjustment at once. This research derives amalgamative and complex intervention strategies by proving relationship between school adjustment and resilience related to academic stress that Korean adolescents have.

**MATERIALS AND METHOD**

**Research Target and Collecting Survey:** This study was conducted targeting 1200 students attending 12 elementary schools and 14 middle schools which are located at Jeollabuk-do province, Korea. Total number of questionnaires collected is 1127 and the study used 1018 of them in analysis, excluding 109 questionnaires which are insincere. The survey was conducted by dividing main survey and preliminary survey which was for understanding problems during production and investigation. Before the preliminary survey in the study, two researchers in master’s degree reviewed the questionnaire to make sure it has appropriate organization and base on the review, we modified and complemented its question methods, answer forms and overall formation.

**Research Methods:** Dependent variables in the study were used by modifying and complementing academic and school life questionnaires about school adjustment that was previously developed by Lee Gu-Mee. Independent variables was used by amending academic stress criterion that was made by Park Yong-Sik, modifying Social Readjustment Ration Scale, based on theory of stress factors that Elkind suggested. Resilience criterion which is a parameter that was modified and complemented by Koo Jae-Eun which was firstly developed by Block and Block was used.
In this study, demographic sociological features like gender, school, family form, and economic status are used as control variables.

**Date Analysis:** Date were analysed by using SPSS PC+ Win 21. The study used analysis method as such to analyze relationship between academic stress, resilience and school adjustment. First, it conducted frequency analysis and descriptive statistics analysis to discover subjects’ general features and main factors’ features. Second, it used correlation analysis to study relationship between childhood school adjustment and main factors. Lastly, it employed mediator effect analysis, thus Mediating regression, to find out resilience’s mediator effect through Baron and Kenny’s\cite{15} regression analysis in relationship between academic stress and school adjustment.

**RESULTS**

**Characteristics of the Subjects:** In the case of Gender, the number of male students were 567(55.7%) and female students were 451(44.3%). Moreover, in the case of family form, 80.2 percent of respondents were living with their biological parents and the rest of 19.8% of respondents had other forms of family. Most of the respondents replied(86.5%) as ‘more than average’ and 137(13.5%) respondents replied as ‘bad’ when it comes to economic status. (Table 1)

**Table 1: Characteristics of the subjects**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Category</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>Male</td>
<td>567</td>
<td>55.7</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>451</td>
<td>44.3</td>
</tr>
<tr>
<td>School</td>
<td>Elementary</td>
<td>545</td>
<td>53.5</td>
</tr>
<tr>
<td></td>
<td>Middle</td>
<td>473</td>
<td>46.5</td>
</tr>
<tr>
<td>Family form</td>
<td>prenatal</td>
<td>816</td>
<td>80.2</td>
</tr>
<tr>
<td></td>
<td>Step parents</td>
<td>202</td>
<td>19.8</td>
</tr>
<tr>
<td>Economic status</td>
<td>Very bad</td>
<td>59</td>
<td>5.8</td>
</tr>
<tr>
<td></td>
<td>Bad</td>
<td>78</td>
<td>7.7</td>
</tr>
<tr>
<td></td>
<td>Average</td>
<td>622</td>
<td>61.1</td>
</tr>
<tr>
<td></td>
<td>Good</td>
<td>224</td>
<td>22.0</td>
</tr>
<tr>
<td></td>
<td>Very good</td>
<td>35</td>
<td>3.4</td>
</tr>
</tbody>
</table>

**Characteristics of Major Variables:** Overall average of school adjustment which is dependent variable in the research was 3.901(SD=.573), average of resilience which is mediator factor is 3.485(SD=.632) which are higher than average and average of academic stress which is independent variable is 2.005(SD=.650) was little lower than average. (Table 2)

**Table 2: Characteristics of major variables**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Category</th>
<th>Number</th>
<th>Min.</th>
<th>Max.</th>
<th>Mean</th>
<th>S.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dependent variable</td>
<td>School Life</td>
<td>1018</td>
<td>1.43</td>
<td>5.00</td>
<td>3.901</td>
<td>.573</td>
</tr>
<tr>
<td>Mediation variable</td>
<td>Resilience</td>
<td>1018</td>
<td>1.09</td>
<td>4.78</td>
<td>3.485</td>
<td>.632</td>
</tr>
<tr>
<td>Independent variable</td>
<td>Academic stress</td>
<td>1018</td>
<td>1.00</td>
<td>5.00</td>
<td>2.005</td>
<td>.650</td>
</tr>
</tbody>
</table>

**Characteristics Correlation among Major Variables:** Result of investigation of correlation between independent variables are at (Table 3). Maximum of correlation between major variables was .617 so it can be seen that multicollinearity has not been found. As a result of investigating Tolerance and Variance Inflation Factor to verify multicollinearity more strictly, maximum of correlation was .617 and all of them were higher than .01, also Variance Inflation Factor was not near to 10. Therefore it was judged that multicollinearity was low.

**Table 3: Correlation among major variables**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Academic stress</th>
<th>Resilience</th>
<th>School Life adjustment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Academic stress</td>
<td>1</td>
<td>-.518**</td>
<td>-.617**</td>
</tr>
<tr>
<td>Resilience</td>
<td>-.518**</td>
<td>1</td>
<td>.583**</td>
</tr>
<tr>
<td>School Life adjustment</td>
<td>-.617**</td>
<td>.583**</td>
<td>1</td>
</tr>
</tbody>
</table>

\[^{**p<.01}\]

The moderation effect on the relationship of academic stress, resilience and school Life

To identify resilience mediated effect in the course of children’s stress affecting school adjustment, the study utilized mediation regression analysis and computed the result. To verify resilience mediated effect in relationship between children’s academic stress and school adjustment, the study used mediated regression analysis like (Table 4) in three steps. The study verified effects of academic stress in resilience in first step, and effects of academic stress in school adjustment in second step. In last third step, to verify effects of resilience in school adjustment in regulating effects of academic stress which is independent variable, the study injected both academic stress and resilience in independent variables, analyzed them and identified effects in school adjustment. Regression coefficient of independent
variables drew as a result of second step regression analysis, should be larger than regression coefficient of independent variable drew by third step to have mediated effect. In model 1, validity of academic stress about resilience and dependent variable was 28.9% and the validity was proved to be meaningful statistically. In addition, it was identified that adolescents’ academic stress($\beta = -.492$, $p < .001$) was identified that it has statistically meaningful effects to resilience. Among dependent variable, gender($\beta = .055$, $p < .05$) and economic state($\beta = .127$, $p < .01$) was verified to affect meaningfully. In model 2, academic stress affects to school adjustment and it had 39.7% of validity. Thus, it is proved that lower the academic stress, the higher the school adjustment. Among dependent variables, it is shown that school and economic state affected meaningfully. Lastly, as a result of model 3, which analyzed injecting both academic stress, independent variable, and resilience, mediated variable, showed 48.7% of validity in school adjustment. Resilience, which is mediated variable, is identified that it has meaningful effect even in restricting academic stress, which is independent variable($\beta = .355$, $p < .001$). However, it is verified that there is resilience’s partial mediation effect by identifying effect in academic stress, independent variable, of school adjustment has also statistically meaningful difference. Among dependent variables, school was shown be statistically meaningful, which means that elementary school students have higher school adjustment.

Table 4: Effect of academic stress, resilience and school life adjustment

<table>
<thead>
<tr>
<th>Classification</th>
<th>Model 1 (academic stress → resilience)</th>
<th>Model 2 (academic stress→ school Life adjustment)</th>
<th>Model 3 (academic stress → resilience →school Life adjustment)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$B$ $\beta$ $t$</td>
<td>$B$ $\beta$ $t$</td>
<td>$B$ $\beta$ $t$</td>
</tr>
<tr>
<td>Constant</td>
<td>4.706 61.817***</td>
<td>5.107 80.235***</td>
<td>3.591 27.962***</td>
</tr>
<tr>
<td><strong>Control variable</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender (0=male, 1=female)</td>
<td>.070 .055 2.055*</td>
<td>.005 .004 .162</td>
<td>-.018 -.016 -.681</td>
</tr>
<tr>
<td>School (0= elementary-school students) 1= middle-school students</td>
<td>.004 .003 .122</td>
<td>-.120 -.105 -4.067***</td>
<td>-.122 -.106 -4.456***</td>
</tr>
<tr>
<td>Family form (0= prenatal parents, 1= step parents)</td>
<td>-.047 -.030 -1.055</td>
<td>-.025 -.018 -.678</td>
<td>.010 -.007 -.293</td>
</tr>
<tr>
<td>economic status</td>
<td>.098 .127 4.343***</td>
<td>.043 .060 2.252*</td>
<td>.011 .016 .622</td>
</tr>
<tr>
<td><strong>Independent variable</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Academic stress</td>
<td>-.478 -.492 -17.719***</td>
<td>-.510 -.578 -22.623***</td>
<td>-.356 -.404 -14.948***</td>
</tr>
<tr>
<td><strong>Mediation variable</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Resilience</td>
<td></td>
<td></td>
<td>.322 .355 12.952***</td>
</tr>
</tbody>
</table>

$p<.05$, $***p<.001$

To verify the result that resilience of mediation effect is statistically meaningful more accurately, the study implemented Sobel test and suggested schematized result. Sobel test that identifies mediation effect verifies whether the courses a, a course independent variable stress from mediation variable resilience and b, a course mediation variable resilience from dependent variable happiness are meaningful. A verification result through Sobel test is
like (Table 5). It was identified that mediation variable resilience in relationship between academic stress and school adjustment has statistically meaningful mediation effect\( (z=-11.351, \ p<.001) \). According to MacKinnon et al’s study\(^{16-17} \), a Sobel test result for verifying mediation effect is meaningful when the result is bigger than ±1.96, and the study’s result is bigger than ±1.96. Therefore it is identified that resilience in relationship between academic stress and school adjustment is statistically meaningful.

<table>
<thead>
<tr>
<th>Channel between variations</th>
<th>Estimation (Standard Deviation a)</th>
<th>Estimation (Standard Deviation b)</th>
<th>Zab</th>
</tr>
</thead>
<tbody>
<tr>
<td>Academic stress → Resilience</td>
<td>-.478 (.027)</td>
<td>.355 (.024)</td>
<td>-11.351***</td>
</tr>
<tr>
<td>Resilience → School Adjustment</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

***p<.001

### DISCUSSION

Significant results and discussion of the study are as follow.

First, it turned out that determinant of school adjustment are resilience, academic stress, school and economic state. It shows that if the resilience of adolescents is higher, academic stress and adolescents’ grade (elementary school) are lower and the school adjustment is higher.

For adolescents school adjustment, we should approach through various aspects because adjustment affects according to school year. Family’s economic state affects adolescents in their adolescence, the lower their parents’ income, the lower the school adjustment. In addition, academic stress is lowering school adjustment. Beginning from elementary school, academic loads increase, students become sensitive in grades, exams and studies related to entrance, students begin to be graded by teachers and competition between friends becomes intensified. These factors can cause difficulties like hardship in interpersonal relationship and in school studies. Therefore, it is required to intervene in adolescents’ healthy development and psychological adjustment to reduce anxiety. It is also necessary to have various prevention and solution programs that can understand and approach family and school’s situational features surrounding adolescents to increase adolescents’ school adjustment.

Second, this study verifies that mediation effect of resilience is valid in effects of adolescents’ academic stress on school adjustment. It can be understood that adolescents have higher resilience have less negative effect of academic stress to school adjustment in contrast to adolescents have lower resilience have more the negative effect. When the resilience is higher, the academic stress gets lower and affects positively in adolescents’ adjustment and health. Considering these results, resilience has close relationship in school adjustment, affecting beneficially in adolescents’ adjustment who are experiencing academic stress. Therefore, activating programs which improve adolescents’ resilience is significant. To improve their resilience, various field works that can enhance interpersonal relationship and confidence, and psychomotor programs that can increase cooperation ability are needed. Adolescents should increase their ability by joining club activities, volunteering and adolescents’ participation activities and these activities should be supported to have environment that adolescents can actively be involved during creative experience programs and autonomy semester.

Third, services that can relieve adolescents’ academic stress are necessary. Academic stress in childhood can make them lose interest in school and it can lead to school maladjustment or problematic behavior. Academic stress acts as factors that lead to school maladjustment by refusing to go to school or losing interest in school. Therefore, intervention is required to relieve academic stress by adolescents’ healthy development and psychological adjustment. In these aspects, it is necessary to create internal and external environment to relieve academic stress, to respect adolescents and to support them to perform their studies independently. In addition, adolescents should be offered alternation that can overcome fragile internal and external surroundings by themselves. Therefore programs that can lead to successful adjustment from negative condition, academic stress should be supplied. Furthermore, training programs that allows adolescents to positively deal with difficult situations during studies should be developed. Moreover, professional school social workers who support school adjustment are required. It is significant to clarify that educational achievement can be completed by cooperating
professionals related to local society, not by fully charging schools. Teachers’ primary responsibility is to provide good education. Satisfying adolescents’ developmental needs is a role focused on schools and classrooms. There are children, adolescents and families who have service needs excepting education service in school. Therefore their needs should be satisfied and roles of professionals who are charging social resource connection must be followed.

In spite of these results, the study has some limitations. First, selection of subjects in the study has restrictions to generalize the result because it selected subjects who are inhabiting in specific region, so carefulness is needed when understanding this study. Second, this study has limitation of not considering variety of variables affecting school adjustment. These limitations should be complemented by developing models including the variables related to adolescents’ academic stress and school adjustment through continuous researches.

**Ethical clearance:** Taken from Hanil University

**Source of funding:** Self

**Conflict of Interest:** Nil

**REFERENCES**


A Study on Analysis of Job Stress Factors of Psychomotricians by using AHP Method

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ABSTRACT

Objectives: The purpose of this study is to analyze the factors of job stress of psychomotricians who provides developmental rehabilitation service among the social service projects of the Ministry of Health and Welfare.

Methods: The subjects of the study were chosen as the psychomotricians of the institutions where provide development rehabilitation service in Seoul and Kyunggi area in 2015. Statistical analysis was performed using Microsoft Excel 2013 and Expert Choice 2000 and by setting the consistency ratio (CR) of the questionnaire response at 0.1 or less, the priority result of the psychomotricians’ job stress factors was derived from the relative importance value of each hierarchy.

Findings: We proceeded with analysis on the priority among high-ranking factors of job stress faced by psychomotricians and found that the professionalism and self-development factor was the most important factors, followed by the role factor, the economic factor, interpersonal relationship factor, and the working environment factor. A closer look into the factors revealed that psychomotricians get most stress from insufficient educational content regarding their expertise and self-development, parents’ satisfaction regarding their role, an unstable paycheck regarding the economic factor, inconsistent job instruction regarding the social factor and physical burden regarding the factor of work environments.

Improvements/Applications: Methods that can reduce job stress of psychomotricians should be considered.

Keywords: Psychomotricians, Job, Stress, the AHP technique

INTRODUCTION

Among the health and welfare sectors, the social service voucher business, which has been in operation since 2006, is expanding and increasing its budget as the number of recipient is increasing year by year. In the budget of 2016 of the Ministry of Strategy and Finance, the budget for health, welfare and employment is 122 trillion won. In comparison with the previous year, the budget for health, welfare and employment part (6.2%) showed the largest budget growth rate followed by culture part (7.5%)¹.

Job stress can occur in work processes, which can have a negative impact on individuals and organizations. Job stress may cause a physiological response such as an increase in heart rate and blood pressure, and would appear as negative psychological reaction such as anxiety, frustration, and helplessness, and may result in a behavioral response such as decline in the effectiveness of organization, loss of responsibility, indifference and absence from work². Job stress also affects not only the therapist but also the subject and caregiver, so that the specialty, quality and effectiveness of treatment could be affected³. Therefore, to the developmental rehabilitation service provider, it is important to study the job stress of the provider because the stress affects the quality of treatment and its effectiveness.

Among the people who provide developmental rehabilitation services, there is a lack of research on job stress of psychomotricians. If many studies are
conducted on this, the service will be provided in a more stable environment, which will have a positive effect on the effectiveness and quality of the treatment.

The purpose of this study is to analyze the factors of job stress of psychomotoricians and identify the ranking of the factors.

MATERIALS AND METHODS

Study subjects: The subjects of this study were chosen as psychomotoricians of developmental rehabilitation service providers in Seoul and Gyeonggi area. The subjects of the basic survey were 32 persons except for 6 persons who had insufficient data, 10 persons for recognition survey, and 16 persons for hierarchical analysis survey. Table 1 shows the general characteristics of the researchers(Table 1).

<table>
<thead>
<tr>
<th>Division</th>
<th>Frequency</th>
<th>Ratio (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>8</td>
<td>50</td>
</tr>
<tr>
<td>Female</td>
<td>8</td>
<td>50</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30 or less</td>
<td>8</td>
<td>50</td>
</tr>
<tr>
<td>30s</td>
<td>6</td>
<td>37.5</td>
</tr>
<tr>
<td>Over 40</td>
<td>2</td>
<td>12.5</td>
</tr>
</tbody>
</table>

Measuring tools: In this study, three surveys were conducted. In the first survey, we constructed an open questionnaire. The second survey, constructed based on the first one, was a questionnaire on recognition importance which derived the importance of job stress factors of psychometricians. Then, we extracted the importance of job stress factors of psychologist. In the final third, the questionnaire for the analysis of stress factors priorities, using hierarchical analysis questionnaire, was constructed.

The first open questionnaire: Based on the basic data obtained from the previous research and literature analysis, the questionnaire items were developed to extract the stress factors of the psychomotorian and the open questionnaire was constructed through expert review.

The Second recognition importance questionnaire: The structured questionnaires were constructed by considering the importance of cognition through the categorization process and the experts’ meeting on the job stress factors of the psychomotorician that were searched through the first open questionnaire.

The third hierarchical analysis (AHP) questionnaire: The AHP questionnaire was constructed based on the second recognition importance questionnaire, and the questionnaire items of the pairwise comparison were reconstructed for analyzing the relative importance among factors.

Data collecting: The data collection period of this study was 2 months, from August 1, 2015 to October 1, and data were collected through questionnaires obtained by e-mail, and smart phone survey.

Statistical analysis: Statistical analysis was performed using Microsoft Excel 2013 and Expert Choice 2000, and the consistency ratio (CR) of the questionnaire response was set at 0.1 or less, and the relative importance of each level was used to determine the priority of job stress factors of psychomotorian.

RESULTS

In this study, we used the hierarchical analysis of the practical priorities of job stress factors and the following results were obtained through a study, targeted to the psychomotorian group providing developmental rehabilitation services, using hierarchical analysis of actual priorities of job stressors

As a result of analyzing the job stress factors of psychomotorian through open questionnaire, it was derived as role factors, working environment factors, professionalism and self-development factors, economic factors, and interpersonal factors except for the low response factors.

As a result of analyzing the priorities among the top factors, expertise and self-development were found to be the most important factors and role factors, economic factors, interpersonal factors, and work environment factors were followed in order (CR = .06) (Figure 1).
As a result of analyzing the relative importance and priority of sub-factors of professionalism and self-development, which are the top factor, lack of education contents were the most important factors, and certification system and lack of time for training were derived in order (CR = .01) (Figure 2).

Figure 2: Relative importance and priority among detailed factors of professionalism and self-development of psychometricians

As a result of analyzing the relative importance and priority of sub-factors of role, which are the top factor, the degree of satisfaction of the caregiver was the most important factor, followed by the lack of awareness and the mental burden on the treatment (CR = .01) (Figure 3).

Figure 3: Relative importance and priority among detailed factors of the role of psychometricians

As a result of analyzing the relative importance and priority of sub-factors of the interpersonal, which are the top factors, inconsistent job directives were found to be the most important factors, and Conflicts with guardians, conflict with peers, lack of organizational system were followed (CR = .02) (Figure 5).

Figure 5: Relative importance and priority among detailed factors of interpersonal relationship of psychometricians

As a result of analyzing the relative importance and priority of sub-factors of working environment, which are the top factors, the physical burden was the most important factor followed by welfare, excessive work, restricted parish, and place (CR = .01) (Figure 6).

Figure 6: Relative importance and priority among detailed factors of the working environment of psychometricians
As a result of analyzing the relative importance and priority according to gender among the background information, male was ranked in the order of professionalism, self-development factor, role factor, work environment factors, interpersonal factors and economic factors (CR = .11). Female was ranked self-development factors, role factors, interpersonal factors, working environment factors, and economic factors (CR = .07) (Figure 7).

![Figure 7: Priority among high-ranking factors of job stress faced by gender](image)

As a result of analyzing the relative importance and priority according to age among the background information, 20s were ranked in the order of professionalism and self-development factors, economic factors, role factors, interpersonal factors and working environment factors (CR = .12). 30s were ranked in the order of professionalism and self-development factors, role factors, economic factors, interpersonal factors and working environment factors (CR = .06). In the 40s, economic factors, professionalism and self-development factors, role factors, interpersonal factors, working environment factor were ranked in order (CR = .04) (Figure 8).

![Figure 8: Priority among high-ranking factors of job stress faced by age](image)
DISCUSSION

Job stress factors and practical priorities of psychomotorian were analyzed using hierarchical analysis. Through the study, we can summarize as follows.

As a result of analyzing job stress factors of psychomotorian, it was derived as role factors, working environment factors, professionalism and self-development factors, economic factors, interpersonal factors. Similar result were found in the study of job stress of art therapist and horticultural therapist, that were set job stress factors as job related factors, working environment factors, professional growth factors, economic factors, interpersonal factors. In the case of developmental rehabilitation service providers, unlike other occupations, increasing professionalism is one of the factors of job stress. Therefore, it can be seen that professionalism is important in providing services to the receiver.

As a result of analyzing the priorities among the top factors of job stress, professionalism and self-development factors were found to be the most important factors followed by role factors, economic factors, interpersonal factors, and work environment factors. It is consistent with a result of study about job stress of horticultural therapist that increasing professionalism was the most important factors among job-related factors, working environment factors, professional growth factors, economic factors, interpersonal factors. The results of analyzing the priorities of the interpersonal factors of the psychomotorian were analyzed using hierarchical analysis. Through the study, we can summarize as follows.

The results of analyzing the priorities of the psychomotorian’s sub-factors of job stress are as follows.

As a result of analyzing the relative importance and priority among sub-factors of the psychomotorian’s role, the satisfaction of the caregiver appeared to be the most important factor, and it was derived in the order of the lack of recognition and the psychomotorian’s burden on their mind for the treatment. It is coincidence with the results of the study on the art therapists’ job stress on relationship formation resulting that many part it is related to relationship with the caregiver. In the case of a child, the parent or caregiver makes a request, rather than the client’s own will. In this situation, the friction caused by the wrong understanding of the caregiver about the receiver is a great stress to the psychologist.

As a result of analyzing the relative importance and priority among the economic factors of psychomotorian, unstable salary were found to be the most important factors, and salary system, burden of training cost, burden of teaching aids cost, and less treatment time were followed in order. This is consistent with a study that salary is the highest part among economical stress factors. These results suggest that the developmental rehabilitation service providers’ stress are high due to unstable salary since many of them work part-time or receive payment per session.

As a result of analyzing the relative importance and priority among the sub-factors of the interpersonal relationship of the psychomotorian, inconsistent task instruction was the most important factor and it was derived in order of conflict with caregiver, conflict with peer, unsatisfactory system, lack of communication. This is partly consistent with a study about the effect of art therapists’ job stress on job satisfaction that job requirement is the highest among sub-factors. It seems that the excessive work of the developmental rehabilitation service and the stress caused by the frequent changing system take up a lot of stress. Therefore it is necessary to simplify the tasks and systems of developmental rehabilitation services so that they can be used more conveniently.

As a result of analyzing the relative importance and priority among the sub-factors of psychomotorian’s work environment, the physical burden was the most important factor and it was derived in the order of welfare, excessive work, restricted teaching aids, and
limited place. This is partly consistent with a result of study that the stress on resting time was the highest among the stress sub-items for the working environment factors of the voucher speech language therapists, stress on the welfare of the work was followed, and the stress on the test tools was the lowest. This suggests that developmental rehabilitation service providers work continuously without rest, resulting in physical stress.

As a final step, we analyzed the priorities of sub-factors of job stress according to background information of psychomotorian.

As a result of analyzing the priorities of gender-occupational stressors among psychomotorian, professionalism and self-development factors were found to be the most important factors in male, followed by role factors, work environment factors, interpersonal factors and economic factors. Professionalism and self-development factors were the most important factors for female, followed by role factors, interpersonal factors, work environment factors, and economic factors so that there were no significant differences in job stress factors between sexes. This is consistent with the results of a study that showed no significant difference in job stress according to gender in the study of job stress of art therapist. Job stress factors according to gender did not show any significant difference, but both male and female showed high stress to develop professionalism, which indicates that super vision and various education are needed.

As a result of analyzing the priorities among the top job stressors of psychomotorian, professionalism and self-development factors were the most important factors in the 20s, followed by economic factors, role factors, interpersonal factors, and work environment factors. Professionalism and self-development factors were the most important factors in the 30s, followed by economic factors, role factors, interpersonal factors, and work environment factors. Economic factors were the most important factors in the 40s, followed by professionalism and self-development factors, role factors, interpersonal factors, and work environment factors. In the study of job stress of art therapist, all of the 20s, 30s, and 40s were in agreement with the study that the stress on the job demand factors was the highest, but there was a difference from the fact that there was no significant difference by age. 40s showed higher job stress on economic factors than other age groups, and other interpersonal and working environment factors showed lower factors of stress in all ages. These results suggest that 40s are based on the expertise accumulated in their 20s and 30s, and that stress on the economical part is higher than expertise as a head of household.

Based on the results of this study, it is necessary to find ways to reduce the stress factors of psychomotorian, and more ideal working conditions should be established based on the existing environment and circumstances.

**Ethical Clearance:** Taken from Republic of Korea committee

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**Conflict of Interest:** Nil

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The Effects of The Cosmetic Surgery Attitude of The College Students Majoring in Dance on The Perceived Dance Performance Ability

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ABSTRACT

Background/Objectives: The goal of this research is to investigate the effects of the cosmetic surgery attitude and body image of the college students majoring in dance on the perceived dance performance.

Methods/Statistical Analysis: To achieve the goal of the research, a survey was conducted targeting at 407 students majoring in dance in the 6 of the 4-year universities located in Seoul City and Gyeonggi-do.

Findings: First, female students had higher cosmetic surgery attitude than male students; students majoring in Korean dance and ballet had higher cosmetic surgery attitude than those majoring in modern dance; students with fewer experiences had higher cosmetic surgery sympathy and risk acceptance attitude; students with more experiences had higher dance performance accomplishment. Second, students with higher cosmetic surgery sympathy and risk acceptance attitude had lower dance performance concentration and dance performance confidence; students with higher cosmetic surgery value attitude had higher dance performance concentration and dance performance confidence; students with higher cosmetic surgery secretive attitude had higher dance performance confidence.

Improvements/Applications: By analyzing the attitude towards cosmetic surgery of dance majors, Dance majors will be able to express their attitudes toward the right appearance, and provide academic knowledge of dance performance.

Keywords: College students, majoring in dance, Cosmetic surgery attitude, Dance performance ability.

INTRODUCTION

In modern times, external appearance is becoming a more important element in social success. Against this backdrop, people are putting a lot of efforts economically and physically into having beautiful appearance, which results in a social phenomenon of lookism. The current status of cosmetic surgery among Korean high school and college students conducted by² found that the experience of cosmetic surgery among general students was 14.8% while that of students majoring in dance was 42.3%, showing a big gap between the groups. One out of two students majoring in dance has gone through cosmetic surgery, which is three times more than that of general students. This makes us investigate the reasons why the group majoring in dance has higher social and cultural attitude toward cosmetic surgery than other groups.

Dance is an art which expresses philosophy and inner side of self by means of body. Therefore, the body of a dancer plays an important role in performing dance. The dance performance ability is the most important ability which can obtain good outcomes in the college entrance exam for high school students, and is also the most important for the improvement of ability in major...
for the college students majoring in dance. According to the research on the current status of cosmetic surgery experience of high school and college students conducted by3, dance majors took up the most in cosmetic surgery experience, and the answer “I had cosmetic surgery done to prepare for the entrance exam.” made up the most. Especially pointed out the subjective effects such as the facilities and physical conditions of the dancer and the effects caused by the environment as important elements, arguing that dancers show a sensitive reaction to anxiety, confidence about performing movements, and complexes about their bodies. Along with this, the researches related to the dance performance ability reported that the distorted image of body has a negative effect on the dance performance ability. The results of these researches imply that the dance performance ability of college students majoring in dance is linked to the cosmetic surgery attitude.

In this respect, the goal of this research is to investigate the factors related to the dance performance ability by analyzing the effects that the cosmetic surgery attitude of college students majoring in dance have on the dance performance ability. To achieve this goal, the research problems are set as follows.

**Question 1.** What are the differences between the physical image according to the personal characteristics of the dance majors in college, the cosmetic surgery attitude, and the dance performance ability?

**Question 2.** What are the effects of the cosmetic surgery attitude of the dance majors in college on the perceived dance performance ability?

### MATERIALS AND METHODS

**Research targets:** To investigate the relationship between the cosmetic surgery attitude of college students majoring in dance and the perceived dance performance ability, this research selected dance majors enrolled in the department of dance in 4-year universities as a population and collected samples using purposive sampling, which is a probability sampling. A total of 6 universities located in Seoul Metropolitan Area were chosen randomly and 403 students were sampled. The period of sampling was 5 weeks in total between September 13 and October 10 in 2016, and 23 samples were excluded from analysis due to their unclear answers, no responses, and repeated contents. Accordingly, samples of 407 people were used for the final analysis and the general characteristics of the research targets are as shown in Table 1.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Level</th>
<th>Frequency</th>
<th>Ratio (%)</th>
<th>Characteristics</th>
<th>Level</th>
<th>Frequency</th>
<th>Ratio (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td>Men</td>
<td>51</td>
<td>12.5</td>
<td>Grade</td>
<td>1st grade</td>
<td>118</td>
<td>29</td>
</tr>
<tr>
<td></td>
<td>Women</td>
<td>356</td>
<td>87.5</td>
<td>2nd grade</td>
<td>125</td>
<td></td>
<td>30.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3rd grade</td>
<td>105</td>
<td></td>
<td>25.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4th grade</td>
<td>59</td>
<td></td>
<td>14.5</td>
</tr>
<tr>
<td>Major</td>
<td>Korean dance</td>
<td>123</td>
<td>30.2</td>
<td>Experience</td>
<td>Less than 5 years</td>
<td>86</td>
<td>21.1</td>
</tr>
<tr>
<td></td>
<td>Modern dance</td>
<td>124</td>
<td>30.5</td>
<td>5 ~ 7 years</td>
<td>177</td>
<td>43.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ballet</td>
<td>160</td>
<td>39.3</td>
<td>8 ~ 10 years</td>
<td>91</td>
<td>22.4</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>11 years or more</td>
<td>53</td>
<td>13</td>
<td></td>
</tr>
</tbody>
</table>

**RESEARCH TOOLS**

To analyze the effects of body images and cosmetic surgery attitude of college students majoring in dance on the perceived dance performance ability, this research used questionnaires as a research tool based on the previous researches and theories. The questionnaire has 4 questions to measure the personal characteristics, 19 questions to measure the cosmetic surgery attitude, and 15 questions to measure the dance performance ability, making a total of 38 questions.
The sub-factors of dance performance ability are composed of 15 questions in total, including 5 questions for performance concentration, 3 for performance accomplishment, and 7 for performance confidence. Each question is composed using 5-point scale from “Not at all” (1 point) to “Very much so” (5 point). High points mean that the dance performance ability perceived by the dance majors in college is high.

As we can see from Table 2, the reliability of sub-factors of the cosmetic surgery attitude including the cosmetic surgery sympathy, acceptance of risk, cosmetic surgery value, and cosmetic surgery secret is Cronbach’s α = .900–.629, and the cumulative dispersion rate of the 3 sub-factors is 59.736%. The reliability of the sub-factors of the dance performance ability including performance concentration, performance accomplishment, and performance confidence is Cronbach’s α = .866–.770, and the cumulative dispersion rate of the 3 sub-factors is 61.169%, showing that all the questions in the questionnaire are reliable and valid.

| Table 2: The difference between the cosmetic surgery attitude and dance performance abilities according to the personal characteristics of the college students majoring in dance |
|---|---|---|---|---|---|---|---|
| Factor | Sex | Major | | | | | scheffe |
| | M | SD | t | M | SD | F | |
| Cosmetic surgery attitude | | | | | | | |
| | 1gd | 2.398 | .777 | 1.074 | 1.Less than 5 | 2.450 | .757 | 2,3>4 |
| | 2gd | 2.439 | .748 | | 2. 5–less than 8 | 2.492 | .717 | |
| | 3gd | 2.548 | .679 | | 3. 8 ye–less than 11 | 2.542 | .753 | |
| | 4gd | 2.361 | .782 | | 4. 11 or more~ | 2.102 | .728 | |
| Cosmetic surgery value | | | | | | | 2.574 |
| | 1gd | 3.032 | .876 | | Less than 5 | 2.939 | .844 | |
| | 2gd | 3.043 | .776 | | 5 ~less than 8 | 3.073 | .743 | |
| | 3gd | 3.017 | .694 | | 8 ye–less than 11 | 3.085 | .775 | |
| | 4gd | 3.179 | .691 | | 11 or more~ | 3.113 | .762 | |
| Cosmetic surgery secret | | | | | | | |
| | 1gd | 2.717 | .786 | | Less than 5 | 2.686 | .694 | |
| | 2gd | 2.805 | .857 | | 5 ~less than 8 | 2.723 | .790 | |
| | 3gd | 2.774 | .985 | | 8 ye–less than 11 | 2.919 | 1.075 | |
| | 4gd | 2.785 | .789 | | 11 or more~ | 2.798 | .9132 | |
| Dance performance ability | | | | | | | |
| performance concentration | | | | | | | |
| | 1gd | 3.486 | .591 | | Less than 5 | 3.416 | .568 | 2,3<4 |
| | 2gd | 3.566 | .581 | | 5 ~less than 8 | 3.443 | .549 | |
| | 3gd | 3.360 | .547 | | 8 ye–less than 11 | 3.496 | .624 | |
| | 4gd | 3.496 | .540 | | 11 or more~ | 3.676 | .541 | |
| performance accomplishment | | | | | | | |
| | 1gd | 3.148 | .618 | 1.270 | Less than 5 | 3.101 | .604 | |
| | 2gd | 3.288 | .573 | | 5 ~less than 8 | 3.137 | .5034 | |
| | 3gd | 3.216 | .538 | | 8 ye–less than 11 | 3.321 | .549 | |
| | 4gd | 3.169 | .627 | | 11 or more~ | 3.452 | .76908 | |
| performance confidence | | | | | | | 1.865 |
| | 1gd | .249 | .043 | 2.474 | Less than 5 | .247 | .041 | |
| | 2gd | .253 | .046 | | 5 ~less than 8 | .247 | .045 | |
| | 3gd | .238 | .046 | | 8 ye–less than 11 | .244 | .044 | |
| | 4gd | .253 | .036 | | 11 or more~ | .261 | .044 | |

**SURVEY PROCESS**

The researcher visited the targeted universities and distributed the questionnaires in person accompanied by three research assistants, who received pre-education and have experience of conducting a survey in the past. The completed questionnaires were collected after the participants answered using self-administration method. To encourage more sincere answers for the questionnaire, we explained the purpose of the research to the guidance teachers and asked for their understanding before visiting the universities. Also, we conducted a survey utilizing break time or the time before class starts, fully explaining the purpose of the research to the students and asking for sincere answers for the questions in an aim to make the survey go smoothly.

**DATA PROCESSING**

With the collected data, t-test and One-way ANOVA were conducted using SPSS 18.0 statistics program for Question 1, and the results were drawn using correlation.
analysis and multiple regression analysis for Question 2. The significance level in applying the inferential statistics was set α = .05.

RESULTS

The personal characteristics, cosmetic surgery attitude and dance performance ability of the college students majoring in dance

The results of analyzing the differences between the cosmetic surgery attitude and dance performance abilities according to the personal characteristics of the dance majors in college are as shown in Table 3. There was a significant difference in the cosmetic surgery value and cosmetic surgery secret according to major(p<.01, p<.05), and there was a significant difference in the dance performance confidence(p<.05). Korean dance major(M=3.164, M=2.864) and ballet major(M=3.115, M=2.827) showed higher cosmetic surgery value and cosmetic surgery secret than those of modern dance major(M=2.862, M=2.599), and ballet (M=2.256) showed higher dance confidence than modern dance(M=2.412). Students with dance experience of under 5-8 years (M=2.412) and under 8-11 years (M=2.412) showed higher cosmetic surgery sympathy and acceptance of risk than students with dance experience of more than 11 years(M=2.412). For dance performance accomplishment, students with more than 11 years of experience (M=2.412) topped the list, followed by under 8-11 years (M=2.412), under 5-8 years (M=2.412), and under 5 years (M=2.412).

Table 3: The effects of the cosmetic surgery attitude on the dance performance ability

<table>
<thead>
<tr>
<th>Factor</th>
<th>Performance concentration</th>
<th>Dance performance ability</th>
<th>Performance accomplishment</th>
<th>Performance confidence</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>b</td>
<td>β</td>
<td>b</td>
<td>β</td>
</tr>
<tr>
<td>Constant</td>
<td>3.458</td>
<td>.218</td>
<td>3.260</td>
<td>.218</td>
</tr>
<tr>
<td>Surgery sympathy, risk acceptance</td>
<td>-.291</td>
<td>-.378</td>
<td>-.010</td>
<td>-.013</td>
</tr>
<tr>
<td>Cosmetic surgery value</td>
<td>.212</td>
<td>.286</td>
<td>-.042</td>
<td>-.056</td>
</tr>
<tr>
<td>Cosmetic surgery secret</td>
<td>.031</td>
<td>.047</td>
<td>.038</td>
<td>.056</td>
</tr>
<tr>
<td>F</td>
<td>16.061***</td>
<td>.489</td>
<td></td>
<td>27.386***</td>
</tr>
<tr>
<td>R²</td>
<td>.107</td>
<td>-.004</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*p<.05 ** p<.01 *** p<.001

The cosmetic surgery attitude and the dance performance ability of the college students majoring in dance: The cosmetic surgery sympathy and acceptance of risk, which are the sub-factors of the cosmetic surgery attitude, have a significantly negative(-) effect on the dance performance concentration (β= -.378 p<.001) and dance performance confidence(β= -.041 p<.001), which are the sub-factors of the dance performance ability. Also, cosmetic surgery value has a significantly positive (+) effect on the dance performance concentration (β= .286 p<.001) and dance performance confidence (β=.403 p<.001), while cosmetic surgery secret has a significantly positive (+) effect on the dance performance confidence (β= .126 p<.05).

DISCUSSION

For the purpose of this study, a questionnaire survey was conducted to inquire into the correlation between the cosmetic surgery attitudes of college students majoring in dance and dance performance ability. Based on the results of the survey, the following subjects can be discussed.

According to the analysis of cosmetic surgery attitude of college students majoring in dance by individual characteristics and difference in dance performance ability, the result manifests that female students show higher sub-factors of cosmetic surgery attitude in all categories than male students. This result coincides with the research results carried out by¹, reporting that students majoring in arts and physical education had higher rate of cosmetic surgery experience. Moreover, the research results of ², supports the results of the present study in the sense that, as for cosmetic surgery awareness of college students majoring in dance, female students showed higher rate than male students; college students showed higher rate than college students.
According to the statistical report of International Society of Aesthetic Plastic Surgery, South Korea took up the fourth rank of the total number of worldwide plastic surgeries in 2014, and this high figure explains how much Koreans are interested in physical appearance. In particular, it is estimated that Korean college students majoring in dance, who are supposed to prepare for the path as professional performance artists, cannot help but have lots of interest in plastic surgery and have high attitude toward it. However, this high degree of expectation and demand for physical appearance can heighten cosmetic surgery value and cause side effects like plastic surgery addiction; therefore, it will be required to provide students with education to build authentic attitude and confidence as artists through in-depth education regarding genuine values of dance arts.

**CONCLUSION**

This research was conducted in an aim to investigate the relationship between the cosmetic surgery attitude of the college students majoring in dance and the dance performance ability. The research conducted One-way ANOVA analysis and multiple regression analysis using SPSS WIN 18.0, and the results of the analyses are as follows.

First, the result of examining the differences in the cosmetic surgery attitude of the college students majoring in dance and the perceived dance performance ability shows that there was a significant difference in the plastic surgery attitude according to the gender, major and dance experience while there was a significant difference in the dance performance ability according to the major and dance experience.

Second, the result of examining the effects of the plastic surgery attitude of the college students majoring in dance on the perceived dance ability shows that the sub-factors of the cosmetic surgery such as the cosmetic surgery sympathy and acceptance of risk had a negative effect on the dance performance concentration and dance performance confidence while the cosmetic surgery value had a positive effect on the dance performance ability according to the major and dance experience.

Therefore, in the standard for evaluating the dance of college students majoring in dance, we need to recognize that unreasonable expectations for the ideal body and excessively thin body elevate the students’ determination for cosmetic surgery, which can lead to negative results such as cosmetic surgery addiction.

**Ethical Clearance:** Taken from Republic of Korea Committee

**Source of Funding:** Self

**Conflict of Interest:** Nil

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Relationships Between Smartphone Addiction and Impulsivity, Depression, and Intention to Use Smartphones among College Students: Mediating Effect of Parent–Adolescent Communication

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ABSTRACT

Background/Objectives: To determine the relationship between college students’ smartphone addiction and depression, impulsivity, intention to use, and parent–adolescent communication, and examine the mediating effect of parent–adolescent communication.

Methods/Statistical analysis: Data were collected via structured questions from 350 college students in Daejeon Metropolitan City, from November 7 to 23, 2016. All data were analyzed with chi-square test, t-test and ANOVA by using IBM SPSS Statistics 22.0. And the structural equation model analysis was employed by using Amos 24.0

Findings: We observed direct and indirect relationships between impulsivity, depression, intention to use smartphones, and smartphone addiction. Specifically, smartphone addiction increased with impulsivity, depression, and intention to use smartphones. Furthermore, parent–adolescent communication had an indirect effect on smartphone addiction, acting as a mediator in the relationship between impulsivity and depression.

Improvements/Applications: Preventing smartphone addiction among college students requires reduction of impulsivity, depression, and intention to use a smartphone. Education aimed at improving communication between parents and adolescents is also necessary.

Keywords: Smartphone Addiction, Impulsivity, Depression, Intention to use, Parent-Adolescent Communication.

INTRODUCTION

Smartphones—devices with combined functions of personal computers, MP3 players, video players, cameras, etc.—have become a necessity in the modern Republic of Korea, given increasing access to the Internet and the high penetration rate of smartphones into Korean society. Coinciding with their increasing necessity, smartphone addiction and its related effects have become a significant social problem. Smartphone addiction has been found to worsen with increasing severity of depression and greater impulsivity. Impulsivity has been named as the greatest risk factor for smartphone addiction and causes social maladjustment or delinquency. It creates negative correlation with adolescents’ communication with parents. Furthermore, adolescents with high levels of smartphone addiction have shown higher levels of externalizing behavior problem (e.g., disturbance of adaptive functions, aggressive and delinquent behaviors), cyber victimization, and suicidal ideation.8
College students, who are in the late stage of adolescence, have high risk of impulsive behavior since lower capability of adapting society and solve problems. In addition, they suffer from high depression and pressure in their future. Meanwhile, their relative lack of exposure to engaging in recreational activities leaves them with little control in everyday life. In achieving this freedom in a society where grades and exams are considered everything, they may be more vulnerable to smartphone addiction. Thus, early intervention for smartphone addiction is needed. Precedent study reported factors of smartphone addiction, but we have to discover a link and path in factors and whether parent-adolescent can mediate smartphone addiction to prevent smartphone addiction.

Furthermore, I was interested in testing whether parent–adolescent communication mediates the relationship between smartphone addiction, depression, and impulsivity. By doing so, this paper will serve as an important basis for developing future measures of preventing smartphone addiction in college students.

MATERIALS AND METHODS

Research framework: A descriptive study conducted on basis of college students aiming to identify the relative importance of several variables to the risk of smartphone addiction and to build a structural model of these risk factors (Fig. 1).

![Figure 1: Research framework of the Study](Image)

Research Subjects and Data Collection: Participants were selected through convenience sampling of male and female college students in Daejoen Metropolitan City who understood the study goal and agreed to participate. Surveys of self-reported questionnaires were administer’d to participants between November 7 and 23, 2016. I excluded all questionnaires that were incomplete and that contained outliers (i.e., standardized residuals greater than +3 or less than -3). In total, 350 respondents were included in the final analysis.

INSTRUMENTS

Smartphone addiction: Smartphone addiction was measured using the Adolescent Korean Smartphone Addiction Diagnostic Scale developed by the National Information Society Agency. This scale comprises 15 questions in subscales of daily-life disturbance, virtual life orientation, withdrawal, and tolerance; each item is rated on a five-point scale from 0 ("never") to 4 ("always"); the total score ranges from 0 to 60, with higher scores indicating greater severity of smartphone addiction. Users at potential risk, and general users (see Table 1 for classification criteria) are given.

Table 1: Smartphone addiction classification standards

<table>
<thead>
<tr>
<th>Variables</th>
<th>The degree of Smartphone addiction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High risk</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>① Total</td>
<td>≥T45</td>
</tr>
<tr>
<td>② First Factor (Daily Life Disorder)</td>
<td>≥16</td>
</tr>
<tr>
<td>③ Third Factor (Withdrawal)</td>
<td>≥13</td>
</tr>
<tr>
<td>④ Fourth Factor (Tolerance)</td>
<td>≥14</td>
</tr>
<tr>
<td>Criteria for Judging</td>
<td>① or ②–④</td>
</tr>
</tbody>
</table>

Impulsivity: Impulsivity was measured using the Barratt Impulsiveness Scale, which was translated into Korean by Lee. This scale measures impulsivity using 23 questions in the sub-scales of cognitive impulsivity (six questions), motor impulsivity (eight), and non-planning impulsivity (nine). All items are rated on a 4-point scale, with the total score ranging from 23 to 92; the higher the score, the more impulsive the user is.

Parent-Adolescent Communication: Parent–adolescent communication was measured using the 20-item questionnaire for adolescents by Barnes and Olson, which was translated into Korean by Kim. This questionnaire comprises 10 questions assessing open and closed tendencies (for a total of 20 items). Questions assessing problematic communication were reverse scored. All question scores are summed to arrive at a total score ranging from 20 to 100.
**Depression:** I employed the 10-item Center for Epidemiologic Studies Depression Scale (CES-D-10), a convenient measure of depression that Radloff adapted from the original CES-D for easier use in clinical practice. It comprises 10 questions rated on a four-point scale corresponding to the frequency of experience over the last week (0 = “hardly” to 3 = “mostly”).

**Intention to Use Smartphone:** According to Fishbein’s theory of reasoned action (TRA), human behavior is directly influenced by one’s intention to perform a behavior. This behavioral intention, in turn, is determined by two factors: subjective norms—namely, how significant others think about an individual’s behavior—and the individual’s own attitude toward the behavior he/she is about to engage in.17,18

Attitudes toward smartphone use refer to whether one has a positive or negative opinion on using smartphones, and was evaluated using adaptations of three questions19 from the Computer Attitude Scale20 and the study of McFarlane and Hoffman.21 Each of these three questions is rated on a five-point scale. The subjective norms for smartphone use refer to participants’ perception of whether using smartphones is tolerable to significant others in their lives, and were analyzed by another three questions rated on a five-point scale; these three questions were adapted from the tool used in Vries, Dijkstra, and Kuhlman to fit smartphones.22

**Statistical analysis:** The data were analyzed using IBM SPSS Statistics 22.0 and IBM SPSS Amos 24.0. Construction models depicting hypothetical causal relationships between the related factors and smartphone addiction and tested the fit of these models and the strength of their constituent relationships by using Amos.

**RESULTS AND DISCUSSION**

**Demographics and factors related to smartphone addiction:** A total of 9.5% of the respondents (2.5% showing high risk, 7.0% showing a potential risk) were considered to have a high level of depression, use smartphones in their daily life, and were significantly more likely to have a high level of depression, use smartphones in their daily life, be highly impulsive.

We observed no difference in time spent on communication with parents between those with smartphone addiction and those who did not have it. Furthermore, while communication tended to be more open among those without smartphone addiction, only communication with the father was significantly different (Table 2).

<table>
<thead>
<tr>
<th>Categories</th>
<th>Smartphone Addiction</th>
<th>χ² or t</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>7(20.6)</td>
<td>134(42.4)</td>
</tr>
<tr>
<td>Female</td>
<td>27(79.4)</td>
<td>182(57.6)</td>
</tr>
<tr>
<td>Age</td>
<td>19.88±1.61</td>
<td>19.89±1.90</td>
</tr>
<tr>
<td>Usage time</td>
<td>9.68±4.53</td>
<td>7.45±4.88</td>
</tr>
<tr>
<td>Attitude</td>
<td>12.50±1.78</td>
<td>10.68±1.59</td>
</tr>
<tr>
<td>Subjective Norm</td>
<td>10.03±2.46</td>
<td>9.58±1.59</td>
</tr>
<tr>
<td>Depression</td>
<td>23.41±6.21</td>
<td>19.54±5.52</td>
</tr>
<tr>
<td>Interaction time</td>
<td>8.54±17.60</td>
<td>8.36±16.29</td>
</tr>
<tr>
<td>Communication</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Father</td>
<td>64.41±16.01</td>
<td>71.20±12.24</td>
</tr>
<tr>
<td>Mother</td>
<td>68.06±16.05</td>
<td>73.47±11.72</td>
</tr>
<tr>
<td>Impulsivity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>60.06±7.73</td>
<td>52.24±7.20</td>
</tr>
<tr>
<td>Cognitive</td>
<td>24.35±3.52</td>
<td>21.57±3.52</td>
</tr>
<tr>
<td>Motor</td>
<td>18.56±3.61</td>
<td>15.44±3.60</td>
</tr>
<tr>
<td>Non-planning</td>
<td>17.15±1.99</td>
<td>15.22±2.18</td>
</tr>
<tr>
<td>Addiction</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>39.29±7.11</td>
<td>21.65±7.62</td>
</tr>
<tr>
<td>Daily Life Disorder</td>
<td>12.47±4.03</td>
<td>7.51±3.07</td>
</tr>
<tr>
<td>Virtual Life Orientation</td>
<td>4.50±3.03</td>
<td>1.82±1.29</td>
</tr>
<tr>
<td>Withdrawal</td>
<td>11.24±2.98</td>
<td>5.40±2.76</td>
</tr>
<tr>
<td>Tolerance</td>
<td>11.09±3.00</td>
<td>6.92±2.49</td>
</tr>
</tbody>
</table>

*p<.05, **p<.01, ***p<.001
**Path Analysis of Smartphone Addiction Model**

**Testing the Model's Fitness:** After reviewing the overall fit of the structural model of this study based on the results of preceding studies and our own results, I found that some of the fit indices were poor, indicating that we could not proceed with the analysis using this model without revising it. I therefore remove irrelevant paths and again tested the fit of the structural model. This model was considered suitable, based on the following indices: $\chi^2=10.343$, $p=.411$, RMSEA=.010, NFI=.985, GFI=.999, AGIF=.976 (Table 3). The path diagram of the modified smartphone addiction model is shown in figure 2.

<table>
<thead>
<tr>
<th>Path</th>
<th>$\chi^2$ ($p$)</th>
<th>GFI</th>
<th>NFI</th>
<th>CFI</th>
<th>AGIF</th>
<th>RMSEA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acceptance level</td>
<td>$p&gt;.05$</td>
<td>&gt;.9</td>
<td>&gt;.9</td>
<td>&gt;.9</td>
<td>&lt;.08</td>
<td></td>
</tr>
<tr>
<td>Hypothetical Model</td>
<td>207.139 (.000)</td>
<td>.917</td>
<td>.877</td>
<td>.906</td>
<td>.866</td>
<td>.088</td>
</tr>
<tr>
<td>Modification Model</td>
<td>10.343 (.411)</td>
<td>.991</td>
<td>.985</td>
<td>.999</td>
<td>.976</td>
<td>.010</td>
</tr>
</tbody>
</table>

**Figure 2: Path diagram of the modified model**

**Parameter Estimates of Revised Model for Smartphone Addiction:** The model indicated that smartphone addiction was significantly influenced by impulsivity ($\beta=.307$), depression ($\beta=.275$), and intention to use ($\beta=.657$). In other words, the severity of smartphone addiction increased with the levels of impulsivity, depression, and intention to use smartphones. Furthermore, parent–adolescent communication acted as a mediator in the relationships of smartphone addiction with depression ($\beta = -.473$) and impulsivity ($\beta = -.308$) (Table 4).

<table>
<thead>
<tr>
<th>Path</th>
<th>Estimate</th>
<th>S.E.</th>
<th>C.R.</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smartphone addiction</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Impulsivity</td>
<td>.307</td>
<td>.046</td>
<td>6.720</td>
<td>***</td>
</tr>
<tr>
<td>Depression</td>
<td>.275</td>
<td>.045</td>
<td>6.121</td>
<td>***</td>
</tr>
<tr>
<td>Intention</td>
<td>.657</td>
<td>.116</td>
<td>5.671</td>
<td>***</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Path</th>
<th>Estimate</th>
<th>S.E.</th>
<th>C.R.</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impulsivity</td>
<td>Depression</td>
<td>.222</td>
<td>.057</td>
<td>3.912</td>
</tr>
<tr>
<td>Intention</td>
<td>Communication</td>
<td>-.308</td>
<td>.071</td>
<td>-4.364</td>
</tr>
<tr>
<td>Depression</td>
<td>Communication</td>
<td>-.473</td>
<td>.064</td>
<td>-7.385</td>
</tr>
<tr>
<td>Attitude</td>
<td>Impulsivity</td>
<td>.063</td>
<td>.028</td>
<td>2.224</td>
</tr>
</tbody>
</table>

*p<.05, **p<.01, ***p<.001

The total effect of impulsivity on smartphone addiction was .362 (direct effect .319, indirect effect .043), while that of depression was .354 (direct effect .276, indirect effect .078). Furthermore, intention to use had only a significant direct effect (.284), while communication with parents had only a significant indirect effect (-.243) (Table 5).
Table 5: Direct, indirect, and total effects in modified model

<table>
<thead>
<tr>
<th>Path</th>
<th>Direct effect</th>
<th>Indirect effect</th>
<th>Total effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smartphone addiction</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Impulsivity</td>
<td>.319</td>
<td>.043</td>
<td>.362</td>
</tr>
<tr>
<td>Depression</td>
<td>.276</td>
<td>.078</td>
<td>.354</td>
</tr>
<tr>
<td>Intention</td>
<td>.284</td>
<td>.000</td>
<td>.284</td>
</tr>
<tr>
<td>Communication</td>
<td>.000</td>
<td>-.243</td>
<td>-.243</td>
</tr>
<tr>
<td>Impulsivity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depression</td>
<td>.215</td>
<td>.000</td>
<td>.215</td>
</tr>
<tr>
<td>Communication</td>
<td>-.263</td>
<td>-.090</td>
<td>-.352</td>
</tr>
<tr>
<td>Depression</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Communication</td>
<td>-.416</td>
<td>.000</td>
<td>-.416</td>
</tr>
<tr>
<td>Attitude</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Impulsivity</td>
<td>.152</td>
<td>.000</td>
<td>.152</td>
</tr>
<tr>
<td>Depression</td>
<td>.000</td>
<td>.033</td>
<td>.033</td>
</tr>
<tr>
<td>Communication</td>
<td>.000</td>
<td>-.054</td>
<td>-.054</td>
</tr>
</tbody>
</table>

In this study, we determined the factors that predict college students’ risk of smartphone addiction, as well as elucidated the possible mediating effects of communication with parents.

When an individual had a strong intention to use smartphones—namely, he/she has a positive attitude towards smartphones and his/her significant others believe that it is good to use a smartphone—they tended to use smartphones for longer and the severity of their smartphone addiction increased. This suggests that intention influenced smartphone addiction only when it was considered an aggregate variable of attitude and subjective norms, and accords with studies indicating that intention influences addictive smartphone usage. Notably, if attitude and subjective norms are considered separate variables, only attitude showed statistically significant results. However, Fishbein’s study revealed that intention influenced smartphone addiction only as a mediator for attitude and subjective norms. Therefore, further research should be done.

Parents-adolescents Communication has a negative indirect impact as a mediator for depression and impulsivity. This is consistent with studies indicating that open communication between parents and their children can lead to decreased severity of smartphone addiction, and that problematic communication with parents causes children to focus more on their smartphones. Overall, the structural model determined that impulsivity and depression have direct, positive effects on smartphone addiction. This may cause them to become reliant on smartphones as a means of distraction, which, when coupled with higher impulsivity, permissive attitudes and subjective norms towards smartphones, and worse communication with parents, can lead to smartphone addiction. Adolescents (including college students) are also more likely to commit suicide due to momentary impulsiveness.

Our results suggest the need for early screening of depression, as well as interventions to control impulsivity and reduce depression. Importantly, the impact of impulsivity and depression on smartphone addiction could be curbed via open parent–adolescent communication. Thus, I might seek to educate parents and adolescents to engage in communication that is more open and to raise public awareness of the importance of such communication.

This study has several limitations. First, it might be difficult to generalize this research to all college students, as our sample was limited to those in certain regions of the Republic of Korea. Second, it is possible that students provided answers that they perceived as desirable but were not the truth, given that all measures were self-report. Nevertheless, it is mandate to identify the direct and indirect pathways between smartphone addiction including impulsivity and depression, and clarified that there was a mediating effect of parent–adolescent communication.

**CONCLUSION**

Higher impulsivity, depression, and intention to use smartphones were associated with worsened smartphone addiction. Furthermore, parent-adolescent communication did not have direct impact on smartphone addiction, but it did have a negative impact as a mediator for depression and impulsivity. In other words, parent adolescent communication lower smartphone addiction by controlled impulsivity and depression.

**Ethical clearance:** Taken from Republic of Korea committee

**Source of funding:** Self

**Conflict of Interest:** Nil
REFERENCES


Kinetic Differences in the Target-Side Knee among Three Shot Types in Each Section During Downswing

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ABSTRACT

Background/Objectives: Attention on knee kinetics during golf swing has been increasing. This study aimed to compare the kinetic differences in the target-side knee among shot types during downswing using different clubs.

Methods/Statistical analysis: Twenty-nine healthy right-handed golfers were divided into two groups: high-skilled (HS) and low-skilled (LS) groups. The angle of extension/flexion, valgus/varus, and external/internal rotation of target-side knee during downswing of shot types, i.e., fade, straight, and draw, using driver and 5-iron clubs were analyzed. The downswing was divided into four sections. One-way RMANOVA was used to identify the differences in knee kinetics among the shot types in each section or group.

Findings: The HS group using both driver and 5-iron clubs and the LS group using the driver club had no significant kinetic differences in the target-side knee among the three shot types during downswing. However, in the first, second, and third sections in the LS group, significant differences among the shot types were noted (p = 0.01, p = 0.01, p = 0.04, respectively). In the first section, the valgus angle of fade shot was less than that of straight shot (p< 0.01), and in the second and third sections, the valgus angles of fade shot and draw shot were less than the valgus angle of straight shot (second section, p< 0.01 and p = 0.03; third section, p = 0.04, p = 0.03).

Improvements/Applications: Only the valgus/varus angle in LS golfers using 5-iron clubs showed differences in target-side knee among the shot types during downswing. This finding could help improve golf performance.

Keywords: Kinetics, target side knee, downswing, shots types, golfer

INTRODUCTION

In golf, the goal is to accurately hit a small ball with a long club via a consistent swing, and this requires substantial practice.1 A consistent golf swing is a complex motion of the entire body that generates and controls the angular or linear momentum to maximize the driving distance and improve accuracy.1,2 Several researches described the best maneuver during golf swing; specifically, an increased upper torso-pelvis separation (or X-factor) and delayed release of the upper extremities were related to a good golf performance, i.e., increased ball velocity and driving distance.3 Moreover, the body weight should shift towards the trail-side foot during backswing and back to the target-side foot until finishing, and the movement of body segments should be sequential from the beginning to end.4

Most researches indicated that the motion of the upper extremity, thorax, and pelvis is considered a critical factor for a successful golf swing.4 However, because of the anterior cruciate ligament injury in Tiger Woods’ target-side knee, more attention has been focused...
on knee kinetics and kinematics during golf swing. Gatt et al.\(^6\) reported that the maximum extension moment in the target-side knee occurs during downswing and the target-side knee has higher joint forces and moments during downswing. Moreover, greater trunk rotation changes the alignment of the target-side knee via compensation of the lower extremity muscles during golf swing, which in turn results in more stress on the target-side knee.\(^7\) Kim and So\(^8\) showed that the flexion angle of the target-side knee during downswing ranges from 125.73° to 152.17° and from 127.10° to 152.18° among professional golfers using driver and 5-iron clubs, respectively. Kim et al.\(^9\) reported that the changes in the target-side knee joint ranges from -3.83° to 0.52° and from -3.80° to 0.58° in the frontal plane during golf swing among lower handicap golfers using driver and 5-iron clubs, respectively.

A golfer’s ability to control the golf ball’s trajectory depending on the types of shots, i.e., straight, draw, and fade, is crucial in high-level competitive golf; the ball may need to be maneuvered intentionally depending on the situation or environment.\(^10\) Analyzing the kinetics of the target-side knee based on three shot types during golf swing could provide objective and quantitative information on the principles and techniques for improving golf performance. In addition, as the use of various clubs is known to require different movements of the lower extremities,\(^11\) identifying the kinetics of the target-side knee among the three shot types during golf swing using different clubs is essential. Hence, this study aimed to analyze the kinetic differences in target-side knee among three shot types during downswing and to compare the differences in relation to different clubs used during golf swing. Ultimately, the findings could help improve golf performance.

**MATERIALS AND METHODS**

**Participants:** Twenty-nine healthy right-handed golfers participated in this study. All participants had no musculoskeletal injury or history of any musculoskeletal injury within the past year. They received a detailed description of the experimental procedures and informed consent was obtained. Prior to starting the experiment, each golfer completed a self-reported questionnaire on their health status, handicap, career, and personal information. Based on their handicap, they were divided into two groups: golfers with zero (0) handicap were in the high-skilled (HS) group and those with ≥ 3 handicap were in the low-skilled (LS) group. Table 1 shows the participants’ characteristics.

<table>
<thead>
<tr>
<th>Group</th>
<th>Gender (n,%)</th>
<th>Age (years)</th>
<th>Height (cm)</th>
<th>Weight (kg)</th>
<th>Career (years)</th>
<th>Handicap</th>
</tr>
</thead>
<tbody>
<tr>
<td>HS (n=12)</td>
<td>Female 2 (16.7)</td>
<td>22.67±2.42</td>
<td>174.00±6.55</td>
<td>68.00±7.17</td>
<td>9.42±2.27</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Male 10 (83.3)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LS (n=17)</td>
<td>Female 4 (23.5)</td>
<td>22.06±1.81</td>
<td>173.35±7.58</td>
<td>74.12±14.74</td>
<td>7.24±3.05</td>
<td>3.88±2.17</td>
</tr>
<tr>
<td></td>
<td>Male 13 (76.5)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Data were expressed as frequency (percentage) or mean ± standard deviation depending on the characteristics of variables.

HS: high-skilled, LS: low-skilled

**Experimental setup and calculation of knee joint kinetics:** The kinetic data in each section during downswing were recorded by a motion capture system using twelve Raptor-E infrared cameras (Motion Analysis, Santa Rosa, CA, USA) operating at 250 Hz. A global frame (4 m × 10 m × 3 m) was created using a nonlinear transformation method, and we used the fourth-order Butterworth low-pass filters\(^19\) with a cutoff of 24 Hz to eliminate errors in data collection.\(^12\) All data were processed using Visual 3D program, standard version 4.91.0 (C-Motion, Inc., Rockville, MD, USA). Fifty-seven reflective markers were attached to the participants’ body using a degrees-of-freedom marker set by a single investigator.\(^13\) For downswing separation, three markers were placed on head and shaft of participants’ 5-iron and driver club.
All golfers were asked to perform the three shots (i.e., fade, straight, and draw) with their 5-iron and driver clubs after their routine warm-up to adapt to the experimental setting. TrackMan system (TrackMan Golf, Vedbæk, Denmark) that allows real-time golf shot monitoring was employed to evaluate their shots, which was located at 2.4-3.6 m behind the participants and calibrated on the same line as that of the flagstick hole projection screen. A straight shot was defined as a shot landing the ball at the centrally located flagstick. And a fade shot and a draw shot were defined as a shot landing the ball at least 10 m to the right and left, respectively, of the centrally located flagstick. This system was reported to be valid in identifying ball launch and flight characteristics in golf.

The key outcome measures were increased extension/valgus/external rotation (negative) or flexion/varus/internal rotation (positive) knee angles in the sagittal/frontal/horizontal plane based on the knee position in the address position during each section. Data of two shots for each shot type and their downswing was divided into four sections based on the trajectory obtained from the markers placed on their clubs: from peak of backswing to parallel to the ground during downswing (first section), from parallel to the ground during downswing to ball impact (second section), from ball impact to parallel to the ground during follow-through (third section), and from parallel to the ground during follow-through to finish (fourth section).

Statistical analysis: All variables were analyzed using SPSS software (SPSS version 21.0 for Windows, IBM, Armonk, NY) and were expressed as mean and standard deviation. For normally distributed data, one-way repeated measures ANOVA with a LSD test was used to identify the differences in knee kinetics among the three shot types using 5-iron and driver clubs in each section during downswing within each group. Statistical significance was set at \( p < 0.05 \).

RESULTS AND DISCUSSION

Kinetic differences in target-side knee among three shot types using driver club: Table 2 shows the differences in extension/flexion angle changes in the target-side knee among the three shot types using a driver club in each section during downswing. In all sections, no significant differences were noted in both the HS and LS groups.

Table 3 shows the differences in valgus/varus angle changes in the target-side knee among the three shot types using a driver club in each section during downswing. In all sections, no significant differences were observed in both the HS and LS groups.

Table 2: The difference of change on extension/flexion in target side knee among drive shots using driver club

<table>
<thead>
<tr>
<th>Section</th>
<th>Group</th>
<th>Shot type</th>
<th>F (p)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Fade</td>
<td>Straight</td>
</tr>
<tr>
<td>First</td>
<td>HS</td>
<td>1.28±0.97</td>
<td>1.32±1.06</td>
</tr>
<tr>
<td></td>
<td>LS</td>
<td>1.58±1.57</td>
<td>1.72±1.52</td>
</tr>
<tr>
<td>Second</td>
<td>HS</td>
<td>-3.21±3.00</td>
<td>-3.36±2.96</td>
</tr>
<tr>
<td></td>
<td>LS</td>
<td>-4.37±3.34</td>
<td>-4.52±3.45</td>
</tr>
<tr>
<td>Third</td>
<td>HS</td>
<td>-4.20±3.27</td>
<td>-4.30±3.19</td>
</tr>
<tr>
<td></td>
<td>LS</td>
<td>-5.81±3.58</td>
<td>-5.86±3.57</td>
</tr>
<tr>
<td>Fourth</td>
<td>HS</td>
<td>-4.38±3.26</td>
<td>-4.40±3.28</td>
</tr>
<tr>
<td></td>
<td>LS</td>
<td>-5.26±3.58</td>
<td>-5.42±3.57</td>
</tr>
</tbody>
</table>

Data were expressed as mean and standard deviation. Units: degree (°).

HS: high-skilled, LS: low-skilled, first: from peak of backswing to parallel to the ground during downswing, second: from parallel to the ground during downswing to ball impact, third: from ball impact to parallel to the ground during follow-through, fourth: from parallel to the ground during follow-through to finish. Negative (positive) values means as an increased extension (flexion) on the basis of knee position in golf address.
Table 4 shows the differences in external/internal rotation angle changes in the target-side knee among the three shot types using a driver club in each section during downswing. In all sections, no significant differences were found in both the HS and LS groups.

Barrentine et al.\textsuperscript{15} demonstrated that PGA golfers had more internal rotation torque in the target-side foot than higher handicap golfers during golf swing; nevertheless, studies comparing knee kinetics between HS and LS golfers are lacking. Although this study did not conduct a statistical test for comparison between HS...
and LS golfers, the knee kinetics using different clubs and in each shot type during downswing apparently have differences. Moreover, Gatt et al.\textsuperscript{6} reported that the internal rotation torque of the target-side knee is slightly lower than that of the trail-side knee, while the external moments of the target-side knee were higher than those of the trail-side knee during golf swing. Worsfield et al.\textsuperscript{16} showed that lower handicap golfers had higher moments and increased internal rotation in the target-side foot than in the trail-side foot. Further studies on the comparison of knee kinetics between HS and LS golfers or between target-side and trail-side knees could provide useful information to improve golf performance.

**Kinetic differences in target-side knee among three shot types using 5-iron club:** Table 5 shows the differences in extension/flexion angle changes in the target-side knee among the three shot types using a 5-iron club in each section during downswing. In all sections, no significant differences were noted in both the HS groups. However, in the first, second, and third sections in the LS group, significant differences among the three shot types ($F = 6.519$, $p = 0.01$; $F = 5.695$, $p = 0.01$; $F = 3.327$, $p = 0.04$, respectively) were found. In the first section, the valgus angle of fade shot ($-5.07\pm2.97^\circ$) was less than that of straight shot ($-5.29\pm3.05^\circ$) ($p < 0.01$), and in the second and third sections, the valgus angle of fade shot ($-1.96\pm2.82^\circ$ and $-0.84\pm2.45^\circ$, respectively) and draw shot ($-2.10\pm2.89^\circ$ and $-0.93\pm2.38^\circ$, respectively) was less than that of straight shot ($-2.38\pm2.86^\circ$ and $-1.23\pm2.50^\circ$, respectively) (second section, $p < 0.01$ and $p = 0.03$; third section, $p = 0.04$, $p = 0.03$). In the fourth section, no significant difference among the three shot types was observed.

### Table 5: The difference of change on extension/flexion in target side knee among drive shots using 5-iron club

<table>
<thead>
<tr>
<th>Section</th>
<th>Group</th>
<th>Shot type</th>
<th>Within group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Fade</td>
<td>Straight</td>
</tr>
<tr>
<td>First</td>
<td>HS</td>
<td>1.24±0.89</td>
<td>1.25±0.83</td>
</tr>
<tr>
<td></td>
<td>LS</td>
<td>1.46±1.79</td>
<td>1.63±1.73</td>
</tr>
<tr>
<td>Second</td>
<td>HS</td>
<td>-2.52±2.92</td>
<td>-2.55±2.99</td>
</tr>
<tr>
<td></td>
<td>LS</td>
<td>-4.07±3.41</td>
<td>-4.13±3.37</td>
</tr>
<tr>
<td>Third</td>
<td>HS</td>
<td>-3.56±3.18</td>
<td>-3.50±3.32</td>
</tr>
<tr>
<td></td>
<td>LS</td>
<td>-5.50±3.64</td>
<td>-5.55±3.53</td>
</tr>
<tr>
<td>Fourth</td>
<td>HS</td>
<td>-3.86±3.19</td>
<td>-3.93±3.40</td>
</tr>
<tr>
<td></td>
<td>LS</td>
<td>-5.21±3.55</td>
<td>-5.32±3.57</td>
</tr>
</tbody>
</table>

Data were expressed as mean and standard deviation. Units: degree ($^\circ$).

HS: high-skilled, LS: low-skilled, first: from peak of backswing to parallel to the ground during downswing, second: from parallel to the ground during downswing to ball impact, third: from ball impact to parallel to the ground during follow-through, fourth: from parallel to the ground during follow-through to finish. Negative (positive) values means as an increased extension (flexion) on the basis of knee position in golf address.
Table 6: The difference of change on valgus/varus in target side knee among drive shots using 5-iron club

<table>
<thead>
<tr>
<th>Section</th>
<th>Group</th>
<th>Shot type</th>
<th>Within group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Fade</td>
<td>Straight</td>
</tr>
<tr>
<td>First</td>
<td>HS</td>
<td>-3.90±3.10</td>
<td>-3.92±3.12</td>
</tr>
<tr>
<td></td>
<td>LS</td>
<td>-5.07±2.97*</td>
<td>-5.29±3.05</td>
</tr>
<tr>
<td>Second</td>
<td>HS</td>
<td>-1.48±2.55</td>
<td>-1.69±2.74</td>
</tr>
<tr>
<td></td>
<td>LS</td>
<td>-1.96±2.82*</td>
<td>-2.38±2.86</td>
</tr>
<tr>
<td>Third</td>
<td>HS</td>
<td>-0.86±2.15</td>
<td>-1.06±2.23</td>
</tr>
<tr>
<td></td>
<td>LS</td>
<td>-0.84±2.45*</td>
<td>-1.23±2.50</td>
</tr>
<tr>
<td>Fourth</td>
<td>HS</td>
<td>0.57±1.04</td>
<td>0.46±0.66</td>
</tr>
<tr>
<td></td>
<td>LS</td>
<td>1.29±1.48</td>
<td>1.18±1.49</td>
</tr>
</tbody>
</table>

Data were expressed as mean and standard deviation. Units: degree (°).

HS: high-skilled, LS: low-skilled, first: from peak of backswing to parallel to the ground during downswing, second: from parallel to the ground during downswing to ball impact, third: from ball impact to parallel to the ground during follow-through, fourth: from parallel to the ground during follow-through to finish. Negative (positive) values means as an increased valgus (varus) on the basis of knee position in golf address. * p< 0.05: significant differences compared to straight shot tested by LSD test.

Table 7 shows the differences in external/internal rotation angle changes in the target-side knee among the three shot types using a 5-iron club in each section during downswing. In all sections, no significant differences were noted in both the HS and LS groups.

Table 7: The difference of change on external/internal rotation in target side knee among drive shots using 5-iron club

<table>
<thead>
<tr>
<th>Section</th>
<th>Group</th>
<th>Shot type</th>
<th>Within group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Fade</td>
<td>Straight</td>
</tr>
<tr>
<td>First</td>
<td>HS</td>
<td>1.51±1.14</td>
<td>1.46±1.12</td>
</tr>
<tr>
<td></td>
<td>LS</td>
<td>2.00±1.20</td>
<td>2.03±1.16</td>
</tr>
<tr>
<td>Second</td>
<td>HS</td>
<td>0.41±0.86</td>
<td>0.45±0.86</td>
</tr>
<tr>
<td></td>
<td>LS</td>
<td>0.69±0.94</td>
<td>0.80±0.93</td>
</tr>
<tr>
<td>Third</td>
<td>HS</td>
<td>0.30±0.75</td>
<td>0.34±0.68</td>
</tr>
<tr>
<td></td>
<td>LS</td>
<td>0.25±0.58</td>
<td>0.39±0.58</td>
</tr>
<tr>
<td>Fourth</td>
<td>HS</td>
<td>0.35±0.29</td>
<td>0.35±0.27</td>
</tr>
<tr>
<td></td>
<td>LS</td>
<td>0.32±0.39</td>
<td>0.40±0.38</td>
</tr>
</tbody>
</table>

Data were expressed as mean and standard deviation. Units: degree (°).

HS: high-skilled, LS: low-skilled, first: from peak of backswing to parallel to the ground during downswing, second: from parallel to the ground during downswing to ball impact, third: from ball impact to parallel to the ground during follow-through, fourth: from parallel to the ground during follow-through to finish. Negative (positive) values means as an increased external (internal) rotation on the basis of knee position in golf address.
As previously mentioned, one’s golf-skill level has a different swing mechanism and movement pattern during golf swing.\textsuperscript{7} Richards et al.\textsuperscript{17} reported that HS golfers shift a larger amount of their body weight to the target-side leg while keeping a more stable base. Moreover, Kim and So\textsuperscript{8} showed that professional golfers have no different flexion angle in the target-side knee regardless of the club used, whereas amateur golfers have a significant difference in flexion angle in the target-side and trail-side knees. Kim et al.\textsuperscript{9} reported that lower handicap golfers have a greater movement in the target-side knee in the frontal plane during golf swing than higher handicap golfers. Our study showed no differences in knee kinetics in each club and each shot type during downswing among HS golfers, whereas LS golfers using 5-iron clubs have a different valgus/varus angle among the three shot types in the first, second, and third sections during downswing, which could be attributed to technical errors or deficiencies among LS golfers during downswing.\textsuperscript{18}

**CONCLUSION**

This study was designed to compare the kinetics of the target-side knee among three shot types during downswing using different clubs. Both HS and LS golfers using a driver club had no significant kinetic differences in the target-side knee among the three shot types; similarly, HS golfers using a 5-iron club showed no kinetic differences in the target-side knee among the shot types. However, the valgus/varus angle in LS golfers using a 5-iron club showed significant differences in the target-side knee among the shot types in the first, second, and third sections during downswing. These findings could help improve golf performance especially for LS golfers.

**Ethical clearance:** Taken from Korea National Sport University committee

**Source of funding:** Self

**Conflict of Interest:** Nil

**REFERENCES**


Antibacterial Effect and Inhibition Ability of Enamel Demineralization by Surface Pre-Reacted Glass Ionomer Filler Containing Composite

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ABSTRACT

Background/Objectives: The present study evaluated the antibacterial effect and inhibition ability of enamel demineralization of S-PRG composite material in a microcosm biofilm model.

Methods/Statistical analysis: The bovine tooth was sectioned and embedded in a cylindrical acryl mold. To fill the dental materials, single hole was drilled on the enamel. Each of the two restorative materials, composite resin, S-PRG composite material was filled the hole. The specimens were incubated in the basal medium mucin (BMM) as microcosm model. After 7 days, surface hardness and red/green value (red fluorescence intensity) was measured using Vickers hardness tester and QLF-D. Changes in red fluorescence and surface microhardness were analyzed using one-way ANOVA and Tukey post hoc, with a significance level of 0.05.

Findings: There was no significant difference in changes of the red fluorescence intensity among the groups according to maturation time. The mean ΔVHN was –31.6 ± 13 for the control group, –30.9 ± 5.17 for the resin group, and –15.4 ± 9.8 for the S-PRG groups. The differences between the S-PRG group and the other two groups were statistically significant (p < 0.05).

Improvements/Applications: The S-PRG filler showed a significantly lower demineralization effect than the other groups. S-PRG composite material may inhibit the demineralization of enamel owing to its ion emission capability.

Keywords: Antibacterial effect, demineralization, microcosm biofilm, QLF-D, S-PRG

INTRODUCTION

Dental caries is a crucial cause of tooth loss in mankind. In the 20th century it has been reported that caries prevalence and severity have been continuously decreasing due to the use of fluoride dentifrice and the development of early caries detection technology such as DIAGNOdent™ or quantitative light-induced fluorescence (QLF). Recently, remineralization and micro-invasive interventions for early dental caries are the most important concepts in dental clinics.

Among the existing dental materials used to repair caries, glass ionomer (GI) have the ability of antibacterial effect. GI can prevent or remineralize caries by releasing fluoride ions. Moreover, its ability to achieve chemical adhesion to tooth structure and continuous fluoride recharge and release is major advantage. However, the lower mechanical properties of GI compare to composite resin is not suitable for high occlusal loading cases.

Surface pre-reacted glass ionomer (S-PRG) have recently been developed. S-PRG filler has been shown to have antibacterial efficacy in dental biofilms and inhibits the adherence of the cariogenic microorganism.
Streptococcus mutans. S-PRG filler could prevent demineralization and promote the remineralization of initial caries by fluoride release and recharge. S-PRG can not only release fluoride but also other ions, such as strontium, silicon, boron, sodium, and aluminum.

Although investigation of dental biofilms in vivo is a good method to reflect the condition of the actual oral cavity, it is more difficult due to ethical problems of donors, heterogeneity of biofilms, and complexity of oral environments.

For these reasons, it is a challenge to reproduction the oral environment in vitro. Although there are various in vitro biofilm models, microcosm biofilm models have been recommended to surmount many restrictions, and it is like oral biofilms.

Traditional methods such as colony count and Scanning Electron Microscope(SEM) are insufficient for detecting pathogenic changes of biofilms. QLF is an alternative solution for these problems. Previous studies have reported bacterial porphyrin is emitted the red fluorescence by blue light at 405 nm.

The present study evaluated the antibacterial effect and inhibition ability of enamel demineralization of S-PRG composite material in a microcosm biofilm model.

**MATERIALS AND METHODS**

**Preparation of the Enamel blocks:** Extracted bovine incisors with no crack or white spot were used to prepare for the enamel blocks. To make 18 enamel specimens (5 mm in diameter), the labial surfaces of the bovine incisors were separated with a low speed diamond disc. Each ground specimen was embedded in a cylindrical acryl mold and leave a 1mm of space at the top for biofilms of consistent depth. To fill the dental materials, single hole (3 mm in diameter) was drilled on the surface extended through enamel and into dentin. The restorative materials groups were randomly divided following: control (no restoration), composite resin (Denfil, VericomInc, Kangwon, Korea), S-PRG composite material (Beautifil flow, Shofu Inc., Tokyo, Japan).

**Basal medium mucin (BMM):** Biofilms were incubated in BMM with 0.5% sucrose as growth medium. The BMM medium contained: 0.25% porcine mucin, 0.5% trypticase peptone, 1.0% proteose peptone, 0.5% yeast extract, 1 mmol/l urea, 1 mmol/l arginine, 0.25% KCl, and 1 mg/l menadione. BMM medium was adjusted pH to 7.0.

**Microcosm Oral Biofilm Formation:** The saliva donor refrained oral hygiene behavior for 24 h. Debris of collected saliva was removed by filtration through glass wool (Duksan Chemicals, Ansan, Korea) and diluted to 30% concentration using sterile glycerol. Each specimen was inoculated by 1.5 ml of prepared saliva, and keep in 24-well culture plates. After 4h, the saliva was sucked in carefully by pipette, and each well was added 1.5 ml of growth media. The microcosm biofilm was grown up to 7 days at 37 °C. Anaerobic condition was kept with 80% N₂, 10% CO₂, and 10% H₂. The growth media in each well was replaced daily.

**Red Fluorescence intensity of the Biofilms:** The biofilm images were taken using quantitative light-induced fluorescence-digital (QLF-D, Inspektor Research Systems BV, Amsterdam, Netherlands). QLF-D could get the two types of image that fluorescence and general image. The setting value of QLF-D for fluorescence image was fixed following: SS, 1∕45 s; Av, 3.2; and ISO, 1600. The red and green values of the fluorescence image were calculated by image analyzer (Image J, NIH, Bethesda, MD, USA). Red/green(R/G) ratio was used to measure the red fluorescence intensity according the time flow. A single trained examiner conducted all procedures.

**Changes of surface microhardness:** The surface microhardness was measured using a Vickers diamond indenter with a load of 200 g for 10 s (JT Toshi Inc., Tokyo, Japan). Microhardness measuring was performed before the inoculation (VHN1) and after 10 days (VHN2). The percentage of surface microhardness change was computed the following: ΔVHN (%) = 100 (VHN1−VHN2)/VHN1.

**Statistical analysis:** Changes in red fluorescence (R/G values) of the biofilm were analyzed using repeated measure ANOVA and Tukey post hoc. Changes in surface microhardness were analyzed using one-way ANOVA and Tukey post hoc, with a significance level of 0.05. All data were analyzed using IBM SPSS Statistics 18 (PASW 18, SPSS Inc., Chicago, IL, USA).

**RESULTS AND DISCUSSION**

By observing the biofilm macroscopically, the biofilm on the specimen surface was getting thicker as time went by. After 1 day of growth, slight redness of the biofilm was observed between the tooth and mold.
in QLF-D images. After 3 days of growth, red biofilm covered the whole surface of the specimens. The red biofilm became darker over time (Fig. 1). As a result of color analysis using red and green values of pixels, the R/G ratio increased until 3 days. However, after the 3rd day, the value was saturated and remained steady. There were no significant differences in the changes of red fluorescence intensity among the groups according to maturation time (Table 1).

The mean ΔVHNs for the three groups (control group, resin group, S-PRG group) immersed in BMM media for 7 days are shown in Figure 2. The mean ΔVHN was −31.6 ± 13 for the control group, −30.9 ± 5.17 for the resin group, and −15.4 ± 9.8 for the S-PRG groups. The differences between the S-PRG and the other two groups were statistically significant (control: p = 0.031, resin: p = 0.039).

Table 1: Changes of red fluorescence (R/G value) according to the maturation time

<table>
<thead>
<tr>
<th></th>
<th>Day 0</th>
<th>Day 1</th>
<th>Day 3</th>
<th>Day 5</th>
<th>Day 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>0.69±0.02</td>
<td>0.82±0.02</td>
<td>0.93±0.03</td>
<td>0.9±0.04</td>
<td>0.91±0.09</td>
</tr>
<tr>
<td>Resin</td>
<td>0.66±0.02</td>
<td>0.84±0.02</td>
<td>1.02±0.04</td>
<td>0.99±0.04</td>
<td>1.01±0.02</td>
</tr>
<tr>
<td>S-PRG</td>
<td>0.67±0.03</td>
<td>0.85±0.03</td>
<td>0.98±0.02</td>
<td>0.93±0.03</td>
<td>0.96±0.03</td>
</tr>
</tbody>
</table>

Figure 1: Red fluorescence images of microcosm biofilms formed on the enamel specimens.

Figure 2: Changes in surface microhardness for 3 groups
DISCUSSION

The aim of the microcosm laboratory model is to mimic closely the physicochemical, microbiological, and nutrient situation of in situ. Microcosms have the advantage that maintain the heterogeneity and complexity of the original sample, enabling real bacterial community dynamics to be copied within the laboratory environment and allow for the manipulation of variables of interest. In this study, biofilms were cultured to form a caries-related biofilm in sucrose contained BMM.

When observed under the fluorescence conditions, the biofilm of the resin group emit more red fluorescence than other groups. However, there were no statistically significant differences in changes of red fluorescence intensity among the groups. This is not consistent with previous studies that reported an inhibitory effect of S-PRG eluate. However, other previous studies reported that the adhesion inhibition effect of S-PRG appeared to be restricted only S. mutans. There was weak or no inhibition effect on other streptococci such as S. oralis, S. salivarius, and S. sanguinis. In addition, Kim et al. reported that microcosm biofilms were composed of various streptococci. However, the ratio of S. mutans in microcosm biofilms is much lower than other streptococci. However, the mechanism of bacterial of specific type inhibition is not clear and there are need more study.

In addition, after culture of the biofilm, the surface hardness of the S-PRG was significantly less decreased than among other groups. A previous study reported that bovine specimens coated by a varnish containing S-PRG were not demineralized in 1 M lactic acid as compared with the control group. Fluoride and other ions of S-PRG considered to inhibit the demineralization of S-PRG specimen.

S-PRG material can release various ions, such as Al, B, Na, Sr, Si, and F. Fluoride has the ability to produce fluorapatite that has an antibacterial effect during remineralization of demineralization lesions. In addition, Sr and Si can help in the remineralization of teeth.

Other previous studies reported that S-PRG filler buffered the lactic acid. The pH of cariogenic microcosm biofilm is known to be decreased due to acid produced by many aciduric and acidogenic bacteria. It has been assumed that a neutralization ability of S-PRG has an effect on the inhibition of demineralization.

This study has a limitation that whereas multiple ions can be recharged via S-PRG filler in the oral environment, the microcosm biofilm model mimics an extreme cariogenic situation without a supply of fluoride.

CONCLUSION

The maturation of the biofilm on the S-PRG composite material appeared to be lower than the control and composite resin group. However, antibacterial effect was not significantly statistical difference among the three groups. The S-PRG composite material showed a significantly lower demineralization effect than the other groups. S-PRG composite material may inhibit the demineralization of enamel surfaces owing to its ion emission capability.

ACKNOWLEDGMENT

This research was supported by the Kyungpook National University Research Fund, 2015

Ethical Clearance: Taken from Kyungpook National University committee

Source of Funding: Self

Conflict of Interest: Nil

REFERENCES


The Relationship between Parenting stress, Parenting efficacy, and Resilience in Mothers with Early school-age children

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Research Scholar, Nursing department, Baekseok University, 76, Munam-ro, Cheonan, Korea

ABSTRACT

Background/Objectives: When a child enters elementary school, the mother takes on the role of a school parent along with the existing role as a parent and experiences various types of parenting stress.

Methods/Statistical analysis: This study is a descriptive research study to figure out the relation between parenting stress, parenting efficacy, and resilience in mothers with early school-age children. The subjects of the study were 206 mothers who had children in 1st grade at 2 elementary schools, who agreed to the purpose of the study. Data collected for the purpose of the study was analyzed using SPSS 18.0 statistical program.

Findings: The most common age group among the subjects was between 35 and 39 with 50.3%, and then it was in the order of 40-44, 30-34, and 45-49. In the subjects, parent life stress was 3.46 points and school parent role stress was 3.65 points. In the correlation between parenting stress, parenting efficacy, and resilience, parenting stress, parenting efficacy, and resilience had a negative correlation, and parenting efficacy and resilience had a positive correlation.

Improvements/Applications: Therefore the study aims to explore the relation between parenting stress, parenting efficacy, and resilience in mothers with early school-age children, and to provide basic data to find a plan to reduce parenting stress.

Keywords: Children, Early school-age, Mother, Parenting efficacy, Parenting stress, Resilience.

INTRODUCTION

Mothers with early school-age children start a new role as a school parent when their children enter elementary school, and as a mother, she is required to perform a new role, and at the same time she faces other difficulties, such as establishing a parent-teacher relationship. In other words, parenting of lower grade elementary school children who enter formal education system can be a major psychological burden due to changes in parenting environment, and this adds on top of the existing parental life stress. Therefore, the parenting stress for the mother with early school-age children is the stress experienced by the mother who plays a new role as the child enters elementary school, and it can be divided into parental life stress which is difficulty experienced in daily life as a parent, and parental role stress which is difficulty experienced in performing the role of a school parent. These parenting stresses occur to some extent in the developmental process facing the family system, and with the tension and pressure within the family system that individuals and families inevitably experience as they develop and change with the passage of time, they are difficulties or burdens that the parents perceive due to child rearing, and it is everyday stress experienced by the mother during the parenting process resulting from childbirth, which can be explained as burden of the parental role and feeling of guilt for non-parental care.

Parenting efficacy is a perception of the ability of parents to think that they can not only discipline their children well but also resolve conflicts with their children when they arise. This is defined as both concepts...
of cognitive dimension reflecting the competence and problem solving ability perceived by the parents about the parent role and the emotional dimension reflecting the frustration or anxiety felt by the parents. The mother with high parenting efficacy showed more favorable parenting behaviors such as warmth, encouragement, and active participation to infant children, but less tendency to improper parenting behaviors such as rejection and control. Parenting efficacy is also a decisive factor in the psychological well-being of parents and children. As a result, it has a positive effect on the development of children, such as more active participation in parenting, more appropriate and consistent parenting, encouraging autonomy, and better parenting that promotes the child’s physical, cognitive, social and emotional development.

Since parenting stress and parenting efficacy of mothers are directly related to parenting behaviors that can affect children, it is necessary to examine the psychological variables that can result in positive effects. This study aims to examine the relationship of resilience as one of the variables.

Resilience is defined as the ability to cope with difficulties when they arise and adapt to the environment and grow mentally. It is the ability of a mother to return and recover to adaptation level even when she has lost some functionality due to life events or stresses she faces parenting children, and it is defined as a concept that includes subfactors controllability, positivity, and sociality. Also, when talking about how well people are adapting, resilience is emerging as an internal factor that takes into account the conditions under which the adaptation process occurs. In other words, resilience is the ability to function effectively in times of extreme stress that others cannot deal with effectively, and to overcome the important stresses that follow. Also, people with resilience are often represented as people with competent coping abilities. Resilience helps a mother to offer personal skills and help such as coping skills and intellectual skills and think clearly and function well despite bad situations with family and friends.

Therefore, because for mothers with early school-age children, appropriate parenting is emphasized to help children to adapt well to the new environment, the study aims to investigate the relationship between parenting efficacy and resilience that can become basic data for the development of intervention to help better coping with parenting stress that will arise from those situations.

**MATERIALS AND METHODS**

**Research Design:** The study is a descriptive research study to figure out the relation between parenting stress, parenting efficacy, and resilience in mothers with early school-age children.

**Research Subjects:** The subjects of the study were 206 mothers who had children in 1st grade at 2 elementary schools located in C, who agreed to the purpose of the study.

**MEASUREMENT TOOLS**

**Parenting stress in mothers:** The parenting stress in mothers and the study was measured using a parenting stress Index developed by Kang for elementary school parents. Parenting stress Index was amended considering parenting stress factors in parents with school-age children, from PSI (Parenting Stress Index) by Abidin. This index is composed of a total of 24 questions, including 7 questions of parenting stress sub area parent life stress, and 17 questions about parenting role stress. It is composed of a 5 point Likert scale from 1 point ‘Strongly disagree’ to 5 points ‘Strongly agree’ and higher points represent that the mother perceives more parenting stress. Reliability Cronbach α in the study was 0.90.

**Parenting efficacy in mothers:** Parenting efficacy in this study was measured using ‘Mother parenting efficacy index’ developed by Choe and reconfigured by Lee. It is composed of 18 questions which include overall parenting ability, healthy parenting ability, communication ability, teaching ability, and disciplinary ability. Overall parenting ability measures the ability, knowledge, and behavior as a good parent and healthy parenting ability is related to the physical and mental health of the children. Also, communication ability measures the understanding an acceptance of the children and degree of communication with children, and teaching ability and disciplinary ability are related to the ability to provide intellectual learning and to control and discipline the children. All questions are composed of a 5 point Likert scale from 1 point (Strongly disagree) to 5 points (Strongly agree) and the Reliability Cronbach α was 0.89.

**Measure of resilience in mothers:** Mother Resilience Quotient Test (RQT) used in the study was a resilience
quotient test that was used in various studies and organized and verified by Shin\(^\text{17}\). This index is composed of a total of 27 questions and sub factors include control, positivity, and sociability. It is composed of a 4 point Likert scale from 1 point ‘Strongly disagree’ to 4 points ‘Strongly agree’ and higher points represent higher resilience. Reliability Cronbach α in the study was 0.86.

**Data analysis:** The data collected for the purpose of this study used the following analysis method using SPSS18.0 statistic program.

First, an average and percentage of the target sociodemographic characteristics were calculated.

Second, an average and a standard deviation were calculated to analyze the target’s parenting stress, parenting efficacy, resilience.

Third, a t-test and ANOVA verification were conducted to examine the differences in parenting stress, parenting efficacy, resilience according to the target’s sociodemographic characteristics.

Fourth, a correlation analysis was conducted to investigate the relationship between parenting stress, parenting efficacy and resilience.

**RESULTS AND DISCUSSION**

**Sociodemographic characteristics of subjects:** The most common age group among the subjects was between 35 and 39 with 50.3%, and then it was in the order of 40-44, 30-34, and 45-49 as shown in table1. The most common level of education was vocational/college graduate with 72.1% and then it was in the order of under high school graduate and over graduate school graduate. The most common occupation was housewife with 72.2% and then it was in the order of sales/service, self-employed, sales/service, office worker, and other. The most common number of children was 2 and the most common m monthly average income was between 3.00 million and 3.99 million KRW.

**The parenting stress of the target:** The parenting stress’s lower variables of the target of this research are shown in Table 2. In the subjects, parent lifestress was 3.76±0.93 points and school parent role stress was 3.95±0.67 points.

**The parenting efficacy of the target:** The parenting efficacy’s lower variables of the target of this research are shown in Table 3. In the subjects, overall parenting ability was 3.78±0.54 points, health parenting ability was 3.56±0.34, ability to communicate was 3.21±0.26, teaching ability of instruction was 3.12±0.53, and faculty of discipline was 3.43±0.62 points.

**The resilience of the target:** The resilience’s lower variables of the target of this research are shown in Table 4. In the subjects, controllability was 2.56±0.23, positivity was 2.78±0.32, and sociality was 2.54±0.42.
Table 4: The resilience of the target

<table>
<thead>
<tr>
<th></th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Controllability</td>
<td>2.56</td>
<td>.23</td>
</tr>
<tr>
<td>Positivity</td>
<td>2.78</td>
<td>.32</td>
</tr>
<tr>
<td>Sociality</td>
<td>2.54</td>
<td>.42</td>
</tr>
</tbody>
</table>

The relationship between parenting stress, parenting efficacy and resilience:

The correlation between parenting stress, parenting efficacy and resilience is shown in Table 5. In the correlation between parenting stress, parenting efficacy, and resilience had a negative correlation, and parenting efficacy and resilience had a positive correlation.

Table 5: The relationship between parenting stress, parenting efficacy, and resilience

<table>
<thead>
<tr>
<th></th>
<th>Parenting stress</th>
<th>Parenting efficacy</th>
<th>Resilience</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parenting stress</td>
<td>1</td>
<td>-37.8**</td>
<td>-41.3**</td>
</tr>
<tr>
<td>Parenting efficacy</td>
<td>1</td>
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<td>Resilience</td>
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</tbody>
</table>

**p<0.001

Table 6: The relationship between lower variables of parenting stress, parenting efficacy, and resilience

<table>
<thead>
<tr>
<th></th>
<th>Parent life stress</th>
<th>School parent role stress</th>
<th>Overall parenting ability</th>
<th>Healthy parenting ability</th>
<th>Ability to communicate</th>
<th>Teaching ability of instruction</th>
<th>The faculty of discipline</th>
<th>Controllability</th>
<th>Positivity</th>
<th>Sociality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parent life stress</td>
<td>1</td>
<td>-34.2**</td>
<td>-43.1**</td>
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<td>-34.2**</td>
<td>-41.3**</td>
<td>-37.2**</td>
<td>-38.4**</td>
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<td>-42.1**</td>
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<td>46.7**</td>
<td>45.6**</td>
<td>41.6**</td>
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<td>63.7**</td>
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<td>62.1**</td>
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<td>52.1**</td>
<td>45.6**</td>
<td>41.7**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teaching ability of instruction</td>
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<td>61.5**</td>
<td>41.5**</td>
<td>47.1**</td>
<td>42.2**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The faculty of discipline</td>
<td></td>
<td>1</td>
<td>56.3**</td>
<td>46.6**</td>
<td>48.7**</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Controllability</td>
<td></td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>Positivity</td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>Sociality</td>
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<td></td>
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<td></td>
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</tr>
</tbody>
</table>

**p<0.001

CONCLUSION

As a child enters a new environment of school in elementary school age, at the beginning of the school period, he or she undergoes major changes in physical, intellectual, and social and emotional changes, and in order to help children adapt well to the new environment, mother’s parenting behavior is important, and the mother is also in a period when she begins to perform her new role and experiences various changes.
Therefore, because parenting stress is a negative factor in the healthy and happy growth and development of early school-age children in the lower grades of elementary school where both children and mothers have to adapt to the new environment of schools, it is very important to reduce this parenting stress. As a result of exploring the relation between parenting efficacy and resilience among psychological factors as a plan to find a mediator to reduce parenting stress, there was a significant relation and it was found that by increasing these two factors, parenting stress could be reduced and it positive parenting behavior.

Therefore, development of nursing intervention that increase parenting efficacy and promote resilience is very necessary for mothers with children of early school-age showing parenting stress.

Ethical Clearance: Taken from Baekseok University committee

Source of Funding: Self

Conflict of Interest: Nil

REFERENCES


Analysis of Sitting Posture using Wearable Sensor Data and Support Vector Machine Model

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ABSTRACT

Background/Objectives: The purpose of this study is to analyze the posture patterns of the user group with back pain and the user group without back pain using the data transmitted from the wearable sensor attached to the user’s body and chair and to guide the correct posture based on this classification.

Methods/Statistical analysis: In this study, the sitting posture of the user was analyzed by attaching a tilt sensor and a pressure sensor to the wearable device and the chair. For the study, sensor data for users with and without back pain were collected via the web. The Support Vector Machine (SVM) model was used to classify the posture patterns that could cause the correct posture and pain. This posture pattern can predict future pain according to the current posture.

Findings: As a result of the study, the posture patterns of the users with and without back pain were classified by the hard margin method and it was verified through the program whether the body was inclined to the left or to the right and bent back or forth based on the posture pattern. The two groups of users were classified clearly in the sitting posture pattern and highly reliable in predicting the presence of back pain in random user data. The results of these studies are expected to be useful for predicting incorrect posture that cause back pain in the future.

Improvements/Applications: This study focuses on back pain that leads to neck and shoulder pain. However, it is necessary to analyze the pain area in detail in future and it is also necessary to optimize the monitoring system for posture prediction that can cause pain.

Keywords: Sitting Posture, Wearable Sensor, Support Vector Machine, Posture Pattern, Classification, Prediction.

INTRODUCTION

The use of sensor technology is rapidly developing due to the spread of wearable devices and the Internet of Things. Recently, various machine learning techniques have been used to recognize human body movements from sensors and predict daily activities. It is not hard to see people who are suffering from pain due to incorrect posture because modern people are sitting around in smart devices every day. Back pain is linked to pain in the shoulder neck, so it is difficult to improve through exercise. The sitting position is 7 times more than when lying down, and 3 times more than when standing, which is the burden on the waist. In this case, the wrong posture causes more difficulty to the body because the weight is not dispersed evenly. Therefore, maintaining an incorrect sitting posture for a long time can cause back pain by easily feeling tired and increasing stress on the lumbar spine. In recent years, there have been a lot of various and inexpensive wearable devices, and products supporting personal healthcare are spreading. There are a variety of products available for correct posture correction, such as a chair or a cushion, as well as a type of waist belt and a type wear behind the neck.

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The purpose of this study is to construct a wearable device by attaching a sensor to the user’s waist and chair in order to induce correct posture. Also, by analyzing the posture pattern between the group with back pain and the group without back pain, to predict the future pain of the user according to the current posture. The system proposed in this study is different from the existing research in the following two aspects. First, the chair and the wearable band were used together to analyze the sitting posture in detail. Second, by analyzing the posture pattern of the user group with and without back pain, it is possible to predict the posture of the user who is potentially expected to have back pain in the future.

**MATERIALS AND METHODS**

**Wearable Device Design:** When a person sits, the weight of the upper body is supported by the pelvis and the tail bone. Back pain is caused when a person sits bent and the pelvis returns to the back of the body and the waist muscle further stretches. Also back pain causes a tremendous overwork in the waist when over-tensioned. Therefore, when the user is seated on a chair, the tail bone should be fixed on the chair so as to guide the body back and forth in a straight line. The wearable device for this study was designed to install four pressure sensors on the inside of the chair to support the pelvis and caudal bone and to install the tilt sensor on the user’s waist to induce correct postures. The following Table 1 outlines the development environment of the system for this study.

<table>
<thead>
<tr>
<th>Division</th>
<th>Development Tool</th>
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<td>Database</td>
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<tr>
<td>Web Sever &amp; Container</td>
<td>Apache Tomcat8.0</td>
</tr>
<tr>
<td>Web</td>
<td>EclipseEE</td>
</tr>
<tr>
<td>App</td>
<td>Android Studio</td>
</tr>
<tr>
<td>Language</td>
<td>Java, JSP, ArduinoC</td>
</tr>
</tbody>
</table>

The wearable device store the data received through the pressure sensor and the tilt sensor connected to the Arduino in the database via the web, and can check the sitting pattern in the application program. If attach a pressure sensor to the chair only, it is difficult to determine the degree of bending at the waist. Using a combination of a chair and a wearable waistband can help in more detailed posture correction. The pressure sensor was model FSR-402. The FSR sensor is a sensor designed to measure physical pressure, weight, etc. The structure is simple and the price is cheap, while the accuracy is somewhat low. The pressure sensor is made up of several layers. When the seat is bent or the waist is bent, the sensor is the principle of reducing the resistance as the area of contact with the semi-conductor in the active dot area increases while under pressure. The tilt sensor uses a 4DT-SEN (4-Directional Tilt Sensor) model. The 4-Directional tilt sensor has an IR LED and a phototransistor for detecting the IR LED signal at two corners. The principle of operation is that when a round bead located at the center of the sensor is tilted forward/backward/left/right due to gravity action, it rolls to the edge of the lowest point. The sensor signals are represented differently depending on where the beads are located at the four corners.

**Sensor data collection via the web:** The system proposed in this study consists of a chair and a wearable device with sensors attached, a smartphone application that receives sensor data about the sitting position of the user and transmits them to the server application, and a server that stores the sensor data via the web. Figure 1 shows the system structure diagram.
The following sensor data were collected for this study. First, the data of the pressure sensors attached to the left and right side of the chair were collected to determine whether the user put the tail bone in close contact with the inside of the chair. The pressure of the left and right pelvis was analyzed when sitting on a chair. Second, data were collected to determine the slope of the upper half of the upper body attached to the upper body of the user. The patterns were analyzed through data collection of each user. Data storage is to transmit data via the web whenever a user wearing a wearable sensor sits on a chair with a pressure sensor. A total of 4530 data were analyzed and R was used for data analysis. R is a popular big data analysis tool used in various fields such as machine learning, visualization, and data modeling. The pressure sensor attached to the chair transmits the data of the load distribution to the smartphone via Bluetooth and stores it on the web server. Back pain was found when the load was not balanced on the chair, such as sitting on a leg or squeezing a hip. In addition, the 4-directional tilt sensor attached to the user’s waist records tilt data such that the waist and pelvis are twisted or bent left, right, front and back.

Classification and prediction of posture pattern using SVM Model: SVM is one of the learning models developed by Vapnik and is the most commonly used machine learning model in recent years as a classification or prediction technique. Machine learning aims to learn the predictions of new data after learning through existing data. The machine learning methodology is divided into supervised learning with labels in the training data, and unsupervised learning with no labels in the training data. Supervised learning is a method of predicting a target variable for new unknown data by estimating one function from the input vector for each attribute and labeled learning data. SVM is a model for predicting whether a new person will subscribe to Newspaper A when there is households subscribing to and not subscribing to Newspaper A in a village. SVM can be classified as linear SVM and nonlinear SVM depending on whether two classes of learning data located in vector space can be linearly separated or linearly difficult to separate. The goal of the SVM is to find a straight line separating the two groups. SVM finds a straight line that is the maximum distance between the line dividing the data and the closest point, and reduces the error rate for future data. Figure 2 shows the 2D SVM. (A) shows an arbitrary SVM discriminant, and (b) shows a case where two groups are closely separated.

In this study, two-dimensional models such as the difference between the left and right pressure sensor value of the chair and the difference of the tilt sensor value of the waist band are used for the user with and without the back pain.

RESULTS AND DISCUSSION

The analysis method using the support vector machine is mainly used when the data to be treated is classified into two groups. In this study, two-dimensional SVM analysis was performed using the pressure sensor attached to the inside of the chair and the tilt sensor attached to the back of the chair. Therefore, this model can know which of the two groups the user who uses the chair belongs to. In table 1, the row is the actual value of Y and the column is the predicted value of Y. Y is a prediction of new data X. A total of 4530 data were divided into 2: 1 training data and test data. The training data used 3020 entities and the test data used
1510 data. The SVM classification model was fit as the training data and the Y predictions of the test entities were made and then compared with the actual Y. Table 1 shows the results obtained by putting the test data into the SVM classification model suitable for the training data. The misclassification matrix of table 1 shows that all test data are correctly classified.

<table>
<thead>
<tr>
<th>Predict</th>
<th>Back Pain</th>
<th>No Pain</th>
<th>Sum</th>
</tr>
</thead>
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<td>Back Pain</td>
<td>882</td>
<td>1</td>
<td>883</td>
</tr>
<tr>
<td>No Pain</td>
<td>3</td>
<td>624</td>
<td>627</td>
</tr>
<tr>
<td>Sum</td>
<td>885</td>
<td>625</td>
<td>1510</td>
</tr>
</tbody>
</table>

Table 2: Classification matrix

Figure 3 shows the training data and the classification boundary with the pressure sensor value and the tilt sensor value. It can be seen that the two groups are separated based on the linear equation that distinguishes the two groups. These results can be predicted with a higher degree of confidence in determining the data entered later.

Figure 4 shows training data and support vector using dimension reduction method for categorical data.

By the SVM model, the posture patterns of the users with and without back pain were classified by the hard margin method and it was verified through the program whether the body was inclined to the left or to the right and bent back or forth based on the posture pattern. The two groups of users were classified clearly in the sitting posture pattern and highly reliable in predicting the presence of back pain in random user data. Analyzing the posture of a user sitting on a chair can predict the possibility of having pain in the future even if there is no pain at the moment. The results of these studies are expected to be useful for predicting incorrect posture that cause back pain in the future. In Table 2, the following data compares how well this model predicts.

CONCLUSION

As many modern people are sitting around in smart devices, they have back and neck pain in the wrong posture. To guide the correct posture, it is necessary to monitor the posture (pressure) when sitting on the chair and the balance (tilt) of the body at the same time. In this study, four pressure sensors were attached to the chair, a tilt sensor was attached to the user’s waist, and the posture pattern was analyzed to classify the user to predict the incorrect posture that caused the pain. In this study, support vector machine which is a typical machine learning model actively used in classification and prediction was used for analysis. Through the analyzed data, the user can check his/her usual sitting position. However, since wearable devices designed in this study are worn on the waist, it is not possible to analyze the neck and arm pain commonly found in modern people using smart phones or computers. In the future, these areas need to be further research. The results of this study are expected to be used as a basic data for system development that can monitor their attitude in real time using wearable sensor stream. In the future, as the spread of high-sensitivity fiber-based sensors is expanded, it is expected to become a more user-friendly wearable device.

Ethical Clearance: Taken from... Mokwon University........Committee

Source of Funding: Self

Conflict of Interest: nil
REFERENCES


The Effect of Happiness Level on Internet Addiction of Early Childhood Education Teachers: Focusing on the Mediating Effect of Smartphone Addiction

Byung-Man Kim
Research Scholar, Department of Early Childhood Education, Kyungnam University, Changwon, 51767, Republic of Korea

ABSTRACT

Background/Objectives: The purpose of this study is to identify the relationship between early childhood teachers’ internet and Smartphone addiction tendency and their happiness among the media addiction variables and the effects of these media addiction tendency to their mental health.

Methods/Statistical analysis: The subjects in this study were 500 randomly selected early childhood education teachers at a kindergarten and daycare center located in the city of Busan. The instruments used in this study were the National Information Society Agency by National Information Society Agency’s Internet Addiction Proneness Scale for Adults-Short Form (KS-A), Smartphone Addiction Proneness Scale of early childhood education teachers. The instrument used to assess the happiness of the early childhood education teachers was Kwon’s Happiness Scale that was an adapted version of Argyle’s21 Happiness Scale which consisted of three areas: external happiness, internal happiness and self-regulatory happiness.

Findings: The results of this study are as follows: First, the early childhood education teachers took an above-average positive view of their own happiness, media addiction (internet addiction, smartphone addiction). Second, significant positive correlations among the internet addiction and smartphone addiction of the early childhood education teachers. Meanwhile there were significant negative correlations among their own happiness and media addiction (internet addiction, smartphone addiction). Third, media addiction (internet addiction, smartphone addiction) could be regarded as the variables to affect their happiness, and smartphone addiction was more influential, followed by internet addiction. Fourth, smartphone addiction has mediation effect in the relations between internet addiction and happiness of early childhood education teachers. The findings of the study suggest that in order to boost the happiness of early childhood education teachers, it’s necessary to decrease their media addiction (internet addiction, smartphone addiction).

Improvements/Applications: This study suggests the possibility and direction for early childhood teacher education to prevent media addiction and tries to provide basic data to help early childhood teacher’s happiness by using digital media represented by internet and smartphone in positive manner.

Keywords: media addiction, internet addiction, smartphone addiction, happiness, early childhood education teachers

INTRODUCTION

Future society is the information society and the information or idea has an unlimited value. Huge changes are expected in every area and signs of various changes are currently progressing. Futurists predicted that humankind will face another tremendous change from industrial to informatization society as the humankind met huge revolution from agricultural to industrial
There is the information in the center of this revolution and the information and communication media delivering the information have strong drawing and spill-over power. Therefore, this overusing causes various individual and physical problems to the people like VDT syndrome, emotional segregation isolation, language distortion, cognitive stimulation and oriented values. As the use of media which is a tool at the information age becomes common, human life seems convenient and enjoyable, but in the dark side of it, serious personal and social problems occur.

Types of these media addiction can be divided into Internet addiction and smartphone addiction. Regarding the happiness of early childhood teachers, the seriousness of the problems due to addictive use of Internet and smartphone are recently being reported. Firstly, regarding Internet addiction, as the American Psychiatric Association (ADA) listed the term, “Internet addiction” in the appendix of the DSM-5, it acknowledges the need and value of related study, and secondly, smartphone addiction is the state that the individuals are too much absorbed in the smartphone and cannot control themselves. The Association concluded it is appropriate to use the term “addiction” from the perspective that the excessive use of smartphone and related problems has the characteristics of dependency, withdrawal and tolerance, which shows the similarity in many aspects with the Internet addiction that has various research results through advance studies.

According to McLuhan, addiction is the state of distortion or bias of human experience about technology or media and ‘the perceptual paralysis’ that other senses are relatively lowered or closed as a certain sense is expanded. In addition, Griffiths emphasized that not only the drugs such as narcotics and alcohols have addiction risk but also all human activities can be addicted such as gambling, overeating, sexual activity, sports, TV and computer games. From this context, internet and smartphone addiction is a numbness phenomenon (paralysis of sense) caused by the misuse and obsession of technology such as uncontrollable excessive use of Internet and smartphone. In case these devices are not available, tolerance and withdrawal symptoms occur and this phenomenon could bring negative influence to ordinary daily life or role execution. This addiction can be defined as the problem that causes physical, psychological and social dysfunction and makes healthy daily life style difficult. Advance studies about the relationship between early childhood teachers’ addictive Internet use and happiness reported that the excessive use of Internet brings not only the physical problems like visual impairment and headache but also mental health problems such as poor academic performance, depression and anxiety and abnormal problems in daily life with family and friends.

Although there are many scholars who are interested in Internet addiction and smartphone addiction, there is no agreed medical definition of smartphone addiction and Internet addiction among scholars until now. In general, internet addiction is the state that excessive use of computer and wireless Internet brings withdrawal and tolerance and consequently causes disorders in daily life and it has been considered as an impulse control disorder that does not include drug dependence. In addition, smartphone addiction refers to the state that the user is too absorbed in smartphone services and suffers a disruption to daily life. The term, (no) meaning the symptom that the user feels uneasy and even frightened without a mobile phone and the new word of (Nomophobia) which is a synthesis of mobile phone and phobia are identically used.

As drug-dependent and drug-independent addiction have the same neurological basis, Internet addiction and smartphone addiction have similar behavioral characteristics with drug-dependent addiction or drug-independent addiction like gambling. Typical symptoms of Internet and smartphone addiction are compulsion symptom, damages to the neighbors, loss of self-control and time concept and experience of anger, tension and depression, but more serious social problems are generated due to the characteristic that the use of smartphone is rapidly increasing because it is more portable and easier to access.

Concerns about the increase in media addiction, as claimed by Young, a pioneer in Internet addiction research, confirm the seriousness that ‘if you become addicted to the Internet, you will be using it for a longer period of time than you have thought, become compulsively dependent, have withdrawal symptom when you stop and eventually you cannot maintain normal daily life and interpersonal relations.’ In
addition, smartphone addiction which is suggested as a new type of Internet addiction is increasing more rapidly than PC-based Internet due to its convenience, increased accessibility, and utilization of various applications. Smartphone addiction also brings withdrawal, tolerance and daily life disorder and in order to understand the concepts and characteristics of smartphone, it is essential to refer to the concept of Internet addiction included in behavioral addiction. Big problem is that the risk of Internet and smartphone addiction is not limited to the problems of the early childhood teachers. Uncontrollable over-use and obsession in the Internet and smartphone of early childhood teachers can be a serious social problem that threatens future child care and young children as well as our country and society. Addictive level of internet and smartphone use could result in low academic achievement and failure of pre-early childhood teachers and consequent low self-esteem and it is so natural that it is closely related with their overall teaching beliefs and teacher motivation in the future and could influence a significant impact on the child’s world’s view and attitude and the diverse experiences of the children.

Social members living in social relations live for their happiness every moment. Most members of the society are trying to achieve their happiness and so are early childhood teachers. Researches about the happiness of early childhood teachers who need to take care of the children should be executed for their desirable daily life, physical and mental health and quality management of successful childcare. Early childhood teachers should play an important role in preventing and mediating early childhood media addiction as a key variable that could influence children’s education because the time they spend with them is so long with their parents. Considering this strong psychological and emotional influence of the early childhood teachers on the children, it can be said that the happiness of child teachers could give an important influence on the whole life development of the children. Therefore, it is necessary to clarify the influence of the tendency of media addiction on the happiness of the early childhood teachers.

However, there are lack of researches about media addiction and happiness of early childhood teachers, and the studies examining the variables between the relations regarding Internet and smartphone addiction are more insufficient. Therefore in reality, it is difficult to identify the tendency and even the basic data for intervention are not sufficient as well. Considering the influence of early childhood teachers’ media addiction on their physical and mental health, quality of care and the relevance with their happiness, this research is judged to provide significant basic data to study the relationship between media addiction and happiness targeting early childhood teachers.

The purpose of this study is to identify the relationship between early childhood teachers’ internet and Smartphone addiction tendency and their happiness among the media addiction variables and the effects of these media addiction tendency to their mental health. This study suggests the possibility and direction for early childhood teacher education to prevent media addiction and tries to provide basic data to help early childhood teacher’s happiness by using digital media represented by internet and smartphone in positive manner.

MATERIALS AND METHODS

Research Subjects: The subjects in this study were 500 randomly selected early childhood education teachers at a kindergarten and daycare center located in the city of Busan. After a survey was conducted, the answer sheets from 436 respondents were gathered. The response rate stood at 87.2 percent, and the data from 417 respondents were analyzed except for 19 incomplete answer sheets.

Research Tools: The instruments used in this study were the National Information Society Agency’s Internet Addiction Proneness Scale for Adults-Short Form(KS-A), Smartphone Addiction Proneness Scale of early childhood education teachers. This test tool consists of 4 sub elements based on the researches related to media addiction, and it consisted of 15 items. The instrument used to assess the happiness of the early childhood education teachers was Kwon’s Happiness Scale that was an adapted version of Argyle’s Happiness Scale which consisted of three areas: external happiness, internal happiness and self-regulatory happiness. The subfactors of this scale were external happiness, internal happiness and self-regulatory happiness, and it was composed of 21 items.
Research Procedure: The literature and precedent research data related internet addiction, smartphone addiction and happiness of early childhood education teachers were collected and analyzed and the survey sheet was arranged with theoretical basis.

The survey was made based on literature review of related researches and the preliminary survey was conducted on 20 early childhood education teachers from April 4, 2016 to April 8, 2016. Difficult or uncertain questions for early childhood education teachers were found through the preliminary survey, and the content validity was secured for internet addiction, smartphone addiction and happiness. The appropriateness was verified by three professors of early childhood education, and then the final questionnaires were confirmed.

Based on the corrected questionnaires, main survey was conducted on 500 early childhood education teachers from April 18, 2016 to May 6, 2016. The subjects were informed about the necessity, purpose, and direction of this research through direct visit or phone call to kindergarten and they agreed on cooperation of this research. Then, this survey sheets were distributed to them. The answered sheets were collected through direct visit or in returning envelope.

Data Analysis: A statistical package SPSS WIN 23.0 was employed, and statistical data on mean, standard deviation and Pearson product-moment correlation coefficients were obtained to determine the happiness and their media addiction (internet addiction, smartphone addiction) of the early childhood education teachers. Besides, stepwise multiple regression analysis was made to measure relative influence.

Moreover, multiple regression analysis was conducted for each stage in order to see relative influence, and conducted mediated effect evaluation according to the regression analysis suggested by Baron and Kenny, and then, Sobel test using standard deviation between non-standardization coefficient and standardization coefficient was conducted to verify significance of mediated effect of smartphone addiction.

RESULTS AND DISCUSSION

The awareness of media addiction and happiness

Table 1: The Awareness of media addiction and happiness (N=417)

<table>
<thead>
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<th>Variables</th>
<th>Sub-Variables</th>
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<th>SD</th>
<th>Reliability</th>
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<td>Internet daily living disorder</td>
<td>2.02</td>
<td>.53</td>
<td>.87</td>
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<tr>
<td></td>
<td>Internet virtual world orientation</td>
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<td>.48</td>
<td>.83</td>
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<td>Internet forbidden</td>
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<td>.60</td>
<td>.82</td>
</tr>
<tr>
<td></td>
<td>Self-regulation happiness</td>
<td>3.64</td>
<td>.62</td>
<td>.85</td>
</tr>
<tr>
<td></td>
<td>Happiness</td>
<td>3.62</td>
<td>.58</td>
<td>.93</td>
</tr>
</tbody>
</table>

As shown in Table 1, the median of internet addiction appeared as 2.25 (SD = .43), smartphone addiction as 2.06 (SD = .50) and happiness as 3.62 (SD = .58).
The correlations of media addiction and happiness

Table 2: The correlations of media addiction and happiness (N=417)

<table>
<thead>
<tr>
<th>Variables</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
<th>14</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internet daily living disorder (1)</td>
<td>-</td>
<td></td>
<td>.76</td>
<td>.71</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Internet virtual world orientation (2)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Internet forbidden (3)</td>
<td>.79</td>
<td>.74</td>
<td>.77</td>
<td>.77</td>
<td>.79</td>
<td>1</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Internet resistance (4)</td>
<td>.62</td>
<td>.73</td>
<td>.76</td>
<td>.76</td>
<td>.76</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Internet addiction (5)</td>
<td>.70</td>
<td>.77</td>
<td>.77</td>
<td>.77</td>
<td>.79</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Smartphone daily living disorder (6)</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Smartphone virtual world orientation (7)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Smartphone forbidden (8)</td>
<td>.60</td>
<td>.63</td>
<td>.82</td>
<td>.77</td>
<td>.85</td>
<td>.80</td>
<td>.71</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Smartphone resistance (9)</td>
<td>.60</td>
<td>.76</td>
<td>.66</td>
<td>.67</td>
<td>.82</td>
<td>.78</td>
<td>.71</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Smartphone addiction (10)</td>
<td>.69</td>
<td>.74</td>
<td>.72</td>
<td>.73</td>
<td>.78</td>
<td>.81</td>
<td>.70</td>
<td>.76</td>
<td>.80</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>External happiness (11)</td>
<td>-.69</td>
<td>-.69</td>
<td>-.69</td>
<td>-.69</td>
<td>-.75</td>
<td>-.78</td>
<td>-.68</td>
<td>-.61</td>
<td>-.76</td>
<td>-.73</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inner happiness (12)</td>
<td>-.74</td>
<td>-.66</td>
<td>-.62</td>
<td>-.68</td>
<td>-.75</td>
<td>-.78</td>
<td>-.68</td>
<td>-.63</td>
<td>-.76</td>
<td>-.73</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Self-regulation happiness (13)</td>
<td>-.74</td>
<td>-.60</td>
<td>-.69</td>
<td>-.83</td>
<td>-.70</td>
<td>-.80</td>
<td>-.77</td>
<td>-.68</td>
<td>.72</td>
<td>-.78</td>
<td>.89</td>
<td>.86</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Happiness</td>
<td>-.69</td>
<td>-.68</td>
<td>-.65</td>
<td>-.75</td>
<td>-.72</td>
<td>-.80</td>
<td>-.75</td>
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<td>-.72</td>
<td>-.77</td>
<td>.88</td>
<td>.86</td>
<td>.88</td>
<td>.87</td>
</tr>
</tbody>
</table>

**p<.01

As shown in table 2, the correlations of their media addiction (internet addiction, smartphone addiction) and happiness ranged from -.78 to .77 (p<.01), and those of the subfactors were between -.83 (p<.01) and .89 (p<.01). This findings implied that there were significant positive correlations among the internet addiction and smartphone addiction of the early childhood education teachers. Meanwhile there were significant negative correlations among their own happiness and media addiction (internet addiction, smartphone addiction).

The relative Influence of internet addiction and smartphone addiction on happiness

Table 3: The relative Influence of internet addiction and smartphone addiction on happiness (N=417)

<table>
<thead>
<tr>
<th>Dependent variables</th>
<th>Independent variables</th>
<th>B</th>
<th>β</th>
<th>t</th>
<th>t²</th>
<th>Change of t²</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Happiness</td>
<td>(Invariable)</td>
<td>-1.37</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>smartphone addiction</td>
<td>-.51</td>
<td>.26</td>
<td>-10.02</td>
<td>.64</td>
<td>.48</td>
<td>237.93</td>
</tr>
<tr>
<td></td>
<td>Internet addiction</td>
<td>-.15</td>
<td>.24</td>
<td>-8.45</td>
<td>.64</td>
<td>.16</td>
<td></td>
</tr>
</tbody>
</table>

***p<.001

As shown in table 3, the internet addiction and smartphone addiction of the early childhood education teachers had a 64% explainability of happiness. To be specific, smartphone addiction had a 48% explainability, and there was a 16% increase when internet addiction was added. So the two had a 64% explainability. Also, the F value was 237.93, which was statistically significant, and the above-mentioned regression model formula was found to be appropriate (p<.001). The findings could be interpreted that the internet addiction and smartphone addiction of early childhood education teachers are the variables to affect their happiness, and
that smartphone addiction is more influential, followed by internet addiction.

**Mediated effects of smartphone addiction in the relations between internet addiction and happiness:**

In order to study the mediated effects of smartphone addiction in the relations internet addiction and happiness of the early childhood education teachers, the next process of this research was an analysis through the 3-step evaluation suggested by Baron and Kenny\(^1\).

**Table 4: Mediated effects of smartphone addiction in the relations between internet addiction and happiness level (N=417)**

<table>
<thead>
<tr>
<th>Step</th>
<th>Dependent variables</th>
<th>Independent variables</th>
<th>B</th>
<th>SE</th>
<th>β</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Smartphone addiction</td>
<td>Internet addiction</td>
<td>.63</td>
<td>.05</td>
<td>.64</td>
<td>8.03***</td>
<td>.64</td>
</tr>
<tr>
<td>2.</td>
<td>Happiness</td>
<td>Internet addiction</td>
<td>-.76</td>
<td>.06</td>
<td>.52</td>
<td>-11.52***</td>
<td>.48</td>
</tr>
<tr>
<td>3.</td>
<td>Happiness</td>
<td>Internet addiction</td>
<td>-.50</td>
<td>.11</td>
<td>.21</td>
<td>-9.08***</td>
<td>.36</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Smartphone addiction</td>
<td>-.25</td>
<td>.14</td>
<td>.37</td>
<td>-8.54***</td>
<td></td>
</tr>
</tbody>
</table>

***p<.001

As shown in table 4, step 1 examines whether the independent variable significantly predicts the assumed mediated variable. As the result of the influence of internet addiction to the smartphone addiction, the internet addiction as independent variable has 64% of organizational commitment as mediated variable, and this regression model is significant in the level of \(F=228.32, p<.001\) that it is a proper regression model. This means the assumption of independent variable works as the variable explaining mediate variable is fulfilled.

Step 2 is the process of studying whether the independent variable significantly predicts dependent variable. As the result of examining if internet addiction affects happiness, the independent variable internet addiction explains 48% of dependent variable happiness, and it is significant with the level of \(F=26.63, p<.001\) that shows this regression model is proper. As a result, the assumption that internet addiction significantly predicts happiness is fulfilled.

Step 3 is the process of studying whether the independent variable and mediate variable predict dependent variable at the same time. This includes the process of looking if the explanatory power increases when internet addiction and smartphone addiction are applied simultaneously, and if the independent variable’s effect significantly decreases. For the study, internet addiction was applied as independent variable and smartphone addiction as mediated variable simultaneously and looked into the degree of prediction of happiness dependent variable. As a result, internet addiction as independent variable and smartphone addiction as mediated variable have 48% of explanatory power for happiness dependent variable. Internet addiction explains 36% of happiness in the second step so it was found that the third step has increased explanatory power \((F=23.23, p<.001)\). Next, it was examined whether the effect of independent variable in step 2 significantly decreased, and as a result, the internet addiction had a decreased value of .21 in standardized coefficient (β) of internet addiction that internet addiction in step 3 affecting happiness from the standardized coefficient (β) .52 that internet addiction in step 2 affecting happiness. This means that the effects of independent variables significantly decreased. If the effect of independent variables on dependent variables is not significant, it has full mediation effect, and if the effect of independent variable on dependent variable is significant, it has partial mediation effect\(^2\). Thus, the relations between internet addiction and happiness are significant \((t=-9.08, p<.001)\) so the smartphone addiction has partial mediation effect in the relations of internet addiction and happiness.

Sobel test can simply examine the effects of mediation variables between independence variables and dependence variables\(^3\). This method calculates Z statistics figures using the standardized error between the effects of independent variable to mediated variable as it directly affect’s non-standardized coefficient and the non-standardized coefficient that mediated variable affecting dependent variable as it directly affect. Sobel test was conducted in this research and Z value is -4.28\((p<.001)\) that smartphone addiction has mediation
effect in the relations between internet addiction and happiness of early childhood education teachers.

\[ Z_{ab} = \frac{ab}{\sqrt{b^2 s_a^2 + a^2 s_b^2}} \] ...(1)

**CONCLUSION**

The purpose of this study is to identify the relationship between early childhood teachers' internet and Smartphone addiction tendency and their happiness among the media addiction variables and the effects of these media addiction tendency to their mental health. This study suggests the possibility and direction for early childhood teacher education to prevent media addiction and tries to provide basic data to help early childhood teacher’s happiness by using digital media represented by internet and smartphone in a positive manner. The results of research conclusion are as follows:

First, the early childhood education teachers took an above-average positive view of their own happiness, media addiction (internet addiction, smartphone addiction). Second, significant positive correlations among the internet addiction and smartphone addiction of the early childhood education teachers. Meanwhile there were significant negative correlations among their own happiness and media addiction (internet addiction, smartphone addiction). Third, media addiction (internet addiction, smartphone addiction) could be regarded as the variables to affect their happiness, and smartphone addiction was more influential, followed by internet addiction. Fourth, smartphone addiction has mediation effect in the relations between internet addiction and happiness of early childhood education teachers. The findings of the study suggest that in order to boost the happiness of early childhood education teachers, it’s necessary to decrease their media addiction (internet addiction, smartphone addiction).

**Ethical Clearance:** Taken from..... Kyungnam University.......committee

**Source of Funding:** Self

**Conflict of Interest:** nil

**REFERENCES**


The Relationship between Students’ Psychological Tendency and Their Satisfaction with University Life

WonshikNa
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ABSTRACT

Background/Objectives: Universities are autonomous educational institutions where how one conducts oneself is of utmost importance. This study looks at the correlation between perfectionism, optimism, and students’ satisfaction with university life.

Methods/Statistical analysis: Students (N:195) enrolled in the N University in the Choongnam region were selected for the research. The selection was from each grade level and restricted to those taking liberal arts classes who responded correctly to the questionnaire. Perfectionism, optimism, and university life satisfaction are the main variables. Conclusions were drawn based on demographic traits, descriptive statistics, factor analysis, correlation analysis, and regression analysis.

Findings: The results were categorized into a total of four sub-categories of perfectionism; the three disposition of perfectionism (self-oriented perfectionism, other-oriented perfectionism, socially prescribed perfectionism) as well as work-oriented perfectionism as a result of a factor analysis. Furthermore, regression analysis was carried out to predict the link between perfectionism and optimism on university life satisfaction, which revealed that optimism has a significant influence on satisfaction while perfectionism does not. In relation to perfectionism, optimism, and university life satisfaction, only optimism was correlated with satisfaction.

Improvements/Applications: Although they are adults, students’ satisfaction with university life is influenced by their psychological tendencies. Thus, we should support individual growth and development that takes personal psychological differences into consideration.

Keywords: perfectionism, optimism, satisfaction with university life, psychological tendency, individual growth

INTRODUCTION

From course registration and attendance to examination preparations, university students are tasked with making all decisions and choices related to their school life. A semester is a little over three months and how this period of time is spent greatly differs among individuals. Some students will apply themselves diligently to receive scholarships and grow closer to their goals, while others will not set particular goals for themselves, exert no effort, and end their semester with no accomplishments.

A similar divide can be seen in the classroom. Some students are active participants and diligent in their studies. This is a prominent phenomenon in classrooms.

Of course, it cannot be said that there is one, simple cause to this polarization. However, it can be inferred that one’s psychological tendencies has the biggest impact on such a divide.

Gigliotti (1990) said it is the university students’ will that decides the actual usage of the myriad of programs offered by universities and other educational authorities,
and that such decisions are largely dependent on their psychological traits.

As such, the psychological traits of university students can be said to influence whether they actively utilize or ignore various programs, and even the most useful of programs have been found to be ineffective in aiding students acclimate themselves to university life (Junghee Ha and Hanik Jo, 2006). Thus, it can be concluded that psychological traits largely influence the students’ university life, and that it is closely correlated to how well they conduct school life. Ultimately it can be said that it is all up to one’s mindset and that one’s psychological inclinations directly influence one’s quality of life.

In particular, perfectionist or positive tendencies, among all psychological tendencies, can be said to be highly valuable for one’s university life.

A perfectionist attitude is explained as a psychological trait linked to satisfaction in university students. It is reported that perfectionism has a significant impact when students decide on their career paths, as well as their ability to successfully finish tasks in order to reach their career goals.

Furthermore, optimism can be defined the general expectation for more positive incidents to occur and the reduced expectation for negative happenings (Schier & Carver, 1992). This psychological trait allows people to have positive thoughts for the future and feel happiness and pleasure while minimizing negative emotions such as depression or fear. Thus, it can also be predicted that this trait also has a great impact on one’s university life.

This study takes the above into consideration and predicts that perfectionism and optimism influences students’ satisfaction of their university life. The study was triggered by the question of which of the two traits leads to higher satisfaction. Furthermore, it proposes the need of efficient education that takes psychological tendencies into consideration, as well as the implications of developing diverse educational programs to suit such needs. Thus, the purpose of this study is to prove the following: First, perfectionism has a meaningful influence on one’s satisfaction with university life. Second, optimism has a meaningful influence on one’s satisfaction with university life. Third, perfectionism and optimism are correlated to one’s satisfaction with university life.

Enrolment percentages in the university. Dropout in residential university is caused by academic, family and personal reasons, campus environment and infrastructure of university and varies depending on the educational structure agreed by the university. Thus, this work aims to effectively formulate education program and institutional infrastructure through which the student’s enrollment rate at the university will get increased significantly. The main aim of this paper is to develop a improved decision tree model and to derive a classification rules to predict whether student will graduate or not using the historic dataset. In this paper, improved decision tree model is used to generate the model. Information like age, parent’s qualification, parent’s occupation, academic record, attitude towards university was collected from the students to forecast the group of students needs the periodical monitoring.

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THEORETICAL BACKGROUND

Hollender (1965) defined perfectionism as one of the irrational beliefs a person has that requires them to exert a higher level of performance than required by the situation.

Thus, perfectionists are often seen holding themselves up to a higher standard of performance and diligently working to reach their goals. However, this type of irrational thinking puts pressure on oneself as perfectionists will set unrealistically high standards and will deem themselves as less valuable if they are not able to meet their standards (Hyunjin Kim, 2013).
In recent years, there is increasing understanding that the rigid and negative cognition that characterizes perfectionism hinders adaptation to new circumstances and increases negative sentiments such as depression and lethargy, thereby making students postpone setting career paths or hindering their decision making process. Of course, one’s cognitive flexibility, depression, lethargy, and other emotional characteristics can greatly differ per person and their personal perfectionism; however, the view is that the cognitive and emotional traits of perfectionism can lead to indecisiveness regarding setting one’s career path (Minsun Kim, 2014).

This shows that the common conception that perfectionists are high achievers in every aspect can be a stereotype, and that such thoughts could actually deprive perfectionists of the opportunity to receive help from others.

On the other hand, optimism is the tendency to believe that all will be well and good things will happen. It is predicted that optimism will greatly affect pleasure and satisfaction since optimists expect positive outcomes for most things in their daily life. Thus, it is expected that optimists will be ambitious with anticipation when attempting most activities, rather than filled with fear or avoidance.

It is reported that optimistic expectations in general play an important role in how people deal with stressful situations and interpersonal issues (Caver, Kus, & Scheier, 1994). The more optimistic a person, the less psychological distress felt and the more stable and positive they are able to adapt to situations (Scheier, Caver, & Bridges, 1994). In this context, it can be reasoned that optimism contributes to the students’ ability to adapt to their university life, a time filled with fear about their future and various difficulties. Of course, this is irrelevant of the concern that optimism could hinder a thorough, systematic, or perfect execution of tasks.

As mentioned above, perfectionism and optimism can be both a strength and a set back in university life. University students are not only satisfied with high grades but also positive interpersonal relationships and the sense of achievement and growth via their career path and employment. To this end, universities should provide facilities, the educational environment, and support of university faculty and the school. Satisfaction in university life will come when such overall factors are in place. Therefore, this study investigates the relationship between these psychological tendencies and satisfaction regarding one’s university life. Understanding the difficulties that can arise from such tendencies, this study aims to bring to light universities’ understanding of personalized and specific support system for students and trigger the dialogue for finding a solution.

**RESEARCH METHOD**

**Subjects:** Students (N:195) enrolled in the N University in the Choongnam region were selected as subjects. The students are from each grade level and are taking liberal arts classes. The subjects’ year and gender are shown in Table 1.

<table>
<thead>
<tr>
<th>Year</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responses</td>
<td>16(8.2)</td>
<td>63(32.3)</td>
<td>77(39.5)</td>
<td>39(20.0)</td>
<td>195(100)</td>
</tr>
<tr>
<td>Gender</td>
<td>Male: 93(47.7%)</td>
<td>Female(%) : 102(52.3%)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Major Field(%)</th>
<th>Management</th>
<th>Welfare Related &amp; Arts</th>
<th>Health &amp; Sports</th>
<th>Humanities</th>
<th>Engineering</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responses</td>
<td>20(10.3)</td>
<td>41(21.0)</td>
<td>35(17.9)</td>
<td>24(12.3)</td>
<td>75(38.5)</td>
</tr>
</tbody>
</table>

**RESEARCH TOOLS**

**Optimism Scale:** The study utilizes the 10-question survey originally modified by Scheir et al. (1994) and further edited and complemented by Hyunsook Shin (2005). Among the 10 questions, 3 questions measured optimism via asking sub-factors of optimism, while 3 questions measured negativity. Answers for the questions measuring negativity were converted to reverse scores since these were inversely scored. This survey tool uses a 5-point Likert rating scale where one of the points has to be selected as a response. Scores ranged from 6 to 30.
points. It can be understood that the higher the score, the higher the level of optimism.

**Multidimensional Perfectionism Scale:** The test for perfectionism is a standardized tool created using the self-report questioning method developed by Hewitt and Flett (1991). This test is called multidimensional perfectionism and was divided into the categories of self-oriented perfectionism, other-oriented perfectionism, and socially prescribed perfectionism. Each section was composed of 15 questions, making a total of 45 questions. The questionnaire was a 7-point Likert rating scale. The questionnaire was adapted into a 5-point scale by Junghee Ha and Yoojin Jang (1993), and questions to be inversely scored were converted to reverse scores. Test takers had to select a point, and the score ranged from 45 to 225 points. Once again, it can be understood that the higher the score, the higher the perfectionist tendency.

**University Life Satisfaction Scale:** This study utilized the scale developed by Yeon seon Kim (2011), which cited the overall satisfaction of university life perceived by university students as recorded by Hyesook Ryu and Namyeon Kim (2008). The scale was composed of three sectors asking the test taker’s satisfaction in university life, peer relations, and courses made available in the student’s department. This questionnaire was a 5-point Likert rating scale with scores ranging from 3 to 15 points. It can be understood that the higher the score, the higher the satisfaction of university life.

**RESEARCH METHOD**

For the goal of investigating the differences in how perfectionism and optimism influence university students’ satisfaction with their school life, a comparison of the mean and standard deviation; an analysis of the respective influence of optimism and perfectionism on university life satisfaction; and an analysis of the correlation between optimism, perfectionism, and university life were conducted. For this end, the study adopted and proceeded with a SPSS 12.0.

**EMPIRICAL RESULTS**

The results of the analysis of this research are the following.

The Mean and Standard Deviation Statistics of the Variables

<table>
<thead>
<tr>
<th>Variables</th>
<th>N</th>
<th>Max</th>
<th>Min</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Perfectionism</td>
<td>195</td>
<td>1.00</td>
<td>5.00</td>
<td>2.4795</td>
<td>.91358</td>
</tr>
<tr>
<td>Self-oriented Perfectionism</td>
<td>195</td>
<td>1.00</td>
<td>5.00</td>
<td>2.3880</td>
<td>.85914</td>
</tr>
<tr>
<td>Other-oriented Perfectionism</td>
<td>195</td>
<td>1.00</td>
<td>4.00</td>
<td>2.3179</td>
<td>.72375</td>
</tr>
<tr>
<td>Socially prescribed Perfectionism</td>
<td>195</td>
<td>1.00</td>
<td>4.00</td>
<td>2.6291</td>
<td>.70651</td>
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<tr>
<td>Work-oriented Perfectionism</td>
<td>195</td>
<td>1.45</td>
<td>3.45</td>
<td>2.4513</td>
<td>.39952</td>
</tr>
<tr>
<td>Optimism</td>
<td>195</td>
<td>1.50</td>
<td>4.33</td>
<td>2.4504</td>
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<tr>
<td>Satisfaction with University Life</td>
<td>195</td>
<td>1.00</td>
<td>4.00</td>
<td>2.6410</td>
<td>.69438</td>
</tr>
</tbody>
</table>

As shown in Table 2, the mean of self-oriented perfectionism is 2.3880 (SD=.85914), while the mean of other-oriented perfectionism is 2.3179 (SD=72375) and socially prescribed perfectionism, 2.6291 (SD=.70631). In addition, the mean of work-oriented perfectionism is 2.4513 (SD=.39952), and the grand mean for perfectionism is 2.4795 (SD=.91358). Furthermore, the mean of optimism is 2.4504 (SD=.43586) and the mean satisfaction for university life is 2.6410 (SD=.69438).

**Analysis Of the Perfectionism Factors:** The results of the validation of perfectionism variables are as follows.
As shown in Table 3, the method of principal component analysis was used as the factor extraction method. The Berimex rotation method with Kaiser normalization was applied. Since the KMO value is .648 and thus greater than .5, and the Bartlett’s significance (p value) is less than .05, the factor analysis is seen as feasible and validated. The result was a total of four factors that are explained by 88.893. Factor 1 was classified as self-oriented perfectionism, factor 2 as other-oriented, factor 3 as socially prescribed, and factor as a work-oriented, and these factors were used as a perfectionism survey tool.

**Relationship Between Optimism, Perfectionism and University Life Satisfaction:** The results of the study to find the correlation between the three variables are indicated in Table 4.

Table 3: Rotated Component Matrix for Perfectionism

<table>
<thead>
<tr>
<th>Item</th>
<th>Component 1</th>
<th>Component 2</th>
<th>Component 3</th>
<th>Component 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>.943</td>
<td>-.045</td>
<td>-.094</td>
<td>.007</td>
</tr>
<tr>
<td>14</td>
<td>.917</td>
<td>-.004</td>
<td>-.125</td>
<td>-.031</td>
</tr>
<tr>
<td>23</td>
<td>.910</td>
<td>-.049</td>
<td>.009</td>
<td>.044</td>
</tr>
<tr>
<td>19</td>
<td>-.018</td>
<td>.913</td>
<td>.018</td>
<td>.028</td>
</tr>
<tr>
<td>38</td>
<td>-.046</td>
<td>.912</td>
<td>-.002</td>
<td>.013</td>
</tr>
<tr>
<td>45</td>
<td>-.032</td>
<td>.895</td>
<td>.061</td>
<td>.017</td>
</tr>
<tr>
<td>13</td>
<td>-.074</td>
<td>.018</td>
<td>.899</td>
<td>.226</td>
</tr>
<tr>
<td>35</td>
<td>-.076</td>
<td>.126</td>
<td>.793</td>
<td>.202</td>
</tr>
<tr>
<td>41</td>
<td>-.052</td>
<td>-.056</td>
<td>.784</td>
<td>-.160</td>
</tr>
<tr>
<td>8</td>
<td>-.018</td>
<td>.031</td>
<td>.064</td>
<td>.960</td>
</tr>
<tr>
<td>15</td>
<td>.042</td>
<td>.016</td>
<td>.130</td>
<td>.950</td>
</tr>
</tbody>
</table>

Eigen Value: 2.579, 2.492, 2.101, 1.947
Common variance: 23.444, 22.657, 19.096, 17.696
Cumulative variance: 23.444, 46.101, 65.197, 82.893
Cronbach's Alpha: 0.619
KMO = 0.648
p = 0.000
Bartlett's test X² = 1335.227 (p < 0.001)

Table 4: Correlation of Variables

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Satisfaction with university life</td>
<td>1</td>
<td>.584**</td>
<td>.028</td>
<td>-.043</td>
<td>.087</td>
<td>-.033</td>
<td>.013</td>
</tr>
<tr>
<td>Optimism</td>
<td>.000</td>
<td>.702</td>
<td>.533</td>
<td>.227</td>
<td>.642</td>
<td>.855</td>
<td></td>
</tr>
<tr>
<td>Perfectionism</td>
<td>.028</td>
<td>.036</td>
<td>1</td>
<td>.092</td>
<td>-.065</td>
<td>-.012</td>
<td></td>
</tr>
<tr>
<td>Self-oriented Perfectionism</td>
<td>.000</td>
<td>.615</td>
<td>.326</td>
<td>.201</td>
<td>.369</td>
<td>.866</td>
<td></td>
</tr>
<tr>
<td>Other-oriented Perfectionism</td>
<td>.702</td>
<td>.615</td>
<td>.876</td>
<td>.475</td>
<td>.004</td>
<td>.000</td>
<td></td>
</tr>
<tr>
<td>Self-oriented Perfectionism</td>
<td>-.043</td>
<td>-.071</td>
<td>.011</td>
<td>1</td>
<td>-.073</td>
<td>-.157**</td>
<td>.479**</td>
</tr>
<tr>
<td>Other-oriented Perfectionism</td>
<td>.353</td>
<td>.326</td>
<td>.876</td>
<td>.309</td>
<td>.028</td>
<td>.000</td>
<td></td>
</tr>
<tr>
<td>Socially prescribed Perfectionism</td>
<td>.087</td>
<td>.092</td>
<td>.051</td>
<td>-.073</td>
<td>1</td>
<td>.062</td>
<td>.502**</td>
</tr>
<tr>
<td>Work-oriented Perfectionism</td>
<td>.227</td>
<td>.201</td>
<td>.475</td>
<td>.309</td>
<td>.392</td>
<td>.000</td>
<td></td>
</tr>
</tbody>
</table>

*p < 0.05, **p < 0.01
As shown in Table 4, the correlation between the three variables were as such: university life satisfaction had a high correlation with optimism but had no correlation with perfectionism. Also, there was no correlation between optimism and perfectionism. Among the sub-factors of perfectionism, there was a high correlation with the work-oriented perfectionism and other sub-factors. Self-oriented perfectionism was highly correlated with work-oriented perfectionism as well as correlated with socially prescribed perfectionism to a lesser degree. It had no correlation to other-oriented perfectionism. Other-oriented perfectionism was only correlated with work-oriented perfectionism. Socially prescribed perfectionism had a high correlation with work-oriented perfectionism and also correlated with self-oriented perfectionism to a lesser degree. From this, it can be concluded that work-oriented perfectionism is an extremely important factor even among other sub-factors of perfectionism.

The Influence of the three Variables on each other: Table 5 shows the results of the analysis carried out to see the influence the variables have on each other.

### Table 5: Multiple Regression analysis of perfectionism and optimism

<table>
<thead>
<tr>
<th>dependent variable</th>
<th>Model</th>
<th>unstandardized coefficients</th>
<th>standardized coefficients</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>predictors</td>
<td>.349</td>
<td>.254</td>
<td>1.375</td>
<td>.171</td>
</tr>
<tr>
<td></td>
<td>optimism</td>
<td>.005</td>
<td>.045</td>
<td>.006</td>
<td>.110</td>
</tr>
<tr>
<td></td>
<td>perfectionism</td>
<td>.931</td>
<td>.093</td>
<td>.584</td>
<td>9.967</td>
</tr>
<tr>
<td>Satisfaction with university life</td>
<td>Model</td>
<td>Sum of Squares</td>
<td>df</td>
<td>Mean Square</td>
<td>F</td>
</tr>
<tr>
<td>Regression</td>
<td>31.941</td>
<td>2</td>
<td>15.971</td>
<td>49.780</td>
<td>.000</td>
</tr>
<tr>
<td>Residual</td>
<td>61.597</td>
<td>192</td>
<td>.321</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>93.538</td>
<td>194</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

As shown in Table 5, optimism had a meaningful influence on university life satisfaction, while perfectionism did not have a meaningful influence.

**CONCLUSION**

University students are at the developmental stage where they enter adulthood, and university is a highly influential time where various important competencies are developed in individuals. However, the psychological tendency of the individual cannot be overlooked since it has an immense influence over one’s studies and daily life. Therefore, this study suggests that university education should acknowledge individual differences and implement programs to support this. Furthermore, it suggests the implication that personalized education can play an active role in cultivating human resources.

**ACKNOWLEDGMENT**

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**Ethical Clearance:** Taken from... Namseoul University.........committee

**Source of Funding:** Self

**Conflict of Interest:** nil

**REFERENCE**


A study on Change of Optimized Asset Complexity

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ABSTRACT

Background/Objectives: The typical important asset in product line is software component. However, studies about component structure and specification are rather insufficient compared to studies about product line. This study aims to optimize product line based asset and measure its influence to complexity of asset.

Methods/Statistical analysis: Architecture asset is designed by inheriting the RAS structure of OMG, and it was optimized to measure the optimization process. Also, complexity of asset before and after optimization was measured to analyze complexity difference of asset.

Findings: Each asset was optimized using chi-square statistics, improved accuracy of reuse search, and confirmed that it did not influence complexity of asset.

Improvements/Applications: Assets based on DMI architecture manages optimized asset information, and it was confirmed that in the process of improving architecture reusable asset below 90% to over 90%, it did not affect the complexity of asset.

Keywords: Asset, Complexity, PLE, Component, DMI

INTRODUCTION

To improve software productivity, component based parts are produced and assembled, but there is a problem adjusting to various changes of architecture platform and it requires maintenance or reproduction to improve productivity. To solve such problem, efficient development method has been in demand. Applying to this, product line engineering method can solve reuse of software system and automated production problem1,2.

Important asset in product line is the component of software. However, studies about asset structure and specification are very insufficient compared to various studies about product line3. DMI architecture provides abstract design information of independent platform about development environment to reuse design information on design level. Also, it enables design of applied domain based on well-designed architecture asset4,5. DMI structure enables reusable design based on platform, and is equipped with PLE structure with extractive method which could solve problems in designing software based on platform and problems of reusing the standardized previous design information.

Also, considering the reusability and assembly in asset component design to adjust architecture asset, the reusable component that are reusable are used in products planned for product line6,7. Architecture asset is designed by inheriting RAS structure of OMG, and a method analyzing and storing asset information was used to optimize it.

The reusable assets were optimized using chi-square statistics and improved search efficiency by removing 23% of unnecessary term. Thus, by enabling PLE architecture based on DMI to store and search in synonym spread method in the processing of storing and using asset information, the reuse of architecture asset was optimized. This study measured how the asset
complexity changes in the process of reusing asset before and after optimization. The optimized asset improved search efficiency, but also increased asset complexity, and there as a need to measure if it affects reusability and cohesiveness of design information.

As for the measuring, the change amount of complexity before and after the asset optimization was compared. To measure complexity, the asset was applied to component measurement formula and used to measure the complexity change of each asset because asset composition method was specified based on RAS and the attribute value of design information of asset inherit the composition method of component⁸. As for the result, it was confirmed that the dynamic range of complexity in asset optimization barely existed. This indicates that as the reuse is based on context of search asset, the complexity does not change in the optimization of asset information. Therefore, a conclusion that the optimization which does not affect asset complexity of DMI architecture based on product line engineering is possible.

BACKGROUND AND RELATED WORKS

Asset Configuration: Assets are composed of various artifacts and each artifact could include other artifacts and might share relationship with other artifacts. Each artifacts related to certain artifact contexts such as requirement development design or runtime context. Artifacts can be specialized into artifact constituent and form of model. When artifacts constituents are reused, it could have variability point which indicates a point that can be revised. Model is composed of another model, or diagram and specification, and it should express the variability point which artifact constituents involve according to each form. The assets used in this study are specified based on RAS, the open standard specifications.

This specification describes the structure, contents and explanation of software assets reusable for the consistency of reuse procedure. The separated assets are specified as below. Architecture assets include all fundamental constituents about asset specification as in Core RAS⁹. Also, the applied asset has profile function which indicates expansion of Core RAS to introduce additional definition about specific form of assets.

![Figure 1: Fundamental composition of architecture asset](image-url)

Figure 1: Shows major sections and elements of architecture asset like the asset composition of RAS8. Core RAS is composed of classification section, solution section, usage section and related assets section. Classification section lists series of statement to classify asset, and solution section describes artifacts of asset. Usage section includes rules for use and customization of asset and related assets section describes relationship with other assets. This study set category to hierarchically classify asset and used a method classify in according with behavioral property of asset.

Complexity measurement: Field of software complexity is a part of software engineering related to investigation, classification and measuring of software property which affects development and maintenance cost of computer program.

According to IEEE(Institute of Electrical and Electronics Engineers) glossary, software complexity is defined as “the degree of complexity among system and system elements which is decided by analyzing elements such as form of data structure, degree of reiteration, number of branch condition, number of interface and system property.”, but it is commonly defined as psychological complexity showing software property which affects capability of program developer. They are the efficient object-oriented design principles reflecting experimental measurement results based on proposed property of measurement model and limited model and complexity element value obtained from fundamental implementation code based on intuitive, theoretic, empirical study results commonly shown in literatures partially referred by desirable design and programming guideline and theoretic, experimental cognitive psychology study results by Miller⁹.
As for the complexity measurement elements, it is decided by number of class in one program, number of methods in one class, average size of LOC in one method, height of class inheritance hierarchy structure, number of class average of instance variables, and number of files included by #include. As one class is one substance in real world in a program, if numbers of classes are in one program, it will lead to difficult composition, apprehension and maintenance of the program. Therefore, it is advisable to keep the number of class in one program below $7 \pm 2$. If there are too many methods in one class, it will cause difficulty in composition, apprehension and maintenance of class object, lowers cohesion to weaken the encapsulation. Class containing number of methods limits functionality for reuse and narrows application range. If a class has lower cohesion, the class ends up separating into two or more sub classes.

If one method increases, more effort is put into to apprehend and maintain the method. Also, as the class containing the method increase in size, it becomes harder to manage the class. In inheritance hierarchy structure, the deeper the inheritance tree is, the larger the method is, which makes it more difficult to test and reuse and increases psychological complexity. Guideline for number of average instance variable per class follows design and programming rule by Lorenze. Lorenze insisted that it is advisable to keep the number of average instance variables below 6. One class having many instance variables indicate the class is designed to have various functions, which in other words complicate the class composition and more likely to have lower cohesion.

**ACCURACY AND COMPLEXITY OF ASSET**

**Accuracy of asset:** This study aims to measure the complexity change of asset in case of increasing reuse efficiency by optimization of asset\(^9\). The accuracy of optimized asset was measured by previous studies and the measuring method and results are as follows. This measuring method is a familiar method which automatically searched asset by providing query and reduced manual job at most. Using the specific weight and specific-context relation value calculated by substructure of asset management system, the query in specific from automatically extracted context related to query. At this point, for the automatic extract of context, the context candidates related to query are extracted. Then, asset satisfying commonly extracted context from query set is detected. Reliability of detected candidate asset and query is calculated and finally, the asset is searched in order of reliability.

![Figure 2: Accuracy in accordance with optimization](image)

As the result of context search, the reliability of query set and asset is calculated regarding all the candidate asset satisfying common contexts in one query set. Final reliability is obtained by calculating equivalence relation, inclusion relation and similarity. Therefore, it improves reuse of proper architecture reuse by search of multi-facet classified components. This is because the method using specific weight and specific-context relation value in order to use reusable asset. To measure the accuracy of reuse of architecture asset, the asset component reuse accuracy result about random query was measured. As in figure 2, the result confirmed that when designing architecture asset, save it and generally reuse(GA) and when conducting optimization and reuse(OA), the accuracy increased. It was confirmed that when the accuracy difference of two methods was less than 90%, the increase of accuracy improved in large. This indicates that the reuse of asset improves much more when the information about architecture asset that is to be reused is not well known. Also, it indicates that DMI assets used concept of facet classification and classified each asset into one or more context to save and was optimized to enable expansion search for synonym. However, if the accuracy was improved by asset optimization, the complexity change must be considered. Optimization could increase reusability, but could damage the original purpose of reuse by dualizing asset by the increase of complexity.

**COMPLEXITY CHANGE OF ASSET**

**Complexity of asset:** Asset information is a software unit which aims for reusability and functional independence, so it is important to measure complexity among internal
properties to measure the asset quality. This study as applied cyclomatic complexity measuring method to component and measured by applying the component measuring formula which measure complexity to asset\textsuperscript{11}. This metric is an asset metric applicable to asset in design stage or implement stage. Asset complexity is measured by calculating the sum of class, abstract class and interface which applied metric to measure general complexity of asset, and it can be used as a standard measuring complexity of classes and methods. The measuring method of general complexity is as formula 1\textsuperscript{11}.

\[
CPC(C) = CmpC + \sum_{i=1}^{n} CC_{i} + \sum_{j=1}^{n} MC_{j} \quad (1)
\]

In the formula, CPC(C) is the general complexity of asset, CmpC is the number of class composing asset, and is calculated by number of methods in class, and give weighted value to method of class or class included in asset for calculation to measure the external complexity of asset. CmpC measuring method is as formula 2.

\[
CmpC = \sum_{i=1}^{n} (\text{Count}(C_{i}) \times W(C_{i})) + \sum_{j=1}^{n} \text{Count}(I_{j}) \quad (2)
\]

In the formula, count(C) is number of class included in asset, W(C) is eight of each class, I(i) is interface provided or used in asset, Count(M) is number of method of classes included in asset, and W(M) is weight of each method.

\[
CC = \sum_{i=1}^{n} (\text{Count}(SA_{i})) + \sum_{j=1}^{n} (\text{Count}(CA_{j}) \times W(CA_{j})) \quad (3)
\]

In the formula, Count(SA) is the number of individual property, Count(CA) is the number of complex property, W(CA) is the weight of each complex property.

\[
MC = \sum_{i=1}^{n} (\text{Count}(SP_{i})) + \sum_{j=1}^{n} (\text{Count}(CP_{j}) \times W(CP_{j})) \quad (4)
\]

In the formula, Count(SP) is the number of simple parameter, Count(CP) is the number of complex parameter, and W(CP) is weight of each parameter.

**Complexity in Optimized Asset:** First Formula is complexity of each class in asset which distinguishes the class property by simple type or complex type using other class as type and give weight to calculate complexity of classes included in asset. And, Next Formula calculates number of parameter about method of classes in asset, distinguishes if the property of parameter is simple type of complex type using other classes as type, give weight to calculate complexity of methods of class included in component.

![Figure 3: Complexity change in accordance with optimization](image)

In figure 3(a) shows how the complexity change was measured from the increase of accuracy in accordance with optimization of asset. The measured data subject asset used in optimization and measured in figure 3(b) how the complexity changes in the process of asset optimization. And figure 3 shows complexity (GA-COM) when reusing the asset created by designer was not very different from complexity of optimized asset (OA-COM). Also, it was confirmed that the complexity ratio did not change in accordance with optimization of asset.

**CONCLUSION**

In order to reuse software system by producing asset parts based on components to increase software productivity and solve problem in automation production,
this study was conducted. Also, the reusability efficiency of asset designed by designer was improved through optimization. In the process of optimization, the initial active value of each property is determined by the weight between asset and property. This is named feature weight and plays role as emphasizing the closest property to asset behavior. Initial active value is set as the weight of feature weight calculated for one property for the use. And the change in design information complexity of asset in the optimization process of designed asset was measured. In asset search process, for candidate assets satisfying all contexts that are common in one query set, the reliability between query set and assets was calculated. The final reliability is obtained by calculating equivalence class, inclusion relation and similarity. Therefore, it improves reuse of proper architecture reuse by search of multi-facet classified components. This is because the method using specific weight and specific-context relation value in order to use reusable asset. Also, it was concluded that complexity of asset is not affected much in the process of optimization. This indicates that there is no change in complexity in the process of asset information optimization as search candidate asset is reused by context. This thesis concluded that the optimization improved reuse search efficiency of asset and it did not affect asset complexity, but there is a need to conduct additional analysis for correlation with complexity in the process of reassembling reusable asset.

Ethical Clearance: Taken from Shinhan University committee

Source of Funding: Self/ or….

Conflict of Interest: Nil

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5. Hanyong Choi, Sungho Sim, Design Composition based on DMI architecture, IJAER, 2015, 10(90), pp. 681-687.


A Study on the Impact of Recognition of Importance of Consulting on Re-engagement Intention through Mediated Impact of Performance of Consulting

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ABSTRACT

Background/Objectives: This paper was conducted to identify the recognition of importance of consulting on the future re-engagement intention in government-funded consulting targeting the small and medium enterprises and present policy implications.

Methods/Statistical analysis: To identify the impact of recognition of importance of consulting on re-engagement intention, the small and medium enterprise who experienced government-funded consulting were selected, and a survey was conducted for about a month from Apr. 2015. And 320 copies were collected and 311 questionnaires excluding the questionnaires with missing values were used. SPSS(ver. 22) and AMOS(ver. 22) were used as statistical programs for data processing in this study.

Findings: As a result of empirical analysis, it was found that the recognition of importance of consulting had a positive impact on project management skills and corporate image as performance of consulting and that project management skills and corporate image had a positive impact on re-engagement intention. Also, in the influencing relationship between project management skills and corporate image, project management skills did not have a significant impact on corporate image. This suggests that project management skills is an internal factor and thus unrelated to the corporate image as external factor. Finally, the conclusion was drawn that the recognition of importance of consulting had a positive impact on consulting re-engagement intention by the medium of project management skills and corporate image. Therefore, the findings from this study suggest that the attitude of small and medium enterprises who participate in consulting, i.e. recognition of importance of consulting is an important factor to encourage them to continue to participate in government-funded projects as well as performance of consulting.

Improvements/Applications: If improving small and medium enterprises’ recognition of consulting and reinforcing the government’s institutional support, it would be expected to contribute to enhancing the effectiveness against the investment in consulting support projects.

Keywords: recognition of importance, project management skills, corporate image, re-engagement intention

INTRODUCTION

Small and medium enterprises play a very important role in national economy. Government has continuously promoted the consulting diffusion policy targeting small and medium enterprises in order to foster them and reinforce their competitiveness. Consulting indicates that a person who has a professional knowledge and experience has a talk with and help the person who is in need. Given this definition of consulting, the characteristics of consumer as well as suppliers such as consultant and government need to be recognized together to identify successful factors. However, the existing studies related to consulting have been conducted centering on consultant’s knowledge, skills, and attitude and the government-led researches on
consulting were very insufficient in terms of amount of research. Also, the interests in consulting by small and medium enterprises, who are the targets of governmental support are considered to act as a major factor for successful consulting. However, the existing multiple studies have largely focused on eternal aspects such as the characteristics of customer side including period of work, sales, capital, and number of employees and type of business, form of business organization, business scale, and period of consulting.

Accordingly, this study made an empirical analysis of the small and medium enterprises which experienced government-funded consulting and aimed to provide suggestions for government-funded consulting projects after finding the impact of recognition of importance of consulting on re-engagement intention as well as performance of consulting in small and medium enterprises.

**MATERIALS AND METHODS**

**Theoretical Background**

**Recognition of Importance:** Schaffer(2002) presented a project design to meet the motivation of customers as one of the key successful factors for consulting projects and McLachlin(1999) emphasized the recognition of importance of consulting among customers stating that for successful consulting, corporate preparations and active participation are important. Choi(2014) maintained that corporate participation is the factor that influences consulting outcomes and the top management’s interest is important and Song(2015) told that to carry out consulting, executive’s intention and interest in the advance preparation and execution stages is important for consulting outcomes in small and medium enterprises.

**Project Management Skills:** As the definition of the concept and composition of consulting outcome is varied, this study used project management skills and corporate image as variable concepts that constitute consulting outcomes. First, about the project management skills, Schaffer(2002) told that for consulting project to be regarded as successful, customers have to obtain measurable improvements by adopting consultant’s solutions and continue to maintain the improvement measures and Gwak (2008) demanded that consulting outcome measurement variables should be divided into effectiveness and efficiency and business performance improvements should be seen as measurement factors for effectiveness.

**Corporate Image:** Next, about corporate image, Dowling(2001) said that corporate image is the image of an enterprise reflected into the minds of consumers, and information on the tangible parts of an enterprise is one of the consumer’s internal attitude systems that are associated with consumer’s intangible emotional factors, and Barich & Kotler(1991) defined that corporate image is premised on the enterprise as object of image and is the image of the whole rather than some aspects of an enterprise and also something that has directivity like attitude. Bae(2008) said that corporate image is an emotional tendency that the general public have toward an enterprise.

**Re-engagement Intention:** Hellier et al.(2003) and Kim & Galliers(2012) maintained that repurchase intention represents an individual’s intention to purchase another products from the same company based on his/her previous experience and Oliver(1980) claimed that repurchase intention represents consumer’s planned future behavior and the probability that belief and attitude are likely to convert to behavior. Also, Kim & You(2014) defined that the intention to reuse consulting represents the intention to reparticipate in consulting support projects or the intention to reselect consulting agency or consultant.

**PROPOSED WORK**

**Research Model:** To identify the impact of recognition of importance of consulting on re-engagement intention, this paper used the research model as shown in figure 1.

![Figure 1: Research Model](image)
RESEARCH HYPOTHESES

Relationship between Recognition of Importance and Performance of Consulting: To look at the preceding studies, consulting commitment had a positive impact on consulting effectiveness by a medium of consulting quality perception, customer participation and preparation had a positive impact on success of consulting, corporate commitment quality had a positive impact on consulting outcomes quality. Performance of consulting were influenced by trust and commitment, consulting environment, consulting participation, consulting understanding, perceived value, corporate trust, and intention of execution.

Based on the past studies mentioned above, following hypotheses are formulated to identify the effect of performance of consulting on re-engagement intention.

H5: Project management skills will have a positive impact on re-engagement intention.
H6: Corporate image will have a positive impact on re-engagement intention.

RESEARCH METHODS

Population and Sample Characteristics: To identify the impact of recognition of importance of consulting on re-engagement intention in small and medium enterprises, the small and medium enterprises who experienced government-funded consulting were selected as subjects of this study, and a survey was conducted for about a month from Apr. 2015. And 320 copies were collected and 311 questionnaires excluding the questionnaires with missing values were used for our final analysis. For data processing in this study, SPSS(ver. 22) and AMOS(ver. 22) were used as statistical programs.

Measurement and Operational Definition of Variables: The recognition of importance of consulting was made to be composed of five questions by referring the items provided by McLachlin, Choi, and Song. The project management skills was constituted by seven questions referring to the items presented by Schaffer, Jeong, and Kwak. The corporate image was constituted by one question referring to the items presented by Barich & Kotler, Bae. The re-engagement intention was constituted by one question referring to the items presented by Hellier et al., Kim & Galliers, and Kim.

Survey questionnaire was made to be composed of 14 questions in total. In scoring the variable related survey questionnaire items, point 1 means ‘It is not at all’ and point 5 ‘It is very so’ on a 5-point scale and the summary results are shown in table 1.

<table>
<thead>
<tr>
<th>Measurement variables</th>
<th>No. of questions</th>
<th>Preceding studies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>14</td>
<td>-</td>
</tr>
</tbody>
</table>
RESULTS AND DISCUSSION

Data Collection: In this study, the general characteristics of this study were presented in Table 2. When it comes to employment history, 11-20 years occupied the highest percentage of 48.9%, and when it comes to technology life cycle, the companies which were in the stage of technical growth occupied the highest percentage of 39.9%. In the scale of capital, the companies which had less than 500 million won occupied the largest percentage of 49.5%, which suggested that the companies are small and medium ones.

Table 2 : The Characteristics of Samples

<table>
<thead>
<tr>
<th>Categories</th>
<th>Frequencies</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Business Period</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 years or less</td>
<td>10</td>
<td>3.2</td>
</tr>
<tr>
<td>11~20 years</td>
<td>152</td>
<td>48.9</td>
</tr>
<tr>
<td>21~30 years</td>
<td>93</td>
<td>29.9</td>
</tr>
<tr>
<td>31~40 years</td>
<td>27</td>
<td>8.7</td>
</tr>
<tr>
<td>41 years or more</td>
<td>29</td>
<td>9.3</td>
</tr>
<tr>
<td>Total</td>
<td>311</td>
<td>100</td>
</tr>
<tr>
<td><strong>Technology Life Cycle</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Development</td>
<td>23</td>
<td>7.4</td>
</tr>
<tr>
<td>Introduction</td>
<td>47</td>
<td>15.1</td>
</tr>
<tr>
<td>Growth</td>
<td>124</td>
<td>39.9</td>
</tr>
<tr>
<td>Maturity</td>
<td>87</td>
<td>28.0</td>
</tr>
<tr>
<td>Decline</td>
<td>10</td>
<td>3.2</td>
</tr>
<tr>
<td>Others</td>
<td>20</td>
<td>6.4</td>
</tr>
<tr>
<td>Total</td>
<td>311</td>
<td>100</td>
</tr>
<tr>
<td><strong>Capital Scale</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.5 BW or less</td>
<td>154</td>
<td>49.5</td>
</tr>
<tr>
<td>0.51~1 BW</td>
<td>53</td>
<td>17.0</td>
</tr>
<tr>
<td>1.1~5 BW</td>
<td>78</td>
<td>25.1</td>
</tr>
<tr>
<td>5.1~10 BW</td>
<td>13</td>
<td>4.2</td>
</tr>
<tr>
<td>10.1 BW or more</td>
<td>13</td>
<td>4.2</td>
</tr>
<tr>
<td>Total</td>
<td>311</td>
<td>100</td>
</tr>
</tbody>
</table>

Validity and Reliability Analysis: Prior to hypothesis testing, validity and reliability were analyzed. In the first place, exploratory factor analysis was conducted to check the validity. To simplify factor extraction and factor loading, principle component analysis and Varimax rotation were selected and used and these methods were based on eigenvalue 1.0 or higher and factor loading 0.4 or higher. Four variables were extracted like the theoretical structure in the preceding studies. The variables were named as recognition of importance, project management skills, corporate image, and re-engagement intention. And for each variable, reliability analysis was conducted. As a result of this reliability, it was found that there were no factors that inhibited the confidence level and so all items were used for analysis. As Cronbach’α for each variable was distributed within the range of .881-.902, it appeared that confidence level (Cronbach’α > 0.8) was satisfiable as shown in table 3.

Table 3: Exploratory Factor Analysis and Reliability Test

<table>
<thead>
<tr>
<th>Categories</th>
<th>MV</th>
<th>ROI</th>
<th>PMS</th>
<th>CI</th>
<th>RI</th>
<th>Cα</th>
</tr>
</thead>
<tbody>
<tr>
<td>ROI1</td>
<td>.786</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.902</td>
</tr>
<tr>
<td>ROI2</td>
<td>.788</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ROI3</td>
<td>.852</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ROI4</td>
<td>.820</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ROI5</td>
<td>.723</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PMS1</td>
<td></td>
<td>.778</td>
<td></td>
<td></td>
<td></td>
<td>.881</td>
</tr>
<tr>
<td>PMS2</td>
<td></td>
<td>.737</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PMS3</td>
<td></td>
<td>.819</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PMS4</td>
<td></td>
<td>.744</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PMS5</td>
<td></td>
<td>.601</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PMS6</td>
<td></td>
<td>.763</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PMS7</td>
<td></td>
<td>.668</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CI</td>
<td></td>
<td>.752</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RI</td>
<td></td>
<td></td>
<td></td>
<td>.840</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EV</td>
<td>3.599</td>
<td>2.897</td>
<td>1.983</td>
<td>1.665</td>
<td>1.169</td>
<td></td>
</tr>
<tr>
<td>V%</td>
<td>25.70</td>
<td>20.69</td>
<td>14.16</td>
<td>11.89</td>
<td>7.245</td>
<td></td>
</tr>
<tr>
<td>AV%</td>
<td>25.70</td>
<td>46.39</td>
<td>60.56</td>
<td>72.45</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Measurement Model Analysis: To test the goodness-of-fit and validity and reliability of measurement models, measurement model analysis was conducted. To generate the goodness-of-fit presented in the final questions, removal was executed based on SMC value, the degree that the measurement value accounted for the latent value. Finally, project management skill 6 and 7 were removed before analysis. As a result of this analysis, it was found that t value from the relational estimation between latent variable and measurement value exceeded 1.965 and SMC value showed 0.4 or higher, which suggested that latent variables accounted...
for variation in the measurement variables well. Also, CMIN/DF was 2.981, GFI .926, AGFI .885, CFI .951, NFI .929, IFI .952, TLI .936, RMR .029, and RMSEA .079, which suggested that measurement model was appropriated as shown in Table 4.

<table>
<thead>
<tr>
<th>Measure</th>
<th>SLFV</th>
<th>SE</th>
<th>Tvalue</th>
<th>p</th>
<th>CR</th>
<th>AVE</th>
<th>SMC</th>
</tr>
</thead>
<tbody>
<tr>
<td>ROI</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>.785</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>.992</td>
<td>.963</td>
<td>.617</td>
</tr>
<tr>
<td>2</td>
<td>.884</td>
<td>.067</td>
<td>17.224</td>
<td>***</td>
<td>.782</td>
<td>.600</td>
<td>.593</td>
</tr>
<tr>
<td>3</td>
<td>.774</td>
<td>.074</td>
<td>14.620</td>
<td>***</td>
<td>.593</td>
<td>.649</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>.770</td>
<td>.074</td>
<td>14.516</td>
<td>***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>.806</td>
<td>.070</td>
<td>15.364</td>
<td>***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PMS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>.698</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>.988</td>
<td>.943</td>
<td>.487</td>
</tr>
<tr>
<td>2</td>
<td>.846</td>
<td>.090</td>
<td>13.097</td>
<td>***</td>
<td>.716</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>.781</td>
<td>.085</td>
<td>12.313</td>
<td>***</td>
<td>.610</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>.702</td>
<td>.085</td>
<td>11.186</td>
<td>***</td>
<td>.492</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>.687</td>
<td>.087</td>
<td>10.968</td>
<td>***</td>
<td>.472</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CI</td>
<td>1.000</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1.000</td>
<td>1.000</td>
<td>1.000</td>
</tr>
<tr>
<td>RI</td>
<td>1.000</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1.000</td>
<td>1.000</td>
<td>1.000</td>
</tr>
</tbody>
</table>

**Table 4: Goodness of Fit of Measurement Model**

Ref.1) FLV : Factor Loading Value  
Ref.2) SLFV : Standardized Loading Factor Values  
Ref.3) SE : Standard Error  
Ref.4) CR : Critical Ratio  
Ref.5) AVE : Average Variance Extracted  
Ref.6) SMC : Squared Multiple Correlation

Table 5 shows the results of distinction validity analysis based on the assumption that AVE value being greater than the square of correlation coefficient confirms distinction validity. Distinction validity was confirmed as the AVE values of each latent variable were greater than the coefficient of determination of the relationship between recognition of importance and corporate image, which has the highest correlation.

<table>
<thead>
<tr>
<th>Measure</th>
<th>Reference Value</th>
<th>Measured Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chi-Square</td>
<td>-</td>
<td>149.060</td>
</tr>
<tr>
<td>df</td>
<td>-</td>
<td>50</td>
</tr>
<tr>
<td>P</td>
<td>&gt;.05</td>
<td>.000</td>
</tr>
<tr>
<td>CMIN/DF</td>
<td>&lt; 3.0</td>
<td>2.981</td>
</tr>
<tr>
<td>GFI</td>
<td>&gt;.90</td>
<td>.926</td>
</tr>
<tr>
<td>AGFI</td>
<td>&gt;.80</td>
<td>.885</td>
</tr>
<tr>
<td>CFI</td>
<td>&gt;.90</td>
<td>.951</td>
</tr>
</tbody>
</table>

**Research Model Analysis:** To evaluate our research model, we tested its goodness of fit as a structural equation model. Table 6 shows how all the Goodness of Fit measures for the research model satisfy their corresponding reference values.

**Table 5 : Distinction validity analysis**

Ref.1) Bold numbers are variable AVE values.  

<table>
<thead>
<tr>
<th>Measure</th>
<th>ROI</th>
<th>PMS</th>
<th>CI</th>
<th>RI</th>
</tr>
</thead>
<tbody>
<tr>
<td>ROI</td>
<td>.963</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PMC</td>
<td>.480</td>
<td>.943</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CI</td>
<td>.678</td>
<td>-.046</td>
<td>1.000</td>
<td></td>
</tr>
<tr>
<td>RI</td>
<td>.174</td>
<td>.120</td>
<td>.463</td>
<td>1.000</td>
</tr>
</tbody>
</table>

Goodness of fit of measurement model

<Initial model>
Chi-Square=230.137, df=73, p=.000, CMIN/DF=3.153, GFI=.905, AGFI=.863, CFI=.934, NFI=.907, IFI=.934, TLI=.918, RMR=.032, RMSEA=.083

<Final model>
Chi-Square=149.060, df=50, p=.000, CMIN/DF=2.981, GFI=.926, AGFI=.885, CFI=.951, NFI=.929, IFI=.952, TLI=.936, RMR=.029, RMSEA=.079
The Results of Hypothesis Testing: The results of the path coefficient analysis for specific hypothesis testing after the research model was found to be appropriate are shown in table 1. It appeared that the recognition of importance of consulting had a positive (+) impact on project management skills (standardized coefficient $\beta=.480, P=.000$) and had a positive (+) impact on corporate image (standardized coefficient $\beta=.678, P=.000$), and also had a positive (+) impact on re-engagement intention (standardized coefficient $\beta=.174, P=.015$). As performance of consulting, project management skills did not have a significant impact on corporate image (standardized coefficient $\beta=-.046, P=.414$). And project management skills had a positive (+) impact on re-engagement intention (standardized coefficient $\beta=.120, P=.031$), corporate image had a positive (+) impact on re-engagement intention (standardized coefficient $\beta=.463, P=.000$).

To identify the influencing relationship of indirect effect, i.e. mediating effect that the recognition of importance has on re-engagement intention by the medium of project management skills and corporate image, Bootstrap was used, and the value for indirect effect (the sum of squares of the direct effect .427 that recognition of importance has on project management skills and the direct effect .184 that project management skills has on re-engagement intention and the squares of the direct effect .593 that recognition of importance has on corporate image and the direct effect .526 that corporate image has on re-engagement intention) was $p=.004$, which suggested that it was statistically significant because it was less than .05. And thus it was found that project management skills and corporate image had a mediating impact in the influencing relationship that recognition of importance on re-engagement intention as shown in figure 2.

* $p<.05$, *** $p<.001$

**Figure 2: The Structural Path**

Finally, Table 7 shows the results of hypothesis testing on the effects of recognition of importance of corporate consulting on performance of consulting and the effects of performance of consulting on re-engagement intention.

**Table 7: The Results of Hypothesis Testing**

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Hypothesis To Be Tested</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1</td>
<td>Recognition of importance will have a positive impact on project management skills.</td>
<td>Accept</td>
</tr>
<tr>
<td>H2</td>
<td>Recognition of Importance will have a positive impact on corporate image.</td>
<td>Accept</td>
</tr>
<tr>
<td>H3</td>
<td>Recognition of Importance will have a positive impact on re-engagement intention.</td>
<td>Accept</td>
</tr>
<tr>
<td>H4</td>
<td>Project management skills will have a positive impact on corporate image.</td>
<td>Reject</td>
</tr>
<tr>
<td>H5</td>
<td>Project management skills will have a positive impact on re-engagement intention.</td>
<td>Accept</td>
</tr>
<tr>
<td>H6</td>
<td>Corporate image will have a positive impact on re-engagement intention.</td>
<td>Accept</td>
</tr>
</tbody>
</table>

**CONCLUSION**

**Study Results and Implications:** This study was conducted to test the impact of recognition of importance of consulting on re-engagement intention as well as performance of consulting from the customer perspective in domestic small and medium enterprises which experienced government-funded consulting. Based on
the preceding studies, the concept and dimension of each factor was identified, and after conducting the validity analysis of measurement items, used for final analysis. After testing the hypothesis of this study according to the structural equation model, the results are as follows:

It was found that the recognition of importance of consulting had a positive impact on project management skills and corporate image as consulting outcomes and that project management skills and corporate image had a positive impact on consulting re-engagement intention. Also, in the influencing relationship between project management skills and corporate image as performance of consulting, project management skills did not have a significant impact on corporate image. This suggests that project management skills is an internal factor and thus unrelated to the corporate image as external factor. Finally, the conclusion was drawn that the recognition of importance of consulting in small and medium enterprises had a positive impact on consulting re-engagement intention by the medium of project management skills and corporate image.

The findings from this study suggest that it is necessary to take policy measures for promotion of understanding of and recognition of importance of consulting in the government’s consulting support project for small and medium enterprises. In government’s consulting support projects, establishing policies and various programs for enhancing the small and medium enterprises’ recognition of consulting is expected to lead to activation of consulting support projects and reinforcement of competitiveness in small and medium enterprises.

Limitations of Study and Future Directions: This study has the following limitations and presents the directivity for future work. First, there is a need to conduct a research on various types of business because the types of business of the domestic small and medium enterprises selected as parent groups are limited. Second, given the diversity of characteristics of small and medium enterprises, more substantial policy implications could be drawn if reflecting various factors such listing, technology life cycle, and joint research. Third, it is thought that if making good use of the qualitative indicators such as project management skills and corporate image to measure the performance of consulting, other results would be drawn.

Ethical Clearance: Taken from Hansung University committee

Conflict of Interest: Nil

ACKNOWLEDGMENT

This research was financially supported by Hansung University.

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An Analysis on the Neighborhood Effect for Regional Economy in Korea

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ABSTRACT

Background/Objectives: The objective of this paper is to analyze the neighborhood effect of the regional economy in Korea. It is necessary for the central governments to examine the neighborhood effect for the public expenditures of local governments in order to find out the optimal size local governments.

Methods/Statistical analysis: We constructed the spatial econometric model in order to analyze the neighborhood effect of regional economy in Korea. Using the panel data for 155 local governments in Korea during 2002-2009 periods, we estimated the OLS, the fixed effect model and the random effect model for the aggregate regional production function. We selected an optimal model among three models using Hausman test estimates.

Findings: Above all we found that there exist significant neighborhood effects for labor and capital inputs in the private sector and the public expenditures of local governments. Specifically, there exists negative spillover effect for labor inputs while there exists positive spillover effects for capital stock in the private sector as well as public expenditures of local governments. It implies that the adjacent local provinces compete each other for obtaining labor forces. There exists positive spillover effects of local public expenditures of neighborhood local governments. The estimation results from the per capita GRDP equation supports the hypothesis that the region surrounded by affluent neighborhood regions are inclined to be affluent.

Improvements/Applications: It is very crucial for the Korean central government to form the optimal size of local provinces based on the empirical findings on the spillover effects from public expenditures.

Keywords: neighborhood effect, aggregate regional production function, spatial econometrics, Korea

INTRODUCTION

The neighborhood effect may be defined in terms of various contexts in various fields such as sociology, political science, education, and economics. In economics the neighborhood effects are defined by geographic proximity as well as distance in social spaces. The individuals living in the adjacent places in geographic sense and social spaces affect each other’s decisions, preferences, information sets, and outcomes. The previous studies on the neighborhood effects in economics and other social sciences examine the social determinants of individual behavior and aggregate outcomes and spillover effects using microeconomic models.

The literature of neighborhoods provides various approaches concerning on the neighborhood effects. Marquez et al. breaks the regional economic growth processes into two broad types, neighborhood and economy-wide effects using a dynamic space-time empirical model. Manski stressed that methodological developments in economic theories opened the ways to use a range of spillover effects in the regional econometric models. Recently the regional agglomeration approach highlights the relationship...
between regional economic growth processes and spatial concentration based on the concept of economies of agglomeration used by Krugman. Brock and Durlauf and Durlauf analyzed how the segregation among groups such as regional income disparity is caused by the neighborhood effects. Internal social effects can affect the income inequality. In macroeconomics wealthy countries are clustered together, since countries close to fast economies experience faster growth in aggregate demand for exports. Manski introduced the social multipliers effect implying that neighborhood effects may amplify the private incentives. The implication of social multiplier effects for policy implementation is important in equality of opportunities. Fang and Zou investigates how neighborhood effects affect chronic poverty in China.

Kwon and Kang investigated the existence of neighborhood effects in farm income using the farm-level income survey data set in Korea. They showed that the neighborhood effect exist for farm agricultural income in Korea. This paper analyzes the existence of neighborhood effects in regional economy in Korea estimating the regional aggregate production function

\[ \text{GRDP} = f(L, K, E, Tax, L_N, K_N, E_N, Tax_N, Z) \quad \ldots(1) \]

where GRDP = gross regional domestic product, \(L\) = labor, \(K\) = capital stock in the private sector, \(E\) = public expenditures by the local government, \(\text{Tax}\) = local taxes, and the subscript \(N\) denotes the neighborhood, thus \(L_N\) represents the neighborhood labor etc. \(Z\) represents the vector of control variables such as the manufacturing industry ratio and the ratio of old population.

We construct the spatial econometric model in order to analyze the neighborhood effect of regional economy in Korea. The estimation equation may be set up as shown in equation (2).

\[
\log(\text{GRDP}) = \beta_1 + \beta_2 \log L + \beta_3 \log K + \beta_4 \log W \cdot L + \beta_5 \log W \cdot L + \gamma_1 \log E + \gamma_2 \log Tax + \gamma_3 \log W \cdot E + \gamma_4 \log W \cdot Tax + \delta_1 \text{manuf} + \delta_2 \text{oldpop} + u \quad \ldots(2)
\]

where \(W\) is the weight matrix and \(u\) is an error term. Based on the assumption that only contiguous regions can influence each other the weight matrix \(W\) has a binary contiguity element \(w_{ij}\), where \(W_{ij} = 1\) if the region \(i\) has a border with region \(j\), \(w_{ij} = 0\) otherwise. The error term is composed of the fixed effect term (\(\eta_i\)) and the idiosyncratic disturbance terms (\(\epsilon_{i,t}\)).

\[
u_{it} = \eta_i + \epsilon_{i,t} \quad \ldots(3)\]

The fixed effect term (\(\eta_i\)) represents the unknown regional specific characteristics such as peoples’ behavioral pattern and cultures. We may set up the fixed effect model if \(\eta_i\) is constant term or the random effect model if \(\eta_i\) is the random variable following the normal distribution.

**ESTIMATION RESULTS**

The estimation results of the regional aggregate production function are shown in Table 1. Using the panel data for 155 provinces in Korea during 2002-2009 periods, we estimated the OLS (Ordinary Least Square), the fixed effect model and the random effect model for equation (3). We selected an optimal model among three models using Hausman test statistic. We selected the fixed effect model using Hausman test estimate which \(\chi^2\) statistics rejected null hypothesis. So we explain for the fixed effect model result.

**Table 1: Regional Aggregate Production Function Estimation Results**

<table>
<thead>
<tr>
<th></th>
<th>Model A</th>
<th>Model B</th>
<th>Model C</th>
<th>Model D</th>
</tr>
</thead>
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<td>Dependent variable:</td>
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<td>0.028</td>
<td>0.145***</td>
<td>0.144***</td>
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<tr>
<td></td>
<td>(3.80)</td>
<td>(1.05)</td>
<td>(6.71)</td>
<td>(6.55)</td>
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Contd…

<table>
<thead>
<tr>
<th></th>
<th>0.172***</th>
<th>0.250***</th>
<th>0.095***</th>
<th>0.110***</th>
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<tbody>
<tr>
<td></td>
<td>(13.32)</td>
<td>(15.82)</td>
<td>(7.13)</td>
<td>(8.18)</td>
</tr>
<tr>
<td>0.549***</td>
<td>(42.33)</td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>-0.255***</td>
<td>-0.130***</td>
<td>-0.130***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(7.09)</td>
<td>(4.59)</td>
<td>(4.64)</td>
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<tr>
<td>0.485***</td>
<td>(22.986)</td>
<td>0.192***</td>
<td>0.1933***</td>
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</tr>
<tr>
<td></td>
<td>(10.09)</td>
<td>(10.25)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.163***</td>
<td>0.165***</td>
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<td></td>
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<tr>
<td></td>
<td>(9.17)</td>
<td>(9.27)</td>
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<td></td>
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<td>0.072***</td>
<td>0.083***</td>
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<td></td>
<td></td>
<td>(4.63)</td>
<td>(5.37)</td>
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<tr>
<td>0.095***</td>
<td>(5.14)</td>
<td>0.108***</td>
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<td></td>
<td>(5.82)</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>0.159***</td>
<td>0.186***</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(6.78)</td>
<td>(7.56)</td>
<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td>-0.258***</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>(5.37)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>0.549***</td>
<td>6.723***</td>
<td>3.134***</td>
<td>2.220***</td>
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<tr>
<td></td>
<td>(18.35)</td>
<td>(27.89)</td>
<td>(10.66)</td>
<td>(6.06)</td>
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<td></td>
<td>0.759</td>
<td>0.637</td>
<td>0.783</td>
<td>0.788</td>
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<td></td>
<td>1,683.21</td>
<td>703.24</td>
<td>649.2</td>
<td>535.5</td>
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<tr>
<td>N</td>
<td>1,758</td>
<td>1,763</td>
<td>1,603</td>
<td>1,602</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>(number of observations)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1,758</td>
<td>1.763</td>
</tr>
</tbody>
</table>

**Note:** absolute t-values in parentheses.

*: significance level 10%, **: significance level 5%, ***: significance level 1%.

Firstly, the first column of Table 1 shows the estimation result for model A where labor and capital stock as well as the neighborhood GRDP affect own GRDP. We notice that the GRDP’s of adjacent provinces positively affect GRDP. Thus, there exists positive externality across the provinces. In model A the estimate of coefficient of variable neighborhood GRDP (, ) is positive(0.549) and statistically significant. This result supports the hypothesis that rich neighborhoods of a region help its economy to grow faster than otherwise.

There are a couple of reasons through which a regional economy grows fast. In terms of supply side, the more the neighborhoods provide private sector capital and public sector, the more there exist positive external effects on the regional economy. In terms of demand side the neighborhoods’ demand for goods and services provided by own region stimulate the regional economy and GRDP at last. In terms of both supply and demand perspectives the wealthy neighborhood with large GRDP will help the regional economy grow faster than otherwise.

Secondly, the model B in the third column postulates GRDP of province is determined by its own labor and capital inputs as well as the neighborhood factor inputs. The estimation result for model B shows that the neighborhood labor inputs have negative effect on GRDP of province while the neighborhood capital stocks have positive effect. It is because the labor forces may move freely across the provinces so that there exists a substitution for labor inputs. On the other hand the capital stocks of adjacent provinces are complementary inputs for the regional production process. Furthermore,
the positive effects from the neighborhood capital stocks are greater than own capital stock.

Thirdly, the model C and the model D postulate that public sectors of own region and adjacent regions affect own GRDP. Local public expenditures and local taxes are included in GRDP equation (3). Both public expenditures of own local government and its neighborhood local governments increase own GRDP. There exists the positive spillover effect of local public expenditures. The positive external effects of local public expenditures come from expenditures of Social Overhead Capital such as road and bridge construction.

Interestingly, the sign of tax variables of its own region and neighborhood regions are positive. We may explain this such that the more local taxes imply the greater fiscal capacities of local governments. There exists a negative effect of local taxes on GRDP since local taxes distort the resource allocation. Thus, there are both positive and negative effects of local taxes on GRDP. It turns out that the positive effect simply outweighs the negative effect.

Among control variables the sign of coefficient of old population ratio is negative. It is because the more old people in the region the higher the level of exhaustive consumption expenditure and the less productive investment.

Per capita GRDP represents the standard of living or welfare of a specific region, while GRDP represents the economic capabilities in general. The estimation results for per capita GRDP are shown in Table 2.

### Table 2: Per Capita GRDP Function Estimation Results

<table>
<thead>
<tr>
<th>Dependent variable:</th>
<th>Model E</th>
<th>Model F</th>
<th>Model G</th>
<th>Model H</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>0.720***</td>
<td>2.001***</td>
<td>0.804***</td>
<td>1.017***</td>
</tr>
<tr>
<td>(14.70)</td>
<td>(89.89)</td>
<td>(6.16)</td>
<td>(7.61)</td>
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<tr>
<td>N</td>
<td>1,488</td>
<td>1,760</td>
<td>1,603</td>
<td>1,602</td>
</tr>
<tr>
<td>(number of observations)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: absolute t-values in parentheses.

*: significance level 10%, **: significance level 5%, ***: significance level 1%.

The dependent variables is the logarithm of per capita GRDP for model E, F, G, and H. The estimation results from model E confirm that the region surrounded by neighborhood regions with high per capita GRDP are inclined to have high per capita GRDP. In other words the affluent provinces get together. The estimation results from model F show that the higher the capital labor ratio becomes, the higher per capita GDP becomes.
The estimation results from model G and H are more or less similar to those from the GRDP estimation equation model C and D.

CONCLUSION

In this paper we analyzed the neighborhood effect of the regional economy in Korea. Using the panel data for 155 local governments in Korea during 2002-2009 periods, we estimated the OLS, the fixed effect model and the random effect model for the aggregate regional production function. We found that there exist significant neighborhood effects for labor and capital inputs in the private sector and the public expenditures of local governments. Specifically, there exists negative spillover effect for labor inputs while there exists positive spillover effects for capital stock in the private sector as well as public expenditures of local governments. It implies that the adjacent local provinces compete each other for obtaining labor forces. There exists positive spillover effects of local public expenditures of neighborhood local governments. The estimation results from the per capita GRDP equation supports the hypothesis that the region surrounded by affluent neighborhood regions are inclined to be affluent. There are many crucial policy implications from our empirical findings. Firstly, we may use the empirical results for reform of local government formation in Korea. Especially, the positive effect of the local public expenditures on adjacent provinces implies that merge of local governments would be optimal.

Ethical Clearance: Taken from Cheongju University committee

Conflict of Interest: Nil

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REFERENCES


Comparative Survey on Modular Cell-Equalizing Circuits for Battery Management Systems

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ABSTRACT

The charge/discharge imbalance problems in series-connected batteries may result in ravage to cells in battery and decrease battery life cycles. This study presents a comparison survey study among different modular cell balancing approaches that are used to balance battery cell voltage for battery management systems. In particular, the cell equalizing methods that are considered in this paper have a modular structure. This paper would provide guidelines for selecting a suitable topology during the design process of modular cell balancers. A module concept of modular cell balancer shown in the paper is useful for future research on modular cell equalization approaches for energy storage applications.

Keywords: Modular-type cell equalizer, cell-balancing circuit, series-connected batteries, Battery management systems.

INTRODUCTION

Because of battery charge/discharge imbalance problems, many battery management systems have been used in series-connected battery strings for electric scooters, electric vehicles (EVs) [1], [29], hybrid electric vehicle (HEVs) [6] and innovative subway systems [22]. These battery charge/discharge problems may be caused as a result of cell disparity variances in electrical and chemical characteristics because of cell degradation with battery lifetime. These imbalanced batteries may cause severe storage capacity reduction. In order to resolve these cell imbalance problems among cells of multiple series-connected battery strings, various approaches have been studied in the past, which used a mono-module [1, 2], [10], [14, 15], [19], [20], [30], [32]. However, such approaches could introduce a high level of complexity during the actual design process. On the other hand, cell equalizing techniques which used multi-modules have been developed for multiple series-connected battery strings and preferred for battery management system [9-13]. To overcome these aforementioned disadvantages, modular cell balancing methods transmit energy both from higher energy cells to lower energy cells and from higher energy modules to lower energy modules. The comparison of cell balancing methods was reported in [1], [14, 15], [19, 20], [30]. [32]. However, few research studies seem to consider comparing on modular cell balance methods in the battery management systems.

Figs. 1(a) and (b) show cell balancing circuits based on a mono-module cell balancer and a modular cell balancer respectively [5], [7]. Fig. 1(a) shows a mono-module cell balancer which is used for one battery string that consists of N by M cells. As shown in Fig. 1(b), a modular cell balancer is divided into M group units of battery cell strings. The whole battery string is associated with M modules or groups, while each module (or group) consists of N number of cells. If the number of cells in a single module are significantly large, this modular cell balancing circuit may reduce the complexity of a cell equalizer.

The objective of this study is to compare different modular cell balancing methods. The considered cell balancing methods use a cell voltage equalizer to increase battery lifetime, balancing speed, and volume of
energy storage devices. Specifically, this study considers modular cell balancing methods. Representative examples of such a method include cell balancing circuits that use switched capacitors\cite{7}, switched transformer methods\cite{4, 10-13}, switched converters\cite{3, 5, 6, 8}, and an integrated module\cite{6, 7, 9}. The organization in the rest of this paper is as follows: Section 2 explains modular cell-equalizing methods using a switched transformer; Section 3 describes modular cell-balancing methods using a multi-winding transformer; Section 4 elucidates modular cell balancers by a switched and DC-DC converter; Section 5 shows outer-modular cell balancers; Section 6 concludes the summary of findings in this survey paper.

Modular cell-equalizing circuits based on a switched transformer: Fig. 2 illustrates a modular cell equalizing circuit based on a switched transformer\cite{10}. As represented in Fig. 3, each module contains battery cells that are connected in series with an individual equalizer. According to this method, cells in a module of a switched capacitor use a flyback converter topology and operates in a time-shared manner. If a battery cell string is manufactured by $M$ modules that consist of $N$ cells, the total number of the diodes and switches (i.e., $A$) can be calculated by

$$A = (2N - 2)M \quad \ldots(1)$$

This modular cell balancer also includes $M$ number of flyback converters. The battery cell voltages are measured by voltage sensors. The voltage information data are also transmitted to a micro processing unit to control the switching activities of the cells. This time-shared cell equalizing method is used for the large battery strings which are required for quick equalization time. However, the disadvantages of this method include difficulties on control and high production cost.
Modular cell-equalizing circuits based on a multi-winding transformer: Fig. 4(a) shows an example circuit of a modular cell equalizer based on a multi-winding transformer [4]. This modular cell balancer is also usually composed of \( M \) number of modules of which sub-components have \( N \) series-connected cells in each module [4], [21]. Each cell is serially connected to both the switcher, and the primary side of the multi-winding transformer uses an auxiliary circuit for fast equalization.

With the aim of equalizing the module voltages in the battery strings, each module uses the secondary side of the multi-winding transformer that is linked to another group of battery cell string to possibly exchange its magnetizing energy. For example, the control flowchart for the balancing circuit with 3 modules is exemplified in Fig. 4(b). Although this method can be used in high power applications, its production size and cost may be high, its balancing time may also take long time. In addition, the control design becomes complex as the size of the battery increases.
Modular cell-equalizing circuits based on a switched and DC-DC converter: Fig. 5(a) shows a cell balancing circuit based on a single switched capacitor to transfer energy among multiple cells. The overall cell balancing circuit that has multiple modules is presented in Fig. 5(b) [8]. In this circuit, there are \( M \) modules with \( N \) cells in each module. In addition, there are \( M \) single switched capacitor circuits, which are used to balance the voltage of each cell inside the modules [30], [32]. The auxiliary battery is used to exchange energy between modules by a bi-directional DC-DC converter. This modular cell balancer is to transmit energy from a higher energy module into an auxiliary battery via the bi-directional DC-DC converter. Then, this energy is transferred back to a lower energy module until the energy level in the modules are equalized with each other. For the operation of the modular cell balancing circuit, not only a voltage sensor for the module is required but an intelligent controller is also necessary. Thus, the switched and converter based modular balancers may be complex and expensive. However, they can obtain a higher efficiency and a faster balancing speed can be achieved with such an approach.

Outer-module cell-balancing circuits: Modular cell equalizing circuits that use an outer-module approach can be classified into several groups based on their main interfaces. Examples of possible interfaces include a multi-winding transformer, multiple transformers and switched capacitors[6, 7, 9]. The common operation principle of these approaches is the transmission of energy from cells that have more energy toward cells that have less energy. In addition, all modules are connected to an outer-module in order to transfer a higher module to a lower one that called modular balancing. Fig. 6 shows a modularized equalization architecture, which is an outer-module based modular cell balancer. This outer module cell balancer is connected with multiple intramodules to transfer higher energy modules to lower energy modules until energy equalization between the modules is achieved. In addition, energy equalization between cells in each intramodule is independently performed.

Fig. 7: Intramodule circuit example in an outer module cell balancer with a multi-winding transformer [7].

Outer-module cell-balancing method with a multi-winding transformer: An outer-module cell-equalizing method with a multi-winding transformer is shown in Fig. 8[7]. A possible example of the intramodule circuit is depicted in Fig. 7. Its multi-winding transformer has multiple secondary windings, and one winding in the primary side resembles the structure of a flyback converter. In this structure, the stored energy is transmitted from the primary side to lower energy cell in the secondary winding of the transformer as illustrated.
Modular cell equalizing circuit is created by connecting the modules in series. The whole battery pack is also equalized by a modular cell equalizer of the multi-winding transformer of a module equalization controller which connects each module to a secondary winding separately. This circuit does not require any voltage sensors for individual cells and modules [31]. Each module has $N$ number of series-connected cells, and each cell is connected serially to both the diode and the secondary winding of the multi-winding transformer [15], [18], [30], [32]. The controller of this modular cellequalizer has higher efficiency and easier to control than other equalization techniques in the applications of EVs with high power and high speed equalization. However, this technique may be cumbersome and costly because the transformer has high leakage inductor current. It is worth noting that such problems could be solved by using a resistor, a capacitor and a diodewhich is called an RCD snubbermethod [23].

**Outer-module cell-balancing method with multiple transformers:** An outer modular cell equalizer with multiple transformers is shown in Fig. 9 [9]. Each module has $N$ cells which are connected accordingly with $N$ single transformers and a flyback converter with cell selection switches, which named an intramodule balancer. This equalizer has the $N$ number of parallel connecting DC–DC converters based on a flyback structure and uses a single switch only. When cell voltages are inequitable, the cell selectings witch depicted in Fig. 9 is turned on. The main advantages of this circuit are as follows: the voltage/current stress that each switch experiences is relatively low, the modular cell equalizing circuit is extremely reliable, and the equalization time is short [9], [26]. However, this method could also result in a high manufacturing cost for implementation.

**Outermodular cell equalizer with a switched capacitor:** Fig. 10(a) depictsan outer modular cell equalizing circuit that uses the operation principle of a switched capacitor. The circuit is composed of different modules for charge balancing [7], [19] in which each module of the battery pack includes $N$ cells (i.e., $Cell_{i,j}$, $i=1-N, j=1-M$), switches (i.e., $S_1-S_{2N-1}$) and $N-1$ balancing capacitors (i.e., $C_{11} \sim C_{j-1}$). This circuit is based on an individual equalization system that is connected with inter-modular balancers of switched capacitors. In this circuit, cell equalization between cells in the intra modules can be realized by cell balancing capacitors [3], [12], [15], [17], [19], [20], [25], [32]. The modular balancing capacitors(i.e., $C_{i,j}$) are also designed to transmit a high energy intra module to a low one [7], [19].This switched-capacitor-based-balancing circuit can be controlled by pulse signals shown in Fig. 10(b).
Table I: Comparison of modular cell equalizing methods.

<table>
<thead>
<tr>
<th>Method</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Switched capacitor</td>
<td>- Simple design</td>
<td>- Unsatisfactory balancing</td>
</tr>
<tr>
<td></td>
<td>- Simple control</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Low voltage and current peaks</td>
<td></td>
</tr>
<tr>
<td>Switched transformer</td>
<td>- Fast balancing</td>
<td>- High cost</td>
</tr>
<tr>
<td></td>
<td>- Low voltage and current stress</td>
<td>- Difficult control</td>
</tr>
<tr>
<td>Multi-winding</td>
<td>- High power applications</td>
<td>- Complicated control</td>
</tr>
<tr>
<td>transformer</td>
<td>- Satisfactory balancing</td>
<td>- Low balancing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Voltage sensor</td>
</tr>
<tr>
<td>Switched &amp; DC-DC</td>
<td>- Fast balancing</td>
<td>- Difficult control</td>
</tr>
<tr>
<td>converter</td>
<td>- High efficient</td>
<td>- High cost</td>
</tr>
<tr>
<td>Outer-modular</td>
<td>- High efficient</td>
<td></td>
</tr>
<tr>
<td>cell balancer</td>
<td>- Fast balancing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Easy control</td>
<td>- Bulky and costly</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Magnetic losses</td>
</tr>
</tbody>
</table>

As this balancing approach with multi-modules does not require voltage sensors for operation, a rather simple and cost effective circuit could be realized. Furthermore, the equalization process can be finished in a shorter time period compared with the approach that uses a single module. Based on the simplicity of design and control, this design approach seems to be attractive for EV battery applications.

CONCLUSIONS

An extensive comparison of modular cell equalizing methods was investigated in this paper. Table 1 shows the difference of the modular cell equalizing approaches. These methods are used to equalize the voltage of series-connected battery string or supercapacitors. The energy transmission principle, disadvantages, and advantages of modular cell equalizing have been discussed to provide the preliminary guideline for designing battery management systems. This paper also showed how to change a circuit from a mono-module cell balancer to a modular cell balancer in order to reduce the number of cells per module. The investigated results in this paper could be useful for further studies on cell balancing techniques which use multi-modular circuits.

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REFERENCES


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Conflict of Interest: Nil


Stability of DC Power Networks with Constant Power Loads for Small Sized Applications

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ABSTRACT

This paper studies the stability characteristics of small sized dc power networks with constant power loads being connected to the network. With the increased application of dc distributed power systems and active loads, maintaining stability in dc power networks with high usage of constant power load has become an important issue. Motivated by the fact that small sized dc systems would have difficulties with accommodating stability improvement methods that require installation of additional components, this paper performs stability analysis and explores application of virtual resistance based approaches for stability improvement in dc power systems. The performance of the studied control approaches is also verified and the characteristics of the considered approaches are also studied.

Keywords: Constant power load, dc-dc power conversion, stability, virtual resistance

INTRODUCTION

This paper studies the stability characteristics of dc power systems with constant power loads (CPLs). Based on the analysis result, several control approaches are also explored with an objective to minimize the adverse impact of CPLs to the stability of dc power networks. The application of dc networks has been reported in various applications, such as in commercial buildings [1], sustainable power networks [2] and vehicular platforms [3]. While the use of dc systems for power networks might introduce several advantages from an operational and design perspective [4], studies on stability of dc systems require a comprehensive approach to ensure stable operation for different conditions [5].

This paper explores the application of control approaches that could improve the stability characteristics of dc power system small sized applications. In such applications, physical constraints (e.g., size and weight) should also be considered. In order to guarantee stability of systems with CPLs, various solutions have been studied. However, instability mitigation approaches that require connection of additional hardware (e.g., energy storage devices or filters) would not be preferable for small sized applications considering possible constraints of weight and size. While changing the system configuration (e.g., decreasing the number of CPLs [5] or changing the load distribution so that CPLs are connected in parallel with other passive loads [6], [7]) could also be an option, such approach would result in a solution that is dependent to each individual application.

The rest of this paper is organized as follows. The following section explores how the stability characteristics of CPL connected dc power systems vary with different system parameter values. Based on the observation results of section 2, section 3 introduces control methods that implement a virtual resistance to the dc power system. To verify the performance of the proposed approaches, section 4 presents the verification results by considering an example of a dc power system. Finally, the last section concludes the paper by summarizing the technical findings.
SYSTEM STABILITY AND CONSTANT POWER LOADS

System Model: Fig. 1 shows the equivalent circuit of the dc power network to be studied. As shown in Fig. 1, the considered dc power network consists of the power source, cable, source converters, and loads. Each source converter includes inductors, capacitors, and switching devices to perform power electronic conversion according to system requirements. In case the power systems loads are required to be classified into different zones, an additional source converter can be installed for each individual zone. For example, the system of Fig. 1 is designed such that the loads of zone A are powered by source converter #1, while the loads of zone B are operated based on the output of source converter #N.

Since the power network should be stable without being affected by variations of the system parameter values, it is necessary to study how the stability characteristics of the network would change with different system parameter values. By choosing the capacitor voltage and the inductor current of the source converter as state variables, the small-signal model of zone A can be modeled as [8]

\[
\frac{d\hat{i}_L}{dt} = -\frac{R_{L} + r_{L} + r_{C}r_{L}}{L R + L r_{C}} \hat{i}_L - \frac{R}{L R + L r_{C}} \hat{V}_C + \frac{E}{L} \hat{d} \\
\frac{d\hat{V}_C}{dt} = \frac{1}{C R + C r_{C}} \hat{i}_L - \frac{1}{C R + C r_{C}} \hat{V}_C 
\]

where \( \hat{i}_L \) is the small signal inductor current, \( \hat{V}_C \) is the small signal capacitor voltage, \( E \) is the source voltage, \( \hat{d} \) is the small signal of the duty cycle for the switch SW, \( L \) is the inductance, \( C \) is the capacitance, \( r_{L} \) is the resistance placed in series with \( L \), \( r_{C} \) is the resistance placed in series with \( C \) and \( R \) is the load.

From the system equations (i.e., (1) and (2)), the characteristic equation of the considered system can be derived as [9]

\[
S^2 + \frac{C(R_{L} + r_{L} + r_{C}r_{L}) + L}{L C(R + r_{C})} S + \frac{R(r_{L} + r_{L} + R) + r_{C}r_{L}}{L C(R + r_{C})^2} = 0 
\]

Regarding the load resistance, it should be highlighted that some type of loads could have a negative incremental resistance value around the operating point [7]. A representative example of loads that have such terminal characteristics is tightly controlled power electronic converters or CPLs [7]. For such loads, the small signal resistance can be expressed as [10]

\[
R_{\text{small,CPL}} = -\frac{V^2}{P} 
\]

where, \( V \) is the input voltage of the CPL and \( P \) is the power of the CPL.

From the source converter, for example, some of the loads in zone A could be viewed as CPLs depending on their functions. Further details on examples and operation of CPLs can be found in [10].
**Stability Analysis:** The stability characteristics of the power network can be studied by observing how the solutions of (3) change with different system parameter values. In particular, this study considers the change in the values of \( r_L \) and \( R \). For stability analysis, the following values were initially assumed: \( E=24 \text{V} \), \( L=47 \text{uH} \), \( C=680 \text{uF} \), \( r_L=1 \text{m\Omega} \), and \( r_C=1 \text{m\Omega} \). Fig. 2 shows how the system poles move as the load resistance value changes from 75 \( \Omega \) to -75\( \Omega \). While the system poles lie in the left-hand plane (LHP) for most load resistance values, some cases with a negative resistance value (\( R=-10 \ \Omega \) and -25 \( \Omega \)) show that the poles are moved to the right half plane (RHP). Such positions of the pole imply that the corresponding equilibrium point is not stable.

For example, Fig. 3 shows the movement of system poles as the \( r_L \) value increases from 0.5 \( \text{m}\Omega \) to 2.5 \( \text{m}\Omega \) when a 15W CPL is connected. It could be seen from Fig. 3 that the system poles move from the right half plane (RHP) to the LHP as the inductor resistance value (\( r_L \)) increases. In particular, the stability characteristics show a noticeable change as soon as the resistance value changes from 1.5 \( \text{m}\Omega \) to 2.0 \( \text{m}\Omega \).

Although an increase in the inductor resistance value might not be ideal from a perspective of loss minimization, the result of Fig. 3 shows that a slight increase in the \( r_L \) might improve the stability characteristics of the system. While this paper studied the effect of \( r_L \), it had been studied that such effect could also be achieved by the parasitic components of realistic power devices (e.g., switches and diodes) \[11\].

Fig. 4 shows how system stability is affected by the changes in the inductance value. In this study, three different inductance values were considered (i.e., \( L=47 \text{uH} \), 94 uH, and 141 uH). The result of such inductance variation is shown in Fig. 4. The locations of the poles with different inductance values shows that an increase in the inductance value might introduce challenges to system stability. Although the inductance value was increased from 47 uH to 141 uH, the system stability characteristics could be improved by increasing the \( r_L \) value as shown in Fig. 4. Fig. 4 shows that the stability characteristics are affected by changes in the \( r_L \) value. In the case of Fig. 4, for different values for \( r_L \) were considered as \( r_L=10, 15, 20, 25 \text{ m}\Omega \). In particular, the poles moved from the LHP to the RHP as soon as the resistance value changed from 20 \( \text{m}\Omega \) to 25 \( \text{m}\Omega \) \[8-10\].

**Stability Improvement Approaches**

Since the stability performance of power systems with CPLs is affected by different factors, various approaches have been proposed to resolve such stability issue. From an hardware perspective, examples of possible solutions include 1) installation of large bus capacitances or energy storage devices at the system bus \[5\]; 2) placing constant voltage loads in parallel to CPLs at the connecting bus \[5\], \[7\]; and 3) introducing passive damping effect by passive device installation \[12\] or parasitic of actual components \[11\]. In this paper, these approaches have been classified as a hardware approach since such methods require installation or relocation of actual hardware (e.g., energy storage device, passive filters or loads).

**Fig. 2:** System Poles with different load resistance values.

**Fig. 3:** System Pole Trajectory with different \( r_L \) values.
Fig. 4: System pole Trajectory with different L and $r_L$ values.

Therefore, this paper considers the application of control approaches that can achieve an effect that is equivalent to introducing actual damping to the power network \[10\], \[13\], \[14\], \[15\].

Fig. 5 and Fig. 6 shows the block diagram of the considered control approaches, which are also known as approaches that implement virtual resistances. The effectiveness of such approaches could be studied by the stability analysis results of Fig. 3 and Fig. 4. Both Fig. 3 and Fig. 4 demonstrated that the system stability can be improved by increasing the series resistance value, $r_L$. Instead of installing an actual resistor, an effect that is equivalent to actual resistance installation can be achieved by introducing an additional virtual resistance term as shown in Fig. 5 and Fig. 6. Both control approaches of Fig. 5 and Fig. 6 implements a virtual resistance term by subtracting a value that is proportional to the inductor current. In case of the approach of Fig. 5, the small signal of the control input to the source converter can be written as

$$\hat{d}(s) = G_c(s) \cdot [\hat{V}^*(s) - \hat{V}(s) - R_v \cdot \hat{I}_L(s)] \quad \ldots(5)$$

while the small signal control input of Fig. 6 can be written as

$$\hat{d}(s) = G_c(s) \cdot [\hat{V}^*(s) - \hat{V}(s)] - R_v \cdot \hat{I}_L(s) \quad \ldots(6)$$

where, $\hat{d}(s)$ is the small signal of the control input to the power converter, $\hat{V}^*(s)$ is the small signal of the voltage reference signal, $\hat{V}(s)$ is the small signal of the output voltage of the source converter, $R_v$ is the virtual resistance, and $\hat{I}_L(s)$ is the small signal of the inductor current \[11-12\].

While the approach of Fig. 5 introduces the effect of the virtual resistance to the signal that enters the voltage controller (e.g., reference value of the voltage), the control approach of Fig. 6 introduces the virtual resistance term to the output signal of the voltage controller\[13\].

For both control approaches, the virtual resistance value should be selected so that inclusion of the virtual resistance does not affect the system performance. Since the inductor current value would increase as the load power increases, the approach of Fig. 5 results in an effect that is equivalent to decreasing the voltage command as the load power increases. Therefore, a larger virtual resistance value would result in larger damping. However, the output voltage would show a deviation as the overall reference value is being intentionally drooped. Hence, the virtual resistance value should be selected so that a large load power value would not introduce a voltage deviation in the voltage reference value that exceeds the minimum voltage limit on the power system \[14\].

In case of Fig. 6, the virtual resistance value is being introduced to the output of the voltage controller. Therefore, a sudden increase in the load power could introduce in a larger deviation during the transients. In case a large resistance value is used, the deviation could be large \[15-16\].

**VERIFICATION RESULTS**

To verify the performance of the considered control approaches, a simulation was performed. For the simulation, both the source converter and the constant power load was assumed to be a buck converter. Details of the parameter values are listed in Table 1.
TABLE I: System Parameters For Verification

<table>
<thead>
<tr>
<th>System Parameter</th>
<th>Value (units)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Source</td>
<td>24 V</td>
</tr>
<tr>
<td>Source Converter Capacitance (C)</td>
<td>470 uF</td>
</tr>
<tr>
<td>Source Converter Inductance (L)</td>
<td>200 uH</td>
</tr>
<tr>
<td>Switching Frequency</td>
<td>100 kHz</td>
</tr>
<tr>
<td>Output Voltage of the Source Converter</td>
<td>15 V</td>
</tr>
</tbody>
</table>

In order to demonstrate the effect of CPL to the stability of dc power network, the power value of the CPL is changed from 50W to 100 W at t=0.1s as shown in Fig. 7. While the voltage is oscillatory throughout the simulation, it could be seen that the amplitude of the voltage oscillation increases after the size of the CPL was increased at t=0.1s. Fig. 8 shows the stabilization process of the system voltage as soon as the virtual impedance term is introduced to the source converter control loop. For Fig. 8, the control approach of Fig. 5 was considered. Until t=0.1s, the voltage waveform shows an oscillatory response, which is similar to the waveforms of Fig. 7. Once the virtual resistance term is activated at t=0.1s, the voltage becomes stabilized by the damping effect introduced by the virtual resistance. Fig. 9 and Fig. 10 show the voltage stabilization process by using the control approach of Fig. 6. In this case, the virtual impedance term is added to the output of the voltage controller. From both Fig. 9, and Fig. 10, the oscillatory nature of the voltage stabilizes at t=0.1 s, which is the instant that the virtual resistance term is activated. In order to study the effect of the different virtual resistance values in the control approach of Fig. 6, different virtual resistance values were considered for Fig. 9 and Fig. 10. The virtual resistance value of Fig. 10 was twice larger than that of Fig. 9. It could be seen from the zoomed waveform of both Fig. 9 and Fig. 10 that a larger virtual resistance value introduces a larger voltage drop during the transients. That is, the voltage drop during transient periods is larger in the case of Fig. 10.

CONCLUSION

This paper studies the stability characteristics of dc power systems that have constant power loads connected. With the increased interest for dc microgrids and actively controlled power interfaces, it is expected to see dc power systems that consist of actively controlled electronic loads for power conversion purposes. Based on the mathematical model of a dc power network, the stability characteristics were studied. With an objective to stabilize...
electrical systems in small sized applications, the design and performance of virtual resistance based approaches have been studied. The mechanism of stabilization was studied and the characteristics of the considered control approaches were studied. The performance of the proposed control approach was also verified.

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**Conflict of Interest:** Nil

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**REFERENCES**


Study on the Design of Service Discovery System Based on IoT Device Extended Information

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ABSTRACT

Background/Objectives: Internet of Things is emerging as a concept to integrate and expand Internet technologies. Internet of things is rapidly developing as sensing technology and wired / wireless communication technology develop. This study proposes a system for applying information generated by IoT devices to web services.

Methods/Statistical analysis: The study presents the processing methods of various information protocols and data generated from IoT devices and provides them to service brokers performing web service discovery based on the generated information so that they can be used for service discovery. The proposed method extracts and generates device information from IoT devices. Through the formal specification of the generated information, the service list is provided to the user using the QoS information and IoT information in web service discovery.

Findings: A service discovery system based on IoT information was proposed for the purpose of using search information when selecting web services by using information generated through collaboration between devices and devices and device interaction with users through extension of IoT environment. The proposed system complements the reliability and availability problems of the existing search methods. The information model for the IoT service is presented in three stages, and the information generated in the IoT environment is defined to be applicable to the web service through the formal specification of each stage. The purpose is to apply to web service discovery system based on defined IoT information so that users can select appropriate services.

Improvements/Applications: By adding IoT devices information to the existing web service discovery method, the problem of QoS unilaterally provided by the provider is solved, and by presenting a list of services suitable for the user based on the information generated in the IoT environment used by the user, user satisfaction can be improved.

Keywords: Web services, IoT, Services discovery, IoT Computing Environment, Service Information

INTRODUCTION

The various search methods used in the web service environment are structures where the user selects based on the information generated by the service provider. Such a structure has a problem that it does not reflect the demand of the user using the service. In addition, the service provider-centric structure includes the problem of impairing the value of services in terms of lack of up-to-date information and availability ¹. The Internet of Things is a base technology in which objects are connected to wired and wireless networks and organically collects information and provides services based on this information. In other words, it is defined as a technology that can provide users with additional value as objects are connected to the Internet. As the IoT
environment expands, various devices are installed in the surrounding environment and connected to each other by the network to generate various information while providing the service are required by the user. In addition, the expansion of services is gradually increasing through collaboration between devices. Internet of Things is a new technology that many industries and research groups are actively researching. The IoT computing environment is a base technology that can provide intelligent services through links between devices, and people and devices, and can be applied with various technologies such as web service, cloud, and big data. In the case of web services, a method of selecting services considering users, where various users can actively participate, is required through the Web 2.0 paradigm. Web service selection methods are categorized into active methods that provide services from search to execution, and passive selection methods that provide only service information. The purpose of this study is to provide active service discovery to the users by applying the IoT devices information generated by the user that reflects the user’s requirements when using web services. For this, a service discovery system based on IoT information is proposed and various data generated from IoT devices are collected. It defines the device type and creates and saves the information needed for web service discovery through a formal specification. Since the service discovery is performed based on the device information generated by the user, the proposed system can present a service list with high availability and reliability to the user. For this, in Section 2, related work on Internet of Things and existing web service discovery are discussed, and Section 3 describes the service discovery system based on IoT information proposed in this study. Section 4 evaluates the proposed system through comparative analysis with existing research methods, and conclusions are made in Section 5.

**RELATED WORK**

**Web Service Selection Method:** The study by Ziqiang proposed a service discovery model in which agent performs service selection based on service function, QoS, and reputation score. In the research method, UDDI registry was improved to use QoS information, and two new functions, agent and reputation manager, were added to existing web service disclosure and search model. UDDI registries use tModel, and Web services store QoS information. The search agent acts as an intermediary between the service client, the UDDI registry, and the reputation manager to find services that satisfy the client’s functional and non-functional reputation needs. Ziqiang’s research method complements existing service discovery, but has a problem in that service discovery is performed by applying functions not provided by UDDI, so that a specific service is repeatedly selected in service selection. In the study by Julian proposed a dynamic selection method based on QoS information to model the interaction between a user and a web service. The proposed study used a rule-based expert system to allow users to infer which of a number of syntactically identical web services would provide the best service. Also, a client-side augmentation approach was selected to obtain shared experience information. Experience information related to QoS attributes are availability, reliability, execution time, and are stored in a publicly accessible QoS forum. In Julian’s study, Web service selection method is performed from the viewpoint of client feedback, so it is vulnerable to new web service or service discovery with improved performance. Meta Search method is a concept to complete metadata standard and to share metadata through registration and authentication in metadata registry. That is, it enables various types of metadata standards to be shared in the metadata registry through the description of metadata elements. Data registry has the function of uniquely identifying and registering data, and learning the data, which helps both the user and the owner of the data to have a clear understanding of the meaning, expression and identification of the data. The unit that describes the data stored in the data registry is the data element. However, these models provide only simple matching, do not provide ranking algorithms, and do not reflect user feedback in the service discovery process. There is a problem that the search and selection of services is still done by the user.

**IoTDevice WSDL:** In order to apply IoT device information to a web service, the web service protocol must be partially specified. DPWS (Device Profile for Web Services) is a Web service standard for providing interactions between devices and services connected to a network. This specifies the device profile information needed to use the Web service on the IoT device, and DPWS is used to provide messaging through protocol, service discovery, specification, and eventing function of devices that need the resources. The DPWS protocol
stack provides a standard for Web service discovery and can integrate Web services based on SOAP and WS-addressing. Figure 1 below shows the IoT Device xml schema.

```xml
<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema">
  <xs:element name="modelID">
    <xs:complexType>
      <xs:sequence>
        <xs:element name="registration" minOccurs="0" maxOccurs="unbounded">
        </xs:element>
        <xs:element name="getProfile" minOccurs="0" maxOccurs="unbounded">
        </xs:element>
        <xs:element name="getSensingData1" minOccurs="0" maxOccurs="unbounded">
        </xs:element>
        <xs:element name="requestDeviceControl" minOccurs="0" maxOccurs="unbounded">
        </xs:element>
      </xs:sequence>
    </xs:complexType>
  </xs:element>
</xs:schema>
```

**Figure 1: Xml schema of device**

Device xml schema is defined for each device model and has a structure similar to the RMI format of the device’s WSDL document. Device xml schema has the device model ID as its top-level element. The child element are elements for device registration, device profile request, device sensing information request, and device control. The elements corresponding to RMI defined in the xml schema are determined by the contents and number of RMI provided by the device.

**MATERIALS AND METHODS**

**IoT information based service discovery system:** IoT information based web service discovery model is a service discovery model in which IoT Info Broker performs service selection based on IoT information. The proposed system uses QoS information in the web service platform and adds two new functions, service broker and IoT info manager, to existing web service disclosure and search model. The Web service registry stores the QoS information of Web services by using WSDL specification. Service Broker acts as a mediator between the service user, the web service registry, and the IoT info manager to find the right service for the user based on the user’s IoT information. The IoT info manager collects and processes information used or collaboratively generated by IoT Devices. It is also designed to provide the IoT information obtained when requested by the service broker. Figure 2 shows the Web service search model based on IoT information.

**IoT information model generation:** The IoT service information model is presented in three stages. Each step consists of 1) device type definition step, 2) device resource definition step, and 3) Web service element specification definition step, and each step defines the information generated in the IoT environment.
as applicable to the service through the method establishment process. The Devices type represents the physical layer and represents real objects. These are devices that are connected by wire or wirelessly to the IoT environment to form relationships. These include sensors, status, tags, and time. Resource type represents a number of functions contained in physical devices independently as a resource. Each function is expressed as a single resource, and functions required for service provision are control defined by type. Service specification definition defines the specific phenomena with which the service can be configured. It is defined as a combination of service elements with a criterion that can be used to determine the usage phenomenon and consists of the user’s service use condition and devices service behavior. Based on this, the service element is defined and generated as an information model that can be used in Web service. Figure 3 shows the IoT service information model search and definition step.

**Figure 3: Service information model navigation and definition steps**

**Formal definition of IoT device types:** Device type has the responsibility and collaboration items necessary to perform the corresponding role. Responsibility and collaboration items required to carry out the role are identified, and characteristics represented by the responsibility and collaboration items are formally defined. Figure 4 below shows a formal identification method of device type.

The characteristics of the identified device type must be formally specified. The reason for the formal specification is to eliminate the ambiguity of expression by expressing the features mathematically and logically. This has the advantage of being able to match the supplied web service specification with the device type specification exactly. In the process of analyzing and formally defining the device type characteristic, the device manager must have information, is responsible for maintaining information, and has collaboration relationships such as external requests and processing to perform its role. Based on these responsibilities and collaboration relationships, it is possible to identify the following device info manager characteristics:

- Has an information repository
- Provides an interface to access information repository
- Has function to maintain information

Once the characteristics of a device type are identified, formal specification is done to more accurately define the characteristics of the device info manager. Figure 5 below shows formal specification of device Info manager.
**Service selection process:** The web service broker calculates the user request, the service QoS information, and the IoT info value, and requests to the user-selected selection algorithm to provide a list of service discovery results. The role of the web services broker is as follows. The administrator looks up the services requested by the user through the request information in the web service registry. Also, the QoS value is requested to IoTInfoManager, and the service is selected through the selected algorithm. IoTInfoManager class connects to IoT DB and calculates matching value for each service. Ranking and DecisionMaker classes are used as types of service objects found through service discovery. Figure 6 shows a Web service administrator service selection sequence diagram.
RESULTS AND DISCUSSION

Comparison of the proposed web service discovery and the existing web service discovery method to show the characteristics of the proposed system is as follows. Web service discovery comparison items were defined as the point of use of the selection algorithm, the kind of information needed for the selection process, the method of acquiring information, and the method used in the selection process, and a comparative evaluation of the search methods was conducted. Table 1 shows the comparative evaluation of service discovery.

Table 1: Comparative evaluation of service selection studies

<table>
<thead>
<tr>
<th>Study</th>
<th>Characteristic</th>
<th>Type of information</th>
<th>Acquisition method</th>
<th>Usage method</th>
<th>Point of use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ziqiang Research</td>
<td></td>
<td>Ad QoS, reputation information</td>
<td>Service provider registration</td>
<td>Matching, ranking algorithm</td>
<td>Execution</td>
</tr>
<tr>
<td>Julian Research</td>
<td></td>
<td>QoS data</td>
<td>Client feedback</td>
<td>Rule-based expert system</td>
<td>Execution</td>
</tr>
<tr>
<td>Meta Search Engine</td>
<td></td>
<td>Keyword</td>
<td>Metadata registry</td>
<td>Keyword matching</td>
<td>Design</td>
</tr>
<tr>
<td>Proposed study</td>
<td></td>
<td>QoS, IoT information</td>
<td>User devices information</td>
<td>Multi-criteria decision</td>
<td>Execution</td>
</tr>
</tbody>
</table>

As for the point of use of the selection algorithms of the comparison object, service discovery is performed by dynamically selecting a web service at the point of execution, whereas only the meta search engine method performs a selection mechanism at the point of design in the user and the community group. In the type of information needed for the selection process, Ziqiang and Julian used QoS data in the selection process, but these have problems of reliability by using only QoS and client feedback information registered by the service provider. This is because the service provider may publish incorrect QoS information, or the posted QoS may have an outdated value due to lack of updating the information. The proposed study used user QoS information based on the performance while service users use the service, stability, and cost information. In the information acquisition method, the user directly feeds the reputation information to the QoS registry or the system. This method of acquiring information may lead to the possibility of missing relevant information and reliability problems, due to autonomous user feedback. In the proposed system, the user acquires QoS information and IoT info information through monitoring while using the service, and user intervention is minimized through feedback to the broker. Thus, autonomous information feedback is possible on behalf of the user. In the method where information is applied in the selection process, only simple keywords are used or the selection process is not explicitly described. The proposed system can classify services through multi-criteria decision method using the acquired QoS information and IoT info information and provide the appropriate service to the user.

CONCLUSION

With the expansion of the IoT environment, the range of objects will be expanded and the generation of information through interaction will gradually increase with the emergence of various devices. Using information generated through collaboration between device information and devices used by the user, the study proposed an application method for when users use Web service. The study proposed a service discovery system based on IoT, which provides a list of services suitable for users by applying IoT devices information to traditional web service discovery method. The service discovery system based on IoT information proposed in this study extracts and generates IoT devices information from IoT devices used by users. Service list is provided to the users by using QoS information and IoT info in web service discovery through the formal specification of generated information. The proposed system can improve the satisfaction of users by solving the reliability and availability problems that appear in the service discovery method when using QoS provided by a service provider, and by facilitating access to new services. Future research will focus on the expansion of individual services for users sharing IoT devices by classifying them into personal and public information based on the information generated by IoT devices.
REFERENCES


Business Knowledge: New Items Advancement and Store Network Frameworks in a FoSE Perspective

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ABSTRACT

This paper manages the thought of Business Knowledge for arranging new items and inventory network framework, from a FoSE point of view. The issue of understanding, outlining, designing and administering the advancements behind these new items requires new ideas. The development of these advanced innovations causes a heap of interconnected frameworks, which are cooperating to fulfill the necessities of present day life. Framework of System Engineering (FoSE) can add to the science group to satisfy this prerequisite.

Keywords: Business Knowledge, Framework of System Engineering (FoSE), Store Network Frameworks.

INTRODUCTION

Today, assembling is being re-molded by synchronization and arrangement of items and procedures life cycles with the creation operations [1]. Associated Industry, additionally called Industry 4.0, offers organizations various open doors for new business and enhanced aggressiveness [3]. The writing has flagged an adjustment in purchaser provider relations with regards to new item/benefit improvement [3].

One imperative issue of overseeing Industry 4.0 and its Supply Chain is taking care of the gigantic measure of data with respect to its individuals and subsequently planning their present business [4]. In this viewpoint, the Business Knowledge (BK) worldview has been presented. BK is characterized as the way toward securing computerized data with respect to the whole association so it might be utilized for giving upper hand [5]. BK frameworks give expansive estimation and investigation.

Our goal is to look at the capability of Framework of Systems Engineering (FoSE) in Store Network Frameworks (SNF) when planning new items [6]. The fundamental commitment of our review is to examine the key approach of FoSE when utilizing item development openings. FoSE enhances association’s production network ability [7]. Our finding unfurls as takes after: After, quickly survey the condition of-specialty of inventory network administration and item improvement, we consider the FoSE as a methodological way to deal with consider advancements in complex supply chains structures [8]. In this paper also described in, the influence of internal locus of control on personal and job oriented factors [9]. One Person Company (OPC)- The new business format for small retailers in India [10].

PROPOSED SYSTEM

A novel executable demonstrating is an approach for Framework of System engineering. This technique gives greater adaptability and versatility to the robotized development of executable models specifically from the building information as opposed to from static models. In light of starting esteems, the ideal plan expands item execution from various parameters. The ideal project arranges considers diverse spending plans, parts and assets through reproductions at each FoSE level. A dynamic asset portion issue is proposed for creating enhanced outlines.

In figure 1, a supply organize tie is comprised of different elements and hubs in the chain which are cooperating to accomplish one single assignment, which is giving the last shopper the required item or administration. Challenges exist as far as recognizing proper execution measures for the examination of the inventory network. Accessibility of opportune and exact data will be basic to a company’s capacity to use it utilizing business knowledge in separating significant bits of knowledge in data and information a design gotten from differing touch focuses for enhancing working
edges, benefit, rivalry and manageability. To outline a more reasonable system, organizations are required to reconfigure their present inventory network and devise another plan of action appropriately.

To outline and execute entomb endeavor e-business forms proficiently and viably, an ever increasing number of associations utilize accessible industry models as SCOR (Supply Chain Operations Reference) and DCOR (Design Chain Operations Reference (DCOR). Utilizing the coordinated structure organizations can address prepare strings that traverse item’s Lifecycle - not quite recently the store network portion? The general system can be utilized to build up a more adjust scorecard with a more entire arrangement of estimations that can be benchmarked.

**Fig.1: Business Knowledge: New Items Advancements & SNF in a FoSE perspective**

FoSE points towards the coordination and incorporation of multiple intricate frameworks inside the norms of SCOR and DCOR while guaranteeing the supportability of the recently made System of Systems. Business Knowledge (BK) frameworks give wide estimation and business investigation ability of the SNF and Product Development.

Ideal plan items consider parts and assets through reenactments from the level of items to the between hierarchical administration capacity level. FoSE consider the breaking points of accessible innovation and deal with the dangers in the connection among various segments and providers. Administration of these mind boggling models gives control, correspondence, mix and coordination works and incorporates the foundation and execution of strategies and techniques that assistance guarantee suitability of the framework

**CONCLUSION**

This paper concentrates the dynamic conduct of the unpredictable arrangement of the item improvement handle while applying FoSE approach. FoSE approach is utilized as it depends on its capacity to fuse a few subsystems and parameters. A comprehension of frameworks pressures can bolster the developing parading of complex framework administration. The item improvement form through SNF is extremely mind boggling and requires the administration of a high amount of assignments with their issue and imperatives. The mix of providers in new item is improvement permit an immense chain response and effect on accelerating the item advancement and time to advertise. The mix integration of providers in new item advancement permit an immense chain response and effect on accelerating the item improvement and time to showcase. The difficulty in BK conveyance incorporates business and FoSE joint effort in the aggressive utilization of the business information for checking new item advancement.

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**REFERENCES**


Advancement and Manageability Connected to UIs in ERP Change Management

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ABSTRACT
Since introducing ERP (Enterprise Resources Planning Frameworks) it has reached to a great extent. The ERP clients like SAP, Microsoft has utilized and enhanced step by step by creating business forms satisfying the client necessities. There is need for change in the ERP Programming due to constant demand which also requires advertising. For development and expansion of the product a permanent support about the product becomes essential. The paper presents new techniques like the changing of administrative right in ERP connected to the SAP user interface and Microsoft Dynamics.

Keywords: Enterprise Resources Planning (ERP), SAP, Microsoft, Change Management, User Interfaces.

INTRODUCTION
ERP Systems apply a few UI advancements to deal with the Systems in proficient and simple to utilize way[1]. ERP change administration issues ought not just manage the uses of imaginative IT arrangements, additionally be worried in maintainability[2]. ERP change administration tasks are thought to be accumulations of complex necessities, each comprising of essential business arrangements[3]. The principle qualities of essential business arrangements are the weighted significance of development and supportability [4]. A gathering of undertakings reflects how the part of advancement and maintainability changes after some time. The present paper epitomizes such assortment of User interfaces for SAP and Microsoft Dynamics, correspondingly[5].

SAP arrangements depend on the SAP Web Application Server innovation. This innovation gives open, versatile and powerful framework for running and creating dynamic applications. This is the center component of the SAP ERP (successor of R/3) framework also [6]. The prior R/2 discharges had two layers, where the business rationale and the capacity as a stone monument component occurred on a centralized computer, and the introduction layer showed up on a terminal [7]. The correspondence abilities were restricted to LU 6.2 for different frameworks. R/3 frameworks acquire the ongoing capacity as should be obvious in the “R” letter, however is updated for three-level customer server architecture.

In this paper also described in, A survey of big data analytics in healthcare and government [8]. A study on consumer behaviour of Avin milk products[9]. Customer options in wealth management with reference to mutual funds[10].

PROPOSED SYSTEM AND RESULT ANALYSIS
The front end interface in SAP is called as SAP GUI (SAP Graphical User Interface). SAP when started was unique in its own way and for accessibility SAP GUI answers all queries for Mac OS/2, Windows etc. For Windows SAP GUI supports ActiveX Controls and OLE frameworks. SAP GUI also supports for Java environment runtime environment. SAP GUI in other words is called as Platin and it itself stages autonomous arrangements. For HTML the SAP GUI is called as Web GUI.

SAP is communicated via DIAG for SAP GUI customers and sometimes RFC is utilized. In workstation SAP GUI is used as a front end which is very close to the customer. For those clients who are using with the numbers, estimations the SAP GUI is being used as a standard GUI. For simpler, beautiful, sensible surface the R/3 4.6 SAP enjoy controls the client need and visualize new plan to the client. For Windows SAP GUI uses Active X Controls and for Java GUI SAP introduces JavaBeans.
As a correspondence layer SAP gives RFC empowered capacity to the outside world. These capacities can be called from claim created projects or applications. The engineering figure appears over that the SAP correspondence through the passage procedure, which handles the program-to-program correspondence to accomplice applications.

As we worked out the specialized capacities we can announce that the reason for making maintainable backend capacities for UI-s are the very much characterized RFCs and BAPIs, which can be called as Web Services also. The principle purpose of the maintainability in time when we have changes in the framework is to have exemplifying, remote empower intermediary administrations. These administrations can assemble the model level of the M-V-C worldview to make a reusable and installing layer for the UI-s. This rolls out conceivable not to improvement anything in the created UI if any change happens behind (like update, administration adjustment), on the grounds that the main the substance of the implanting administration ought to be altered if necessary. This ensures a more economical condition, on the grounds that the end-client notes fill any progressions on the UI, regardless of the possibility that the back-end usefulness is adjusted.

The inverse side likewise stays unmodified against the progressions, in the event that we consider an administration or usefulness toward the back side stable, yet we change from a UI alternative to another. As we learned over the all inner, standard SAP UIs can utilize any Workbench question, which gives usefulness as model. In any case, we can utilize remote enabled work modules too to execute demonstrate functionalities to ensure the freedom from the UIs (even outside UIs). In the event that we consider not RFCs, the standard Dynpro, ITS EWT, BSP or WebDynpro can be utilized also. On the off chance that we need to change from one to the next the control and view layers ought to be updated, however the model can remain as it seems to be. Utilizing RFCs we have the chance to change to ITS Flow Logic or utilize isolated Web surface, which can be an outer some SAP Web AS based UI (like ABAP or Java WebDynpro). This variability on UI side leads us past the UIs, in light of the fact that it tries to reveal the energy of plan and advancement philosophies prompted for economical and viable arrangement in an evolving domain. These advancements for improvement techniques help us to create better change administration in a heterogeneous framework scene too.

**CONCLUSION**

The stage based arrangements like SAP, Microsoft ERP have contrasting information source and capacity to fabricate a characterized UI surface. For each and other application administrations can be given to devour for both arrangements. For better utilization of administrations different back end functions the new exchanges, applications can handle heterogeneous situations. For outside utilizations SAP offer RFCs, BAPIs and Web Services by which the MS AX gets benefited from this for UIs or UI augmentations. For Engineer if accessible rights for SAP NCo (SAP Connector for Microsoft .NET) are given the accessible RFCs and BAPIs administrations can be devoured. SAP Connector is not connected on the off chance, SAP which offers services to Web Services (inserted RFCs and BAPIs too) are consumed by AX

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A Study of Stress Management in IT Companies

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ABSTRACT

For dynamic social variable, desires in life stress leads to large attributes. In order to respond to outward circumstances for physical, mental and activity changes stress plays a major role. By nature all burdens are not damaging and the anxiety slaughters neural structure cells. Stress that offers intense dysfunctions are referred as various ailments that increases rates with total different provocations for reviews. The work stress is in IT Consultancy due to the target and desired output on each and every persons. From eu-push the athletes encounter a particular standard that shapes for a contention. In order to perform according to each and every one’s ability eu-stress has to play a vital role. The main motive for the IT professionals is to ease out the anxiety and adapt stress related programs by physical excises as well as by setting various programs to overcome the stress.

Keywords: Stress, Provocations, Adapting systems, Stressors.

INTRODUCTION

In the Nineteen Nineties Asian country up as a motivating player within the field of programming building, information innovation administrations and Web-based administrations. By and by the Indian information innovation business utilizes somewhat over million people and offers circuitous work to over a fourth of 1,000,000 folks (NASSCOM). During this day and age, the amount of stress swollen because of urbanization, economic process that outcomes into bloody contention [1].

Stress is for certain piece of gift day life, work place is popping into hit or miss anxiety manufactory for many representatives and it’s fitly referred to as because the Age of uneasiness. Push has finishing up plainly essentially with the aftereffect of dynamic social components and dynamic desires of how of life [2]. Stress is man’s versatile response to associate outward circumstance which might prompt physical mental and activity changes. Mind cells build thoughts; Stress might slaughter neural structure cells. Actually not all anxieties are dangerous in nature. Appropriate live of stress will extremely trigger your enthusiasm for work, faucet your idle capacities and even stumble motivations.

Stress is that the burning and physical strain caused by our reaction to weight from the skin world. Traditional anxiety responses incorporate strain, intractableness, failure to suppose, associated an assortment of physical aspect effects that incorporate cerebral pain and a fast pulse. What is stress? The review tosses lightweight on the across the board quiet issue by name Stress’, that offered raise to intense dysfunctions and arreferred to as various diseases, increment separate rates, and totally different provocations. Within the event that left uncared the furthest purpose of stress might flip a person overpowered and even prompt the suicide of the individual [3]. The work stress is found altogether callings, the very influenced are the IT consultants UN agency are exceptionally target driven, passing compelled on results, and are ironed each physically and rationally to the best on their elements and masses [4]. The anxiety is showed in numerous ways in which and implies, and therefore the abundant inclined phase is that the IT division, that has flipped around simply their operating hours, in addition their natural framework, that influences at 3 distinct levels viz., individual, relative and authoritative level. It turns into the indispensable a part of the administration to subsume the representatives welfare rather giving simply the money connected benefits, that isn’t thus by and by of the fullest.

Review of literature: Vasudha Venugopal, (2010), associate increasing range of IT consultants are thinking...
that it’s arduous to subsume ardent worry, as indicated by specialists. A ‘occupational risk,’ the anxiety known with work ought to be cared-for like a shot, they stress. Adapting to fret and creating progress toward emotional eudemonia welfare got to involve worry for all and not regarded even as some way of life issue of the ‘IT wonder’, says Nithya Chandrasekaran, associate consultant doctor for a few IT organizations within the town[5].

Deshmukh N.H. (2009), Stress and life fulfillment among operating and none operating girls from comparable levels of economic standing of the final public, befell that there was no important distinction in physical and family worry among operating and non operating girls. Half stress was essentially higher among operating than non operating girls. Life fulfillment was most popular in operating girls over non operating girls[6].

Shane Schick, (2007), centered on that consultants UN agency utilize associate regulate of issue targeted adapting systems and feeling targeted adapting procedures are best in managing the concern of staying endlessly exceptional. The review highlights the importance of perceptive the anxiety that outcomes from the steady request on that consultants to refresh their specialized skills on the grounds that the danger of specialized out of date quality might create a better rate of nonattendance, work burnout and a craving to vary vocations. Directors will facilitate by furnishing IT consultants with solid assets, for instance, explore time, probabilities to travel to courses, and physical offices that encourage experimentation[7].

Murali Raj, (2009), Depression is often known with work and stresses these people expertise in lightweight of the load to perform higher, modifies totally different partners and meet tight due dates. The bulk of their work is target-situated and if targets aren’t met, it will prompt nervousness. Associates aren’t exceptionally steady as they in addition competitory in a very similar field. Besides, weakness regarding the utilization might prompt sentiments of expression. Kamala Balu, (2002), most anxiety administration computer code engineers concentrate thought on the individual either serving to representatives or facilitate them to adapt to figure connected stressors.

In this paper also reviewed in, Social media recruitment from employer’s perspective[8]. Job satisfaction of employees in telecom industry[9]. The influence of internal locus of control on personal and job oriented factors[10].

RESULT ANALYSIS

Identified stress coping strategies at organizational level: The reviews encourage unbroken on recognizing stress adapting procedures at authoritative level. The related are the results of this review.

Stress management programs: Directing anxiety administration programs at authoritative level, with the target of creatingof creating attentiveness regarding anxiety and making staff to be told Stress administration ways.

Physical activities planned in job design: The body will discharge push, higher through physical effort, as doctors were proposing, reveling any style of physical movement is prescribed whereas work define.

Stress-audit: Directing anxiety review at authoritative level, for the explanation showing singular, what causes stress and its result on themselves. This prompts set up the simplest affordable procedures for addressing the anxiety.

Life style modification programs: To battle the evil impacts of stress, means of life adjustment programs at individual and gradable level are prescribed, within the wake of examining specialists. Finally individual got to be capable to convey forward these comes.

Ergonomics and environmental design: Requirement for development geared used at work, and physical operating conditions ar in abundant request in gift technically knowledgeable world, and while not a doubt this can find yourself perceptibly one in all the simplest anxiety adapting procedures at authoritative level.

Stress counseling programs: Presenting stress advising programs, to understand and watch out of stress connected problems to manage typically activity and ardent results of staff.

CONCLUSION

For IT occupation, in a fast world stress issue is a major cause of concern that has got to be taken care of. It will make the IT representative to worry at different level which is developing in day to day life. In the field
of IT giants like Tata, Infosys, Wipro, Microsoft, and Cognizant are adopting different strategies for Stress relief. Once it is recognized and in order to overcome this one has to build a profitable and production related amount for that. One has to be positive and always stay occupied due to furrow outrage and vitality when there is anxiety problem. If we have adequate knowledge of stress amendment life can become smooth. After getting an opportunity to work in America expectations will be more and eu-worry will create problems which become additional burden.

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Big Data Analysis Framework on Marine Datasets via Climate Data Analysis Tool

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ABSTRACT

Marine datasets contain huge volume of data overwhelmed in our environment recently in few decades. Data analysis of marine data sets are taken care of climate data analysis tool where it collects all geology data from marine big data, to run some analysis and prediction on climate regions as well as ocean, environment changes, metrological data. In our approach, metrological data collected from various fields of pressure, temperature and wind speeds are analyzed using climate data analysis tool (CDAT) and predict marine ecological environment. Analysis framework designed to process data sequentially without any time delay, increase in throughput.

Keywords: Marine big data, datasets, analysis, CDAT.

INTRODUCTION

Currently, marine big data holds its own datasets of satellite data, aerial remote sensing, buoys, ships, stations, and undersea sensing. Marine big data is globally initialized on ecological centers where the data cannot be modified or deleted without any proper knowledge. Modeling and Analysis in Marine Big Data and the future of ecology is explained by[1][2]. An advantage over big data is, if a system of name node failures the other system of name node will automatically replace in a short period of time. Which tends that no data loss even if the name node or data node malfunctioned or cannot work due to some failures in their systems. Web technologies for environmental Big Data are discussed by[3].

Centralized server are implemented to automatically fetch similar information according to the query simultaneously with an authentication access over the systems will be complete set of query processing. A method for reconstructing three-dimensional dive profiles of marine mammals using geomagnetic intensity data is discussed by[4]. During short time of period a big data system can analyze pita bytes of data on multiple name nodes without any data loss. Other thing is redundant files, when using big data concept the data storage is not a matter. Big concerns with high latitude marine protected areas (MPAs) are described by [5]. But, duplicate files are automatically created on data nodes for providing data without any data loss. Due to this redundant files the processing of data going to done by analyzing all the files which increases carbon emissions more than any other systems in the world.

Proposed Work: In our proposed framework datasets are imported into climate data analysis tool to analysis data and prediction reports are generated via analysis tool. Tool designed to predict environmental changes from surrounding sensors. Those datasets are evaluated with analysis procedures to get final throughput of datasets.
RESULT AND DISCUSSION

In fig 2, the various datasets are processed in climate data analysis tool, where three analyses have been carried out to get maximum throughput result report from CDAT. Dataset variation depend on environment fields such as temperature, pressure, wind speed surroundings.

CONCLUSION

Big data emerged on different domains includes marine big datasets that process analysis on datasets to predict ecological balance on environment. Our application improvised analysis schemes on variety of data sets to provide maximum throughput, carried out simultaneously predict changes in environment concurrently with dataset reports.

Ethical Clearance: Taken from AMET University.
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Significance of Discrete Mathematics in IT and Communication Field

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ABSTRACT
The significance and the part of discrete science points in the area of data innovation and interchanges are talked about. A few associations and uses of these themes with the substance of sanctified subjects in a data innovation program are investigated. An uncommon accentuation is given to the uses of established and fluffy rationale in data innovation.

Keywords: Fuzzy Logic, Probability, Huffman

INTRODUCTION
The goal of the Discrete Mathematics themes is to acquaint understudies with principle scientific ideas and strategies utilized as a part of data innovation. The objective is not to give nitty gritty scientific evidences yet rather to make understudies agreeable in a domain where those strategies are progressively utilized\[1\]. In this manner, the decision of gave points is associated the likelihood of at present applying them in Information Technology and Communication\[2\].

The PC has a limited structure. In this manner, its properties are all around clarified and deciphered with regards to limited arithmetic\[3\]. (Consequently the concentrate won’t be on such ideas as point of confinement, subordinate, necessary, and so forth.) The key thoughts that will be considered will utilize the scientific properties of limited sets. This branch of arithmetic that reviews discrete articles, i.e. objects made out of unmistakable and scattered components, is called discrete arithmetic\[4\]. The fundamental points include: established and fluffy rationale, sets and combinatorial, capacities, relations and frameworks, enlistment, recursion, calculations, diagrams and trees, Boolean variable based math, and some of their applications. A research center utilizing the product Maple 7 or Mathematical will go with the course\[5\]. In each of these areas the examined ideas and their properties are picked with respect to their pragmatic significance in Information Technology and Communication. Glaucoma detection using fuzzy C-Mean (FCM) is presented in this paper\[6\]. As per their significance we will intend to give suitable inspirations and remarks. What’s more, various down to earth cases are embedded all through the course to outline the ebb and flow applications in other IT&C courses, for example, information administration, databases, web pursuit and web programming, displaying and reproductions, information structures, PC design, and so forth. (Obviously, when a limited structure is “extensive”, consistent and diagnostic ideas could offer preferred chances of study over discrete ones. We don’t attempt to prohibit the utilization of differential and basic analytics!). In this research paper discussed the Survey on fuzzy Petri nets for classification\[7\]. Design of a Single Input Fuzzy Logic Controller Based SVC for Dynamic Performance Enhancement of Power Systems presented in this paper\[8\].

APPLICATIONS OF GRAPHS AND TREES
Neural nets (NN): NN are interconnected gatherings of straightforward handling components. Normally a NN is an uncommon DAG (coordinated non-cyclic diagram). The vertices are put on a few completely requested layers, and bolts are permitted just between a vertex on layer l and a vertex on layer l+1. It is gathered that vertices have little “brains” that procedure esteems yielded toward the prompt second rate layer \[3\]. Every bolt has a weight (positive or negative) affecting the yield of the source vertex in the handling done by the address vertex. The weights are altered in starting learning steps.
Semantic Nets (SN): SN is coordinated charts where vertices speak to articles and edges/bolts speak to connections between items.

Bayesian (Causal) Networks (BN): BN are coordinated non-cyclic diagrams where every vertex speaks to an arbitrary variable and the bolts speak to restrictive reliance.

Minimum Spanning Trees: MST is unique sub-diagrams of a weighted and associated chart; they are trees and contain all vertices (e.g. improvement of aggregate cost of an electrical system in a provincial region, and so on.).

Binary Trees: In a BT each inside vertex has at most 2 youngsters (and no less than one!). Portrayal of twofold trees in the memory of a PC is done subsequent to forcing a requesting between the two offspring of a vertex (in the event that they exist). One of them is the “left tyke”, the other is the “right kid”. Numerical and intelligent expressions (– Possibly including brackets –) could be spoken to for the most part as twofold trees. Inner vertices speak to administrators; leaves speak to qualities (numbers and additionally images) – see figure 1 for basic illustrations.

Compression of data using Huffman algorithm: Give us a chance to remind that an expanded ASCII character is put away on 8 bits. Assume we have a “long” message made out of developed ASCII characters (for instance the substance of a content document is such a message). In the event that our message has n characters, then to store it we require under 8n bits! (Each character is put away on 8 bits.) In our message each character could have an alternate recurrence. Assume we know the (relative) frequencies of all characters f0, f1, f2, … , f255 where fi signifies the recurrence of character i. (For instance, in English messages the character “e” shows up with recurrence approx 0.13). We make a double tree in which the characters are the takes off. The substance of every vertex is the recurrence (for inside vertices it is the aggregate recurrence of every single descendent leave). The Huffman code replaces each character with the code of the one of a kind way from the root (finishing in the leaf speaking to the character). In a way (00101110…) “0” signifies “left” and “1” signifies “right” (see the figure 2 underneath). On the off chance that a few standards are regarded, then a message classified utilizing Huffman code involves less space and the de-systematizing method is conceivable without error.

\[ a + 3 \times b \]

\[ (a + 3) \times b \]

**Fig.1: Mathematical expressions as Trees**

![Huffman Codes](image)

**Fig. 2: Huffman Codes**

**BOOLEAN ALGEBRA**

PCs are developed from incorporated circuits (CPU, memory, and so on.). The incorporated circuits are comprised of transistors, resistors, capacitors, and other electronic parts that are joined into circuits. Transistors can go about as speakers or switches. In the PCs, these transistors changes are joined to shape rationale entryways, which show operations in Boolean variable based math. Boolean variable based math is the hypothetical reason for PC rationale outline. Transistors are the blocks for usage. Computerized circuits are utilized to perform number juggling, to control the development of information inside the PC, to look at esteems for basic leadership, and so forth. Combinatorial circuits will be circuits in which the after effects of an operation depend just of the present contributions to the operation (e.g. number-crunching circuit). A successive circuit is reliant on the past condition of an operation and also the present arrangements of data sources (e.g. counter circuit, memory circuit, and so on.)
DISCUSSIONS

Fuzzy Logic (FL) versus Probability Theory (PT):
Fluffy Logic and Probability Theory are particular (they portray various types of instability). They are reciprocal as opposed to focused. PT is the hypothesis of irregular occasions (manages the desire of a future occasion, in view of something known at this point). FL manages the instability coming about because of the imprecision of importance of an idea communicated by an etymological term in a characteristic dialect, for example, tall, warm, warm, quickly expanding, and so forth.

1. PT does not bolster the idea of fluffy occasion (e.g. “the costs will balance out over the long haul”).
2. PT offers no systems for managing fluffy quantifiers like some, most, a few, few.
3. PT does not give a framework to figuring with fluffy probabilities communicated as likely, far-fetched, not likely.
4. PT is not adequate expressive as a significance portrayal dialect (where we manage sentences as “it is not likely that there will be a sharp increment in the cost of the oil sooner rather than later”).
5. PT can’t deal with some sort of inexact thinking.

The absorption of established (bivalent) rationale is an essential start for concentrate different rationales, the non-standard rationales, for example, intuitionistic rationale, modular rationale, worldly rationale, multi-esteemed rationale, fluffy rationale, and so forth. The thought behind fluffy rationale is to relate a fluffy set (semantic) to any multi-esteemed (fluffy) predicate. The estimation of the enrollment capacity of a fluffy set in a component x of the area demonstrates reality of the announcement “x confirms the predicate”.

The contrasts amongst established and fluffy rationale include:
- The fluffy rationale derivation is construct not just in light of the structure of the announcements, additionally on the semantic of each fluffy predicate.
- The fluffy rationale derivation is estimated, i.e., from loose premises it determines uncertain conclusions. Fluffy rationale can be broke down from legitimate, reasonable and philosophical perspective.

From philosophical perspective:
1. Fuzzy rationale relies on upon the semantic translation of each fluffy predicate.
2. The fluffy derivations are not fluffy predicate-based proclamations but rather fluffy set translated predicate-based explanations. Be that as it may, Fuzzy Logic is a thoroughly numerical framework. Its fundamental limit is to demonstrate phonetic learning. Its fundamental point of confinement is that the quantity of standards develops exponentially with the precision level. In a more exact way, a master in data innovation needs intelligent capability for:
3. Showing that an issue can be explained by a PC program;
4. Translating an issue portrayal in a programming dialect;
5. Arguing that a PC program is right and productive;
6. Applying the new strategies of programming which require the authority of various parts of rationale (e.g. in PROLOG, in information portrayal inside AI, in the database inquiry dialects, and so forth.)

Fig. 3: Computing Arithmetic Expressions
The amazing advances in formal rationale and the stupendous advances in the chip innovation made conceivable improvement of today’s PCs.

CONCLUSION

In Discrete Mathematics the topics covered are traditional and fluffy rationale, sets and combinatorial, capacities, relations and lattices, enlistment, recursion, calculations, charts and trees and Boolean variable based math. The demonstrated calculation themes (dialects and language structures, limited state machines and Turing machines) are not secured due to hypothetical advancements with the data innovation. In Soft Computing with various common sense executions there is a light as well as weight systems to sums to demonstrate human recognitions. The main focus is between the Fuzzy logic and Probability Theory.

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REFERENCES

Managing Philanthropic Organizations

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ABSTRACT
The essential approach, money related guide, the essential model, was from fluctuated sees pertinent to the social and political setting of the nineteenth century. With rare game plan by not-for-benefits and government, organizations offered organizations to those not fit to take a gander at over themselves. As governments progressively gave various organizations to various social affairs, establishments balanced the organization on account of oversee give organizations correlative to those of state or to fill fissure in statutory plan. Till the center twentieth century, this approach was conceivable effective; in any case, it had and continues having genuine inadequacies that shield organizations from abusing their fullest potential. to begin with, the money related guide approach has any sensibly result to those adequately fortunate to benefit by the organization, regardless, taken alone, has no outcome past that. Second, the approach includes a propensity to figure on the right now to a great degree false need that someone else can take up the control of growing and looking after influence. As a rule, it totally was normal that what foundations start, government can and need to continue with a doubt that at no time inside the future holds. Moreover, this approach is and is grasped by various non improved or non advantageous relationships, with the top objective that specific selected part for foundations isn’t any more drawn out proverbial.

Keywords: shield organizations, statutory plan, proverbial

INTRODUCTION
This approach isn’t exactly steady as money related guide in its complement on overseeing causes instead of appearances of issues. Innovation streams, ambidextrous organizations and strategic change is explained in [1]. Once more, the rising of the compassionate foundation was consequences of now could be the best time. inside the ideal time to mid-twentieth century, religion inside the vitality of a “coherent approach” was riding high, somewhat like the prospect of social arranging. To build a culture of innovation, avoid conventional management wisdom is determined in [2].

Social, therapeutic, and cash issues may all be handled once their causes were valued and coherent courses of action associated. A conservative call for philanthropic renewal is discussed in [3]. For every one in every one of the achievements of the helpful/consistent approach, it too encounters various inadequacies once observed from a 21st-century motivation behind read.

In any case, practically like the budgetary guide approach, the unselfish approach tumble completely to manhandle the exceptional ability of favored foundations Poorly understood challenges and tradeoffs of managing private foundations is illustrated in [4]. For the most part, this approach is and is gotten by contrasting sorts of affiliations as well. Second, it lays on assumptions that might be substantial in characteristic theory however region unit flawed once associated with social issues. A guide to effective philanthropy is explained in [5]. On the off probability that the clarifications for one thing as perplexing as, say, destitution zone unit acknowledgeable, they won’t be exposed to intelligent courses of action and fundamental administration measures. Launch of New Cement Brand in Existing Market is examined in [6]. Third, while the sacrificial approach has well a considerable measure of serious potential outcome, it oft fails to worth the long, direct, complex, and costly on account of feasible vital considering.

PROPOSED METHOD
Inventive establishments recognize that they include knotty and dynamic conditions. Second, headway incorporates danger and powerlessness. Integrated environmental management for sustained development is said in [7]. This implies foundations envious to
enhance got the chance to handle weakness, be open with respect to it, and not take cowl behind solicitations for here and right now execution and yield markers or safe subsidizing practices to legitimatise their validity. Supporting progression must consider the risk of frustration. Energy efficiency and cost saving economy is determined in [8]. The vital reason for existing is that establishments, not at all like totally extraordinary associations, will remain to ingest such risks. Third, the outcomes the foundation tries to fulfill for the first half need long haul obligation, and for the present, there could be few obviously detectable results.

Board individuals and laborers got the opportunity to keep certain and submitted. various of the organizations thought about guided that board individuals all the a considerable measure of adequately adjust to the “direct expend” marathon of the cunning methodology if the foundation what’s more has somewhere in the range of a ton of immediately satisfying shorter term wanders/ endowments.

Another technique to encourage the harmed of the comfort back devour could be to guarantee some early results by pounding at formally half-open system doors.

Finishing the oft long “spill stream” of social change is particularly inadmissible amid a culture that likes to be perpetually monitoring who’s triumphant and proceeding with forward. Be that since it may, the system of advance in affiliations.

DISCUSSIONS

De-underscoring particular obligation focusing on targets as basic dispensing issue and obligation. Keeping up a vital separation from quantitative destinations and over inflexible dispensing plans asking for that individuals be aesthetic while not withdrawing from game plans, payment arrangements, and typical working systems doesn’t work not rebuking messes up; besieging early and frequently is better than slumping once toward the finish of a program; and dampening inside rivalry. Moreover, this approach is and is grasped by various non improved or non advantageous relationships, with the top objective that specific selected part for foundations isn’t any more drawn over proverbial. Examination the organization consequences of this approach incorporates moving standoffish from technocratic, practical person organization models to know Associate in Nursing organization arrange all the considerable measure of completely tuned into the substances of those foundations.

CONCLUSION

This question sheet recommends that organization troubles and tradeoffs don’t appear to be steady for all establishments however rather territory unit associated in basic ways to deal with however foundations see their parts and attempt condition. we have concentrated on establishments that see their one in all the sort parts as requiring high bright and entrepreneurial point of confinement and their attempt condition as sketchy as route as every fanciness and dynamism. Examination the organization consequences of this approach incorporates moving standoffish from technocratic, practical person organization models to know Associate in Nursing organization arrange all the considerable measure of completely tuned into the substances of those foundations.

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Planning Data Management in Marine Ocean Gliders

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ABSTRACT
The exceptional qualities of the sea lightweight planes drive conspire bless these vehicles with a to a great degree high perseverance, at the cost of a moderately low surge speed. Consequently, lightweight flyers’ direction is exceedingly affected by sea streams, which can even surpass the vehicle’s ostensible speed. This calls for insightful way arranging calculations, certainty that reflects in the high number of arrangements proposed by scientists that can be found in late book reference. In this paper we propose a novel technique to consolidate numerous sea estimate models keeping in mind the end goal to bolster the lightweight flyer way organizer with as solid as conceivable source data. The plan is designed as a multi-prove combination that coordinates elements, for example, sensor versus demonstrate approval, estimate soundness and model memorable execution.

Keywords: Data Management, Path Planning, Gliders

INTRODUCTION
Way getting ready for sea lightweight planes is a testing errand particularly due to the unique attributes of the drive framework utilized by these vehicles and its generally low greatest surge speed [1]. The direction a lightweight plane portrays is profoundly impacted by sea streams, which frequently can be practically identical to or even surpass the vehicles’ ostensible speed [2]. This calls for insightful way arranging calculations, actuality that reflects in the high number of arrangements proposed by specialists that can be found in late book reference [3]. In spite of the fact that the lightweight flyers are exceptionally intended for long haul missions, they have been likewise utilized for shorter eras to look at transient sea properties in particular locales [4]. Application situations incorporate both committed organizations and crafty re-arranging of fundamental long haul missions to investigate structures distinguished close-by along the way [5]. The lightweight plane here and now missions are substantially more requesting on way arranging calculations as there is no open door for attempt and mistake techniques, particularly when managing the inspecting of exceedingly unique structures like fronts or whirlpools.

MOTIVATION
Encounter demonstrates that while applying way arranging calculations in genuine lightweight flyer missions there is a solid reliance on the sea ebb and flow show. Diverse models for a similar locale can show negating data about the momentum condition of the sea. In the most pessimistic scenario solid streams might be expressed in inverse headings, which really influence the arranged direction. The reasons why sea models contrast is owed to various model outline or potentially unmistakable instating parameters. Emanant sea structures like swirls or temperamental areas may be moved spatially or the direction be balanced in time. Additionally the force of sea streams for instance at gag focuses between islands or submerged rivulets may be over or disparaged.
goal to sustain the lightweight plane way organizer with as dependable as conceivable source data. The plan is designed as a multi-confirm combination that incorporates components, for example, sensor versus demonstrate approval, conjecture strength and model memorable execution. Here we will center in the quality assessment of two diverse sea models joined to a consolidated model fusing the latest and neighborhood estimation, which for this situation is gotten from the sea lightweight flyer itself (find in Figure 1 one of the lightweight flyers whose mission information have been utilized as a part of this paper). The objective is to enhance the estimate by building a group with nearby legitimacy considering estimation information from one lightweight flyer or an armada of lightweight planes that work in a specific district.

The fundamental hypothesis of creating gatherings of sea models is depicted in II-A which was tried with a recreated approach in III-A. Sea conjecture information and lightweight plane estimations from genuine missions were gathered separately, removed and utilized as a part of request to enhance the figure in III-B. The refreshed estimate gathering was approved with the accompanying lightweight flyer estimations.

**EXPERIMENTS**

**Simulated Ocean Measurements:** The engineered setting comprises of two static sea models which portray a vortex with the distinction that the swirl’s middle is moved in position in connection to the next. Discretionary current examples that additionally rely on upon time can be utilized as a part of the reproduction, yet for a superior understanding the less difficult static whirlpool structure was utilized. The supposition for the genuine sea state is the presence of a whirlpool whose genuine position is obscure and just caught by the estimations from the lightweight flyer.

Two whirlpools are created as portrayed in Figure 2 as a reason for re-enactment. Estimations are created computing the sea streams at the given position were the lightweight flyer surfaces including a measuring clamor with a Gaussian conveyance and a counterbalance. A direction for the lightweight plane is recreated over the field to decide the estimation area when surfacing in equidistant way. For effortlessness a straight line is accepted, however can be stretched out effectively to a discretionary direction. The re-enacted estimations are taken from a virtual swirl focused where the dark speck shows up. Take note of that the genuine condition is created as a vortex however just the data given by a loud estimation is utilized to reproduce the sea state, by adjusting the example of both models to produce the outcome. Refreshed troupes can be figured for this test setup at whatever point new information arrives, i.e. amid the recreated surfacing when correspondence is accessible. The most recent estimations are considered inside a specific sliding-window time allotment or inside certain topographical points of confinement. While the lightweight plane advances along its way new estimations are added always to the arrangement of preparing information for the count of the outfit. Figure 3 demonstrates the troupe produced from the two sea models and the estimation for one minute in time.
**Real Data:** Three lightweight plane missions in the canary territory have been utilized as a reason for research. One lightweight plane, the SLOCUM Silbo-354, begun on July, 24 of 2012 in the south of Gran Canaria and leaving the regular network zone at 26N making a beeline for Cabo Verde. The other two missions were here and now missions executed in the east and north of Gran Canaria with another SLOCUM lightweight flyer P201. The primary mission was directed in August in 2012 and the accompanying in 2013, April and July. Figure 4 demonstrates the area of the missions examined. A lightweight plane itself can be utilized as an estimation gadget giving direct input for mission arranging. Two unique sorts of even current estimation standards must be recognized. Surface streams are measured while the lightweight plane is floating at first glance while having contact to GPS satellites. As the surfacing time is around 20 minutes, a direct and steady float can be expected and furthermore that the float speed speaks to the sea ebb and flow speed at first glance. This is estimation at an all around characterized point in time.

![Fig. 4: Details of Missile Locations](image)

**Short-term Ensemble:** For each surfacing the lightweight plane estimations inside a sliding-window time allotment are utilized for the count of the BMA parameters. The sea display factors are removed introducing the sea models so that position and date consent to the estimations. For the surface streams a hourly yield is given, that incorporate the high inconstancy delivered by the tides. The sea demonstrates streams and estimations are currently used to figure the arrangement of BMA parameters, which are connected to the latest gauge given at the season of the surfacing as per Equation (2). The outfit is the blend of both models prepared with the present estimations given by the lightweight plane. The subsequent group created for the fleeting genuine information situation and the lightweight flyers’ way is appeared in Figure 5. On the correct hand side the information for the fluctuation related to the recently created group is delineated in type of the joined change = +. The instability of the group is a coveted consequence of the BMA as it considers encourage work with more modern way arranging calculations.

**Short-term Ensemble including Forecast Variation:**

For the most part in displaying, the figure quality abatements for an estimate with a more noteworthy time skyline. Delineation: Numerical yield of dynamic models gives gauges to up to a few days. Inside the transient figure there is a lot of devotion relying upon the time skyline of the estimate which can be measured taking a gander at the conjecture soundness. It is broke down inside one model, i.e. the figures to their substantial dates are contrasted with the hind casts to their legitimate dates. Give y a chance to be a sea variable to be depicted, it can be composed as

\[ y(\vec{x}, t, c) \]  
\[ yd(\vec{x}, t, c) = y(\vec{x}, t_0 - c, c) - y(\vec{x}, t_0 + 1, -1) \]  

Where \( t_0 \) is the time when the model information is substantial. That implies an impeccable estimate considering the hind cast ought to have the distinction.

To incorporate the estimate vulnerability in the gathering, the estimations are contrasted with the figures to their legitimate date. Contingent upon the gauge time skyline distinctive BMA elements result from the figuring. In Figure 6 distinct weightings \( w(t, c) \) are thought about, where thrown alludes to day by day square. These distinctive BMA elements are utilized when making the group for various time skylines which are presently weighted as for their capacity to anticipate the sea state. Along these lines, a gauge of a model that has been less correct concerning expectation is weighted in like manner contrasted with be better performing figure. In any case, an examination of the Mean Vector Velocity Difference mistake of the models and estimation, as found in Figure 5, uncovers that for our situation the blunder amongst models and estimations is more prominent than the mistake between the distinctive time skylines to their substantial dates. This reality decreased the significance of computing separate BMA esteems for each time skyline. As a result the weightings are comparative between the distinctive estimates as found in Figure 5.
DISCUSSION

Long-term Estimation: Generally a lightweight plane mission keeps going a more drawn out timespan than estimate information is accessible. Lightweight plane way arranging calculations may require input legitimate for up to weeks or months. As re-arranging most likely happens with a specific recurrence, for the long haul gauge, which is inaccessible in time and space, a static model portraying the overarching sea state suffices the requirements. The static model can be acquired by separating an example for the sea state in a measurable way which would be the mean and the fluctuation for the sea variable. For long haul estimation, the estimations from the lightweight plane can’t be considered as extra data because of its fleeting and positional separation. Be that as it may it is sensible to accept a mean an incentive between both models. Putting on a show to be the after-effect of estimation, the BMA can even now be connected utilizing this incentive as a contribution to request to figure the difference subject to space for the group. In Figure 6 the instability is delineated as the entirety of both differences for u and v streams.

CONCLUSION

Since there are diverse end-client sea models accessible, the need to naturally produce gathering with a higher data esteem is tried. Models can have variable aptitude relying upon particular gauge locales and sea expresses, the lightweight flyer estimations in this manner can be utilized to enhance the general sea state conjecture, with the additional advantage of having a measure for the current instability for further business. The showing of the speculation turned out to be clear in reenactment. Then again, for genuine missions there are a few confinements to the utilization of these troupe strategy as, there is an exchange off between a high determination and a more vigorous estimation. Concerning the genuine mission information it is noticed that the lightweight flyer jumped up to 1000 meters with a twofold yo-yo. Change of execution can seen for lightweight flyers that jump less profound and in this way surface all the more regularly.

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REFERENCES


A Study of Leadership Through Bridge Team Management

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ABSTRACT
When discussing administration on a trader deliver we need to think about the way that the ship speaks to a specific workplace. In this paper we should talk about the idea of initiative spoken to by the Captain, the principle expert installed a ship over the Deck Department and Engine Department. Advance on, when discussing the Deck Department we might think about the way that there is a Bridge Team that guarantees the wellbeing of route, which means likewise the security of group locally available and in a similar time, the wellbeing of the ship and freight installed. We might likewise talk about how this specific Bridge Team settles on its own whether a few moves ought to be made or not but rather these choices are taken under the nearby supervision of the Captain through its Standing Orders. The primary reason for this paper is to show how a ship’s pioneer, the Captain, must guarantee that the ship achieves its goal securely as per the given voyage. In this paper we are attempting to show what initiative truly implies inside an exceptional group, for example, team individuals locally available a dealer deliver and what sort of pioneer a Captain ought to be.

Keywords: Administration, Deck Department, Engine Department, Bridge Team

INTRODUCTION
Keeping in mind the end goal to talk about the idea of Bridge Team Management we have to comprehend that its execution is set to clarify how a voyage is to be done securely in a way that regardless of the individual accountable for the navigational watch, this is conveying emphatically. Studies of managerial jobs and behavior and the multiple effects of diversity in organizational groups are explained by [1] [2]. As a rule, Bridge Team Management is more than an idea. It implies execution of the way the work ought to be done in light of route measures forced by the Maritime Organizations. It essentially implies that every one of the people included ought to use in the most ideal way that is available all the human and material assets locally available a ship with a specific end goal to effectively accomplish the proposed objective. Bridge Procedures Guide is described by [5].

Broadly, administration on board sends speaks to the capacity of picking up regard and specialist inside a ship’s group. A ship’s Captain gets regard and can indicate expert when the group is persuaded that he is equipped for applying the specialist forced by the occupation, that he has the important skill and learning, that he comprehends distinctive circumstances and he is fit for illuminating them and that he is prepared to lead reasonable and definitively. Leadership development is discussed by [3][4].

BRIDGE TEAM MANAGEMENT CONCEPT
Connect Team Management is intended to clarify the way a voyage must be sorted out in wellbeing conditions so regardless of who is the individual in control, the voyage is done emphatically. Present day electronic frameworks for route and current specialized gear for working route are substituting human work, but in a similar time they require a prevalent standard of preparing for the route faculty. E-navigation requires new methods of training for deck officers are described by[6].

The idea of Team Management infers expecting the part of a pioneer by all individuals from the group, not just by a solitary individual. Thinking about this, every individual from the group must have the essential specialized information additionally regulatory characteristics of the accessible HR. enhancing the quality of maritime education is explained by [9]. In the event that a pioneer locally available a ship is not prepared to apply his initiative capacity, the team individuals will search for another pioneer, circumstance that prompts expert disturbance. Combined Complex Maritime Simulation
Scenarios for Reducing Maritime Accidents Caused by Human Error is discussed by [7]. Another circumstance that could prompt Captain’s power disturbance locally available a ship is dictated by the Company’s exceptional ramifications in ship’s administration and breaking intentionally coordinate requests given by the Captain installed the ship. Isolation, Optimization and Extraction of Microbial Pigments is described by [8].

1. Types of Leaders Onboard Ships: Installed trader delivers there can be distinguished two sorts of pioneers. The primary sort is pioneers who carry on of their own advantages, and who accept that others do likewise. They are ascertaining and utilize complex methodologies to vanquish resistance, and to accomplish their points. The other sort is pioneers who have a feeling of social having a place. They act as indicated by the Shipping Company’s practices of common comprehension of what is valid, sensible, normal, and ideal in associations. The principal kind of pioneer acts from the rationale of results: authority decision is a cognizant, outcome driven activity and the pioneer’s inspiration is self-intrigue. This rationale tends to consider pioneers to be collaborating self-governing and self-intrigued. They are likewise expected to be touchy to impetus instruments, which imply that the best approach to direct the inspiration of pioneers is to adjust their self-interests to the interests of the Shipping Company.

2. Leadership through Bridge Team Management: A productive administration of the route connect originating from the pioneer (Captain) implies redress utilization of the accessible HR and advancing a decent correspondence inside the extension group. Junior officers are regularly worried that they may bother the Captain as Leader by calling him to the scaffold. Nonetheless, Captains should be called as quickly as time permits if a troublesome circumstance is creating, as he is destined to have the capacity to help the Officer on Watch settle the issue. Chiefs have more trust in Officers on Watch who exhibit their ability to call the Captain than those Officers on Watch who enable perilous circumstances to create. The Officer on Watch, by calling the Captain early, will have the capacity to gain from the experience of the Captain when he goes to the scaffold. The Officer on Watch has an obligation to call the Captain early and this must be the managing guideline at all circumstances.

The Captain has a definitive obligation regarding the sheltered and proficient operation of the ship. He is probably going to be the most experienced pilot on the ship and will presumably have managed most circumstances some time recently. The Officer on Watch accordingly has an obligation to consent to his requests and to keep the Captain educated of advance. The Officer on Watch ought to get some information about any irregular or conceivably unsafe events.

**TRAINING ONBOARD AND COMMUNICATION**

Correspondence inside the scaffold group must be clear. Correspondence between individuals from the scaffold group, who talk diverse dialects, particularly with team individuals who are not authorized, must be done in a typical dialect, and that is Maritime English. At the point when there is a pilot installed the ship, similar tenets for correspondence are connected. The capacity of the faculty locally available to organize their exercises and to effectively convey between them is fundamental in crisis cases. Particularly for the pioneer (Captain) it is imperative to have the capacity to discuss productively with the individuals from the extension group at whatever point it is fundamental however in the greater part of the cases it is vital for the Captain to have the capacity to transmit his aims and requests to his team individuals, particularly in instances of crisis. Regardless of if the ship is in progress or in the event that it is doing a passage in the port move the extension group must capacity as an upright group.

**DISCUSSIONS**

The scaffold group must know exceptionally well what they need to answer to the Captain in typical states of route, the necessities with respect to finish data of the Captain, additionally the conditions in which the Captain must be approached the extension. The Captain should plainly express the errands, and these must be constrained to those that can be successfully proficient and furthermore their need must be obviously settled. The individuals from the group must be requested that
and they have affirm that they have comprehended the undertakings and duties they have been appointed. Periodical reports of occasions that happened amid satisfaction of errands speak to one of the best intends to screen execution of individuals from an extension group and to identify any debasement in executing the watch. To be a decent pioneer intends to force regard and expert inside a group, to apply the important specialist, to have the vital abilities and learning, to have the capacity to comprehend diverse circumstances and explain them effectively, to have the capacity to have an open correspondence and furthermore to be prepared at any minute to control accurately and indisputably.

CONCLUSION

Installed a ship, authority is a prerequisite for authoritative development of the team’s action. In the delivery business there is a steady requirement for recognizing and developing future pioneers who can possibly exceed expectations in basic positions of authority installed dealer ships. Ships require pioneers who can be a compel for lucidity and solidarity, and who can add to effectiveness – related with exploitative and explorative hierarchical learning. To be a decent pioneer intends to force regard and expert inside a group, to apply the important specialist, to have the vital abilities and learning, to have the capacity to comprehend diverse circumstances and explain them effectively, to have the capacity to have an open correspondence and furthermore to be prepared at any minute to control accurately and indisputably.

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A Study of Age Related Work Motivation

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ABSTRACT

The reason for this exploration paper is to give a review of age-related impacts on work inspiration and its results. In the principal segment, we give a short diagram of the key builds and instruments required in work inspiration. In the second area, we talk about two noteworthy wellsprings of age-related impacts on inspiration: (a) social-relevant impacts and (b) changes face to face qualities over the life expectancy. In the third area, we examine four age-related change designs face to face characteristics that impact key determinants of inspiration and execution. In the fourth area, we consider circuitous impacts on inspiration related with age predisposition in administrative basic leadership and laborer view of age segregation. In the fifth and last area, we depict how age-related components may impact working environment inspiration, and we portray ramifications of hypothesis and research for the advancement of viable practices to support and advance work inspiration in a maturing workforce.

Keywords: Age-related impacts, information, abilities, interests, age-related attitudinal.

INTRODUCTION

Work inspiration relates to the dynamic individual and logical elements that impact a person’s continuous decision among objectives, allotment of individual assets (as time and exertion), and techniques executed for objective achievement. Individual differences in work motivation are explained by[1]. A person’s inspiration, communicated as far as objective decision, behavioral aims, force of exertion toward objective achievement, and perseverance has for quite some time been perceived as a key determinant of employment execution and work change. Domain-specific knowledge is discussed by[2]. In the course of recent years, various ways to deal with work inspiration have united on an expansive picture of how motivational procedures work. An investigation of age, intelligence and notability determinants is described by[3].

In the work setting, inspiration is ordinarily conceptualized as an arrangement of two interrelated procedures in particular, objective decision and objective endeavoring. Singular contrasts in psychological capacities, aptitudes, striking quality attributes (e.g., identity), thought processes, and interests alongside situational components have been appeared to impact both the objectives that people deliberately receive and the activity administrative procedures by which people seek after objective achievement after some time. A theory of adult intellectual development and influence of rater and rate age on two performance judgments are discussed by [4][5]. Speculations that attention on the determinants of objective decision normally conceptualize the choice about which objective an individual receives to be an element of cognizant, subjective procedures coordinated toward augmenting expected positive results and limiting foreseen negative results. life span approach to social motivation is described by[6].

In occasions where an objective can be promptly expert, for example, happens when one stops composing and kill the PC, there is generally no requirement for further motivational handling. Green synthesis, characterization and antimicrobial activity studies is explained by [7]. Be that as it may, as is regularly the case at work, a person’s objectives might be unpredictable, not well characterized, and additionally require a long period to fulfill. People looking for advancement, for instance, must show their suitability for the position by effectively finishing an assortment of errands and ventures. Age bias in laboratory and field settings: A meta-analytic investigation is discussed by [8]. In these occurrences, the individual must utilize self-administrative or objective endeavoring procedures to guarantee effective fulfillment of the essential undertakings keeping in mind the end goal to accomplish their long haul objective. Task-specific motivation is described by [9].

Hypotheses
of objective endeavoring and self-direction set that people who are focused on their objective will screen their execution, assess their advance, and alter conduct and influence to encourage objective achievement. Generous writing offers help for these exercises, and further proposes that the motivational introduction that an individual embraces may impact objective endeavoring and execution.

AGE RELATED INFLUENCES ON WORK MOTIVATION

The impacts of age-related factors on work inspiration might be conveniently composed into three general classes. The main class relates to the impact of the life expectancy connected relational and social setting, specifically the impacts of generational or partner contrasts that may lead midlife and more seasoned specialists to encounter less open doors for expertise advancement and work part change than more youthful laborers or lead more established specialists to see themselves as less instrumental to the achievement of authoritative objectives.

Conversely, the second classification of age-related impact on work inspiration, which is the concentration of this exploration paper, relates to the way that age-related changes in the individual influence the appropriation and quest for work objectives. Various reviews archive age-related changes in subjective capacities, work encounters, information, thought processes, influence, and self-administrative abilities over the life expectancy. These different changes are set to impact work inspiration through their impact on a person’s objectives and the procedures and aptitudes that are used for objective achievement.

The third, maybe most surely understood class of age-related impacts on work inspiration and execution relates to the utilization of age as a gathering variable and the utilization of age-reviewed standards and age-based generalizations in faculty basic leadership and relational interchanges. Age predisposition and utilization of age generalizations by administrators and others in the working environment are for the most part viewed as adverse to work inspiration and hierarchical viability.

Social Cohort Influences: Ordered age is nearly connected with a person’s beneficial encounters. Generational or age associates typify the normal encounters of people inside a specific age extend—chronicled encounters, for example, war, financial changes, and major mechanical developments help to shape center esteems and convictions that recognize partners from each other.

Adult Development Influences: The second classification of research, which is the concentration of this examination paper, relates to the pathways by which standardizing, age-related changes in psychological capacities, work encounters, information, thought processes, influence, and self-administrative abilities influence inspiration identified with the appropriation and quest for work objectives. Over the grown-up life expectancy, physical abilities bit by bit decay and may energize early retirement among laborers occupied with physically requesting employments. In created nations, in any case, many occupations, for example, handyman, pilot, and specialist put moderately few requests on physical capacities. Or maybe, these employments tend to put solid requests on psychological capacities and learning.

Adult Development and Work Motivation: Where the employment or work part puts levels of popularity on area information and the utilization of all around created schedules, midlife specialists can hope to perform at more elevated amounts with less exertion as an outcome of expanding occupation learning and ability advancement over the life expectancy. Senior bookkeepers, for instance, may keep up abnormal amounts of execution with moderately less consideration exertion than new bookkeepers who are less comfortable with methods and expense laws.

AGING, WORK MOTIVATION, AND SUCCESSFUL ADAPTATION

Rising hypothesis and research on the impact of maturing on work practices and results recommends a mind boggling picture as for both inspiration and work results. Early examinations, fabricating to a great extent on advances in subjective maturing hypothesis and research, concentrated on the ramifications of formative decrease in psychological capacities for occupation execution. Albeit formative decrease in select subjective procedures was related with decrease in a few occupations, prove immediately collected that other age-related changes in learning, aptitudes, and employment significant attributes, for example, steadfastness are
emphatically connected with occupation execution. These two restricting procedures are most likely in charge of the discoveries of a close to zero relationship amongst age and execution. As a result, contemporary details of work and maturing have embraced a more adaptable fit point of view, in which the effect of age on employment execution is seen as best assessed as far as the fit between age-related changes in the individual and work part requests.

CONCLUSION

Effective convenience to the developing extent of midlife and more established laborers speaks to an extraordinary test in contemporary associations. Albeit logical advance in the investigation of formative changes related with maturing gives basic data about age-related changes inside people, generally little research has been led on the procedures by which these progressions impact work inspiration and execution. Be that as it may, research to date gives no confirmation to bolster the thought of an all inclusive decrease in work inspiration among midlife and more established specialists. Or maybe, late work proposes that the impact of a person’s age on work inspiration mirrors the mind boggling interchange of three main considerations:

(a) Changes in the individual’s capacities, information, abilities, interests, and thought processes with respect to occupation requests and openings,

(b) Age-related attitudinal, regulating, and behavioral correspondences between directors, associates, and the more seasoned laborer, and

(c) Organizational adaptability in arrangements and practices that empower work part rebuilding to keep up a viable fit between individual capacities and employment requests.

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REFERENCES


A Study of Business Imitation

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ABSTRACT

Imitative conduct is inescapable in the business world, where it can be seen over an extensive variety of business choices. For instance, firms regularly emulate new items and procedures presented by others. Impersonation is additionally predominant in the selection of administrative strategies and authoritative structures, and in the planning and decision of new innovation, showcase section, and different ventures.

As anyone might expect, if a company’s item or administration demonstrates effective in the commercial center, contenders will attempt to emulate it. This is the most widely recognized sort of business impersonation. The enhancing association’s benefits will tend to fall as the impersonation happens. To forestall or diminish this disintegration, the enhancing firm might have the capacity to make hindrances to impersonation utilizing different techniques, for example, licenses, copyrights, and mystery. The firm may likewise endeavor to enhance its items, along these lines remaining in front of opponents. This kind of impersonation—where an obviously fruitful item or administration is imitated—is a central piece of the focused procedure. Effective firms may dedicate much time and push to attempt to avoid impersonation, and supporter firms may work similarly hard at duplicating. By and by, this sort of impersonation is genuinely clear, and its fundamental components are surely known.

Keywords: Business impersonation, Theories of Imitation, Risk Minimization.

INTRODUCTION

Hierarchical developments are additionally imitated. For instance, concentrated the reasons for the spread of the multidivisional frame among extensive U.S. firms from 1919 to 1979 and found that organizations will probably adjust their hierarchical structure to the multidivisional shape when different firms in the business did as such. Simple model of herd behavior is discussed by[1]. Today, the multidivisional frame is generally considered as an unrivaled hierarchical shape for some organizations, so its impersonation was for the most part useful. Oligopolistic reaction and multinational enterprise is explained by[2]. In any case, impersonation has additionally driven firms to receive brief administration prevailing fashions and to commit considerable assets to their usage. A theory of fads, fashion, custom, and cultural change as informational cascades are described by[3]. Corporate projects for “reengineering,” “representative strengthening,” and “administration by goals” were well known in the 1990s, however have been to a great extent been overlooked today. Spread of the multidivisional form among large firms is discussed by[4].

As these illustrations uncover, impersonation may have constructive or pessimistic ramifications for individual firms and for society. The iron cage revisited is described by[5]. Sometimes, for example, impersonation of obviously prevalent process advancement, brisk and far reaching appropriation is probably going to be broadly advantageous (albeit maybe not for the spearheading firm). Nonresponse, and delayed response to competitive moves are discussed by[6]. In different cases, impersonation may lead firms adrift, some of the time with emotional results.

Information Based Theories of Imitation: Data based speculations of impersonation have been proposed in different fields, for example, financial matters, institutional human science, and populace environment. One Person Company (OPC)-The new business format for small retailers is discussed by[7]. These hypotheses apply in dubious and questionable conditions. Chiefs might be uncertain of the probability of conceivable results, and they may have more key challenges perceiving cause-impact connections and the full scope of potential outcomes. Print Media Business Model in Current Situation is described by[8]. In such situations,
chiefs are especially liable to be open to data verifiable in the activities of others. Such data, while exceedingly flawed, can affect administrative discernments and convictions. Additionally, in unverifiable situations directors may mimic to flag others about their own (or their firm’s) quality.

**Theories of Organizational Sociology and Ecology:**
Association hypothesis gives a related clarification for behavioral likeness: institutional isomorphism. DiMaggio and Powell (1983) contend that objective performing artists make their associations progressively comparable when they attempt to change them. This procedure of homogenization is caught by the idea of isomorphism. Isomorphism is an obliging procedure that drives one unit in a populace to look like different units that face a similar arrangement of natural conditions.

Among three sorts of institutional isomorphism (coercive, mimetic, and regularizing isomorphism), mimetic isomorphism is simply the procedure whereby associations show on different associations when the earth is unverifiable. The demonstrated association is seen as more real or effective. Such mimetic conduct is discerning on the grounds that it manages on hunt expenses to diminish the vulnerability that associations are confronting. Exact reviews have demonstrated the operation of mimetic isomorphism in an assortment of hierarchical areas, for example, appropriation of another authoritative structure and expansion.

**Rivalry Based Theories of Imitation:**
A moment set of hypotheses sees impersonation as a reaction intended to alleviate aggressive competition or hazard. Firms impersonate others with an end goal to keep up their relative position or to kill the forceful activities of adversaries. Dissimilar to the speculations talked about in the past segment, firms’ activities don’t pass on data. The speculations identifying with competition and hazard have their essential source in the fields of financial matters and business system.

Impersonation to moderate contention is most regular when firms with similar asset blessings and market positions confront each other. In such cases, it is frequently troublesome and dangerous for firms to separate their assets and market position from those of contenders. It is not sure that the separated market position and assets will be prevalent. Along these lines, firms frequently seek after not separation methodologies but rather homogeneous procedures, where they coordinate the conduct of adversaries with an end goal to facilitate the power of rivalry or diminish hazard.

**Risk Minimization:**
In “victor takes-all” conditions, equal firms may embrace comparable conduct to keep others from driving the race. For instance, in innovative work (R&D) rivalry, where the principal innovator can get patent rights to an innovation so that different firms can’t utilize it, R&D ventures among firms are emphatically corresponded. Comparative victor takes-all circumstances can emerge when the market has fleeting trend impacts or system externalities. In business sectors for framework merchandise made out of equipment and programming, for example, PCs and varying media gear, the innovation design that picks up an expansive introduced base turns into a true standard and overwhelms the market—the champ takes all. Subsequently, a configuration pioneer tries to align with its opponents to build the piece of the pie of good items, permitting out the innovation. The opponent firms supply perfect items (impersonation) to abstain from being allowed to sit unbothered when the market tips for the pioneer. Once a typical industry standard has risen, many firms and clients may embrace it.

Appropriation of models, which benefits firms by limiting expense, may show up as a type of impersonation.

**Distinguishing Among Theories:**
The data and contention based speculations depicted beforehand are not fundamentally unrelated; both sorts of impersonation can happen at the same time. Firms may impersonate adversaries to keep up aggressive equality and furthermore out of conviction that opponents may have unrivaled data. By and by, one kind of impersonation or the other is adept to be prevalent in any given setting.

To recognize data based and competition based impersonation, three criteria might be connected:

1. Do pioneers and supporters contend in a similar market or specialty?
2. Do pioneers and devotees have comparable size or assets?
3. Is the earth exceedingly questionable?

The initial two criteria, advertise cover and asset similitude, build up whether the leader(s) and supporters contend as opponents. Rivals have solid cover in product offerings and geographic market scope. Regularly they have comparable assets, and they may have comparative causes and history.
Performance Implications: Numerous cases in this examination paper demonstrate that impersonation can have intensification properties that make results more outrageous, with outcomes that might be great or terrible for firms and for society. On the positive side, data based impersonation can speed the selection of valuable advancements, and competition based impersonation can goad firms to enhance their items and administrations. Both sorts of impersonation have antagonistic ramifications on the off chance that they lead firms to misuse assets on inefficient, duplicative ventures.

Performance Implications of Information-Based Imitation: While both sorts of impersonation can have enhancement impacts, sensational adverse results are more probable under data based impersonation. The data falls hypothesis is unequivocal about the potential for air pockets and sudden inversions. Other work in association hypothesis demonstrates how slacks in learning forms enable temporary fads to develop. The danger of sub-par results is most noteworthy if supervisors see a need to submit before real instabilities are settled. For instance, in the 1990s numerous business visionaries trusted that early passage into the Internet area was a necessity for business achievement. In the end, as more data developed about the prospects for Internet organizations, stock costs given way, and many firms fizzled. By and large, obviously a significant part of the underlying surge had been pointless and that it added to the extent of the crumple. Had more firms held up until real vulnerabilities settled, numerous misfortunes could have been maintained a strategic distance from.

CONCLUSION

We have overviewed speculations of business impersonation and have demonstrated that they fall into two general classifications: data based hypotheses and contention based hypotheses. These two sorts of impersonation frequently have diverse ramifications, albeit both have intensification properties that can make results more outrageous. Data based impersonation can speed the appropriation of unrivaled items and strategies, or it can prompt sensational disappointments if firms’ decisions demonstrate wrong. Contention based impersonation can diminish hazard and encourage plot albeit all the more regularly it heightens rivalry. In the last case, impersonation may continue over many rounds, fortifying firms on the off chance that they have picked a gainful way or driving them encourage off track in the event that they have not.

We have recommended some approaches to recognize data based and competition based impersonation, yet this is not a simple assignment. A few issues make recognizable proof troublesome. Firms may react indistinguishably (however not imitatively) to normal natural stuns. In addition, the two sorts of impersonation frequently coincide, and recognizing qualities might be difficult to survey impartially. ID of impersonation procedures in this way remains a vexing test in numerous business settings.

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REFERENCES

A Study of Employee Absenteeism

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ABSTRACT

Representative non-appearance is an overall wonder which, because of the budgetary effect on a country’s economy, is an essential subject on the worldwide plan. Keeping in mind the end goal to give new bits of knowledge into representative truancy a model with an expansive assortment of determinants is built and tried for Europe in general and the individual nations. In light of past reviews, a wide determination of determinants was recognized and separated into classifications, for example, socioeconomics, well being, and family unit and occupation qualities. With the nation correlation the outlined model tried whether it likewise holds logical incentive for individual nations and whether contrasts existed in nonattendance conduct because of nation qualities. This overview gave the vital data and is built thusly that it can be utilized for global examinations. The composed model depends on the impacts of dormant factors and on account of the paired part of the reliant variable fidelity examination is directed.

Keywords: Permanent contract, Personal labor income, Personal labor income.

INTRODUCTION

The results of worker truancy are across the board and comprise of immediate and circuitous impacts. For example higher expenses are an aftereffect of non-attendance, which can be caused both specifically as in a roundabout way. Guide expenses of affliction nonattendance to bosses incorporate statutory wiped out pay, cost of covering nonappearance with brief staff and lost generation. Gift Exchange and Efficiency-Wage Theory is discussed by [1]. Circuitous costs, for example, low assurance among staff covering for those missing in light of infection and lower consumer loyalty, are hard to gauge. The effect of truancy on firms or even a country’s economy is tremendous, assessing the expenses related with it. A superior comprehension of the determinants of truancy can be important for firms and policymakers. An Empirical Model of Work Attendance is discussed by [2].

Nonattendance is not simply a restorative condition. While representative nonappearance frequently is portrayed as infection, there are more perspectives which assume a part or affect the nonattendance conduct of workers. A basic issue, since truancy is really an assortment of practices with various causes taking on the appearance of a unitary marvel. Ethnic Differences in General Practitioner Consultations is described by [3]. Affliction is a mind boggling marvel that is impacted emphatically by elements other than wellbeing. All through past research numerous determinants have been tried upon their conceivable logical capacities on representative nonappearance conduct. While these determinants regularly demonstrated comparative outcomes it is some of the time hard to think about these results since different exogenous components affected them. Sickness Absence from Work is discussed by [4].

LITERATURE REVIEW

Cows and Rhodes (1978) bolster the view that generally the family obligations, for example, dealing with debilitated kids, are attributed to the spouse or mother. A comparable rate of nonappearance for ladies with or without ward kids while normally is seen that nearness of kids is related with a higher rate. An investigation demonstrated that most wiped out ladies did not continue work until they were completely recouped, while most men frequently (halfway) continued work notwithstanding when they were not completely recuperated. An Analysis using Microdata is discussed by [5].

The reason for this view can be found in the speculations concerning the work relaxation decision system and authoritative duty. The higher nonappearance rate among more youthful specialists can be normal as a
result of the more prominent open door cost of sworn off recreation. They additionally express that more youthful laborers are commonly extremely portable amongst employments and accordingly will be less dedicated to the firm and workgroup than more established specialists are. Additionally express that full of feeling and continuation responsibility has a tendency to be higher for more established than for more youthful workers, too for representatives with longer, as opposed to shorter, authoritative residency. A Practical Investigation on Training Need Analysis of the Employees in Probationary Period in Information Technology Sector and Connect among employee engagement and three key of organizational commitment level are discussed by[6][7].

Likely the most imperative pointers of non-attendance are identified with the strength of workers. While different elements have their effect on affecting the nonattendance rate, wellbeing itself, for instance general ailment, is the most happening purpose behind a worker to be truant. Better wellbeing related with lower disorder nonappearance. The variables examined in this class will talk about how self-surveyed wellbeing, certain wellbeing ways of life, for example, Body Mass Index (BMI) and smoking, and whether a man is hampered in his typical exercises by his ailment identify with nonattendance.

Weight and overweight increment mortality and have been related with an extensive variety of incessant illnesses. Underweight and weight change are likewise prescient of untimely mortality and infection, which gives proof of a U-molded connection. Additionally express that smoking has appeared to be a determinant of very much approved general measures of wellbeing. Additionally recommend that a potential for diminishment of ailment nonappearance can be found in intercessions towards smoking and heftiness.

**JOB CHARACTERISTICS**

Other than individual attributes, the working conditions or qualities likewise has impact on the rate of nonappearance. A fundamental mental support for noteworthiness of such figures can be discovered the perspective that when individuals appreciate what they are doing or in the event that it coordinates their requirements, they will apply more exertion so as to meet the responsibilities, for this situation participation at work. All through the writing a wide range of employment angles have been talked about and identified with non-appearance.

**Job satisfaction:** Cost depict work fulfillment as the general degree to which representatives like their employments. As specified before, when someone is happy with what he is doing he will apply more exertion in staying faithful to his commitments, which here means appearing at work. Fulfilled individuals are additionally less slanted to concentrate on the negative viewpoints which could bring about a (more) negative mentality which connects with nonappearance emphatically. Cows and Rhodes (1978) compress this impact obviously; much fulfilled workers would most likely need to go to emphatically, while profoundly disappointed representatives would presumably need not to go too unequivocally.

**Permanent contract:** The perpetual character of an agreement is required to impact non-attendance. Workers with perpetual contracts have more employer stability and are in this manner less determined, while non-lasting representatives are uncertain whether their agreement will be restored. Non-perpetual workers are in this way more anxious to apply increasingly or additional exertion keeping in mind the end goal to get a positive evaluation and maybe contract prolongation.

**Personal labor income:** At the point when a worker gains a higher work wage, as per the work relaxation system, his time being missing will have higher open door costs. A worker is hence anticipated that would apply more push to go to at work and pick less for recreation. This is in accordance with the effectiveness wage hypothesis which clarifies that representative procuring higher wages will apply more exertion and be less truant.

**Job status:** Representatives working at higher capacities carry on contrastingly as for the rate of nonappearance. Representatives with a higher occupation status are thought to be missing not as much as workers with a lower status. Purposes behind this relationship are that representatives with a higher status frequently have more obligations and work in less unsafe conditions.

**CONCLUSION**

Toward begin of this exploration on worker non-appearance its impact on a country’s economy was known. Be that as it may, the exploration led towards
clarifying the fundamental elements of nonappearance conduct was uncertain. In spite of the fact that the impact of the determinants incorporated into this exploration and more were analyzed in before research they were not yet tried in a wide point of view. Their connection with non-attendance was tried by looking into the impact of determinants of a particular classification on nonattendance conduct. Thus unique outcomes were discovered when determinants from an alternate classification were incorporated. The absence of models in which these determinants were controlled for backhanded impacts, brought about the way that it was unrealistic to demonstrate the impact of a particular determinant. Notwithstanding the absence of such models, likewise minimal cross country examinations on the distinctions in nonappearance conduct had been finished. Nation nonattendance rates were found to vary. Still most nation correlations did not surpass looking at nation attributes, for example, work rates or representative age with nonappearance rates. In spite of the found and guessed contrasts in nonattendance rates between nations, a model hunting down clarifications for these distinctions was not yet built.

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**REFERENCE**


A Study of Organizational Politics in Management

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ABSTRACT

Political conduct is a wonder that has been available crosswise over relational, gathering, and authoritative settings for hundreds, if not thousands, of years. Truth is told, Aristotle contended hundreds of years back that man is an intrinsically political creature, and few have tested that idea since. This marvel has turned into an inexorably imperative issue for business professionals to comprehend and oversee because of the changing hierarchical progression influencing today’s workforce.

As administrators turn out to be progressively mindful of the profoundly versatile nature of their association’s interest in human capital, they understand what number of vital intangibles become possibly the most important factor and should convey newly discovered regard for these components. Hierarchical governmental issues are a critical variable that profoundly affects the adequacy of the workforce. Chiefs should comprehend what elements are essential drivers in making a reliably compelling condition and limiting negative political practices, consequently inclining their authoritative individuals to accomplish their most extreme potential.

Keywords: Political conduct, macro causes of political behavior, human capital, social capital, and hierarchical capital.

INTRODUCTION

This paper will talk about perspectives on how governmental issues and political conduct are characterized, the life cycle of their unpredictable progression in and over the association, and how they can best be comprehended and overseen in the working environment of the 21st century. Governmental issues will be investigated crosswise over full scale and small scale levels of examination and will mirror the diverse essential floods of research. A complete strategy for creating a more productive and profitable organization is explained by [1]. The subject will be explored from various fields of research, for example, social brain science and humanism and also from various perspectives inside and crosswise over orders. This point of view will outline the development of this field has originated from a differing foundation to a multidisciplinary approach that is picking up force. Power and politics in organizations is discussed by [2]. Despite the fact that governmental issues will be investigated from these diverse perspectives, the driving concentration will be the manner by which professionals can recognize, comprehend, and oversee authoritative legislative issues and consequently utilize it as a wellspring of managed upper hand. Empowered manager is described by [3]. This favorable position comes by means of relieving negative legislative issues such that it upgrades hierarchical adequacy and lessens inefficient practices. The levels of political movement inside the association that will be tended to incorporate large scale examination for association wide progression and microanalysis for relational and intra-gather elements. Social media recruitment from employer’s perspective is discussed by [4]. Causes, impacts, and overseeing procedures of political practices will be talked about on small scale and full scale viewpoints so that the marvel can be comprehended in entire and in sensible parts. Toward a definition of organizational politics is explained by [5].

Macro Causes of Political Behavior: Large scale legislative issues are characterized as occurring at the hierarchical level and entomb authoritative level. This is unmistakable from small scale governmental issues which happen at the relational and gathering levels of the association. The organization as political arena is discussed by [6]. Three
qualities that are generally examined when looking to comprehend the way of legislative issues at a full scale level incorporate force, inescapability, and span (or dependability). Force alludes to the extent of the political activities being attempted. Inescapability alludes to how across the board the political practices are all through the association. Efficiency in evolutionary games are described by [7]. Span or soundness alludes to what extent the political moves have been making place or will happen, how enduring the impacts will be, and to what degree the political practices destabilize the association.

Micro Causes of Political Behavior: Smaller scale legislative issues are characterized as occurring at the relational and gathering levels. This is unmistakable from full scale legislative issues, which happens at the hierarchical and bury authoritative levels. The reasons for destructive small scale political conduct are partitioned into two noteworthy classifications: political practices that are purposeful think, and regularly planned and political practices that are at first inadvertent and brought on by fundamental self-conservation needs. Many components can rouse people to vindictively utilize destructive political practices as intends to accomplish their points. Dispositional qualities, for example, impression of ethical quality can incline people to assess elective systems to accomplish their objectives, for example, destructive legislative issues. At the point when people see that the earth in which they are working is as of now profoundly political or that the association overlooks political conduct, they will likewise emphatically consider the utilization of political practices. Different variables that affect political practices incorporate employment independence, contribution to basic leadership, work fulfillment, word related status and esteem, representative relations, saw control of one’s own conditions, and comprehension of what and why occasions happen in a situation.

Threat Assessment as Catalyst for political Behavior: Our perception of characteristic risk examination accomplished by impression of environmental segments has foundations in the work of masters in the humanistic systems. Things being what they are, these examiners have made a structure for understanding the association between levels of self-grouping in perspective of impression of regular components. As of now analyzed, self-arrangement is just the course in which we describe as a component of our characteristic setting. Self-course of action urges us to fathom the points of confinement of what social occasion we see as most striking in a given setting and serves to develop what total size will satisfy our necessities at the required level. Exactly when a specific level is most striking, its relating needs will influence a man’s lead, paying little respect to whether purposely or unwittingly.

Management of Politics as a Competitive Advantage: The three essential topics of human capital, social capital, and hierarchical capital will be utilized to examine how the powerful administration of governmental issues inside the authoritative condition can be a wellspring of upper hand. Human capital alludes to the esteem that an association gets from the learning, knowledge, aptitudes, capacities, and gifts had and used by an association’s individuals. Social capital alludes to the esteem that associations get from the courses in which their kin collaborate, convey, work in groups, help each other, share data, and identify with each other. Authoritative capital incorporates the esteem an association gets from its arrangements, methods, structure, and procedures.

CONCLUSION

In spite of the fact that the presence of governmental issues inside associations is just the same old thing new, the scan for a superior comprehension of how it impacts the workforce is absolutely rising as an imperative test for chiefs in the 21st century. This exploration paper has offered a guided voyage however the dynamic and advancing field of authoritative legislative issues inside administration settings. The peruse ought to leave with a comprehension of how the information of hierarchical legislative issues has gone to its present shape; strategies and procedures utilized as a part of the course of political conduct; foundations for political practices including reasons for no malignant practices; lastly, systems for alleviating governmental issues through adequately overseeing ecological elements that trigger political practices.
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REFERENCES


A Study of Outsourcing to India

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ABSTRACT

Today outsourcing is broadly rehearsed in all types of associations including enterprises, governments, philanthropies, and religious organizations. Basically, outsourcing is a legally binding assertion between the customer (the association that does the outsourcing) and at least one outside providers (sellers) to give administrations or procedures at present given by the customers’ inner association. A current survey of outsourcing gives diverse meanings of outsourcing that has developed after some time. This paper is organized in eight wide segments managing the accompanying points: distinctive sorts of outsourcing, outsourcing of data innovation (IT) and related administrations, IT outsourcing to India, favorable circumstances of outsourcing to India, advancement of outsourcing to India, slants in Indian IT off-shoring, and outsourcing to India in non-IT-related zones.

Keywords: outsourcing, innovation, India, customer, sellers.

INTRODUCTION

Outsourcing includes making an assortment of “make” or “purchase” choices to get the fundamental supplies of materials and administrations for the creation of the association’s products and ventures. Outsourcing is a cooperation assention between various sorts of firms in which one firm is an expert in Information systems outsourcing: A literature analysis. Information & Management, this paper also review innovation and makes a noteworthy commitment to the next by giving physical or potentially HR amid a specific period with a specific end goal to achieve a decided goal. Outsourcing includes the substitution of exercises performed in-house by gaining them remotely, in spite of the fact that the firm has the essential administration and money related abilities to create them inside. Implementing Reverse Logistics Activities Into Existing Companies Systems is discussed by. These models are the consequence of the fast advances in media transmission and data advances and the developing solace with outsourcing among industry officials. Comprehensively, the type of outsourcing can be any or a blend of the accompanying relying upon the merchant area:

- On-shoring: An outsourcing contract marked with a supplier situated inside the nation. While there may be a development of occupations starting with one organization then onto the next in an on-
shoring contract, there is no loss of work chances to a remote nation.

- Off-shoring: An outsourcing contract marked with a supplier situated past the country’s limits. Off-shoring work can at times result in occupation misfortunes in those nations undertaking outsourcing. As of late, off-shoring has gotten a considerable measure of reputation, antagonistic or something else, in nations like the United States due to occupation misfortunes.

- Near-shoring: Similar to off-shoring with a slight variety. In a close shoring engagement, outsourcing is done to a specialist organization situated in a neighboring nation. For instance, if a firm in United States outsources its work to a firm in Canada or Mexico, it is called close shoring

OUTSOURCING OF IT AND RELATED SERVICES

The most regularly referred to advantages of IT outsourcing incorporate cost lessening, benefit quality change, and the capacity to concentrate on the center business. Cost diminishment is a prompt advantage that many outsourcing organizations can accomplish. Firms in the United States or the United Kingdom as a rule pick up from the lower compensation in the LCCs, which are 40% to 60% beneath the predominant rates in the United States and the United Kingdom. Firms assess outsourcing to decide whether the current working expenses can be decreased and if spared assets can be reinvested in more aggressive procedures. Since the outsourcing contract beneficiaries are regularly overhauling numerous customers, financial aspects of scale and extension frequently enable the sellers to accomplish bring down unit costs than can any single organization.

Advantages of Outsourcing to India: In the course of the most recent couple of years, India has turned into a goal of decision for off-shoring. In a recent report on seaward area, engaging quality list by AT Kearney, India positioned first in the rundown of the 25 nations incorporated into the review. It held the top opening in the review as in the earlier years by an agreeable edge over China, the second nation in the positioning. Indeed, even other research offices like Gartner, Forrester, Giga, and soon have given the top rank to India in their particular research thinks about on seaward goals.

The accompanying is a synopsis of the key focal points that India offers as an outsourcing goal:

- Low-cost structure: Software advancement is a labor escalated action. The work cost arbitrage that exists amongst India and its Western nations can hence give critical money saving advantages. For instance, the normal yearly compensation of an IT expert is $5,850 in India contrasted with $63,000 in United States. This prompts a huge cost differential to customers since a normal programming software engineer

- Education: India has had a long history of interest in tertiary training, particularly building. The nearness of the incredibly famous Indian Institutes of Technology (IITs) and the utilization of UNIX in the scholarly condition give a decent instructive foundation to the designers.

- Human assets: India has a genuinely youthful populace where the greater part the populace is less than 25 years old. Since India has numerous times of involvement in off-shoring, the instruction and preparing establishments have possessed the capacity to confer abilities that are pertinent for the business. Building instruction gives solid specialized and quantitative aptitudes, which are useful in creating programming. Indian specialist co-ops have now developed from giving low esteem included administrations, for example, upkeep and relocation to high esteem included administrations, for example, business handle administration, examination, and counseling.

OUTSOURCING TO INDIA IN OTHER AREAS

Manufacturing: Despite the fact that India drives the market in giving seaward administrations in IT, as an assembling focus it lingers behind nations like China and Thailand. The reasons are as per the following: flighty electric supplies, poor streets, gridlock seaports and air terminals, and government arrangements that demoralize enlisting and terminating of work holdback local requests in numerous divisions. In spite of the fact that the foundation obstacles can be impressive, many organizations have pushed forward to take the upside of India’s minimal effort, yet gifted work in outline and assembling.
Pharmaceutical Research and Development:
Expansive pharmaceutical organizations, for example, AstraZeneca and Pfizer have set up their exploration and explanatory focuses in India to bolster their worldwide item advancement endeavors. Before any new medication is presented in the market, it is compulsory to test the adequacy of the medication on human patients. This procedure is called clinical research.

RESULTS AND DISCUSSION

The achievement in IT outsourcing has offered ascend to another type of worldwide outsourcing, which is currently prevalently known as information process outsourcing (KPO). It is another outsourcing idea concentrating on learning serious administrations and information administration. Catching, making, sharing, and looking after, following, enhancing, and teaming up learning are couple of spaces of information administration separated from two noteworthy parts of learning application and dispersal.

CONCLUSION

A large portion of the organizations today take a gander at outsourcing as a helpful instrument to empower them to contend all the more adequately. The basis for outsourcing has extended past customary cost reserve funds and the need to outsource is currently guided by the accompanying destinations:

- Improved profitability estimations
- Increase in cost-productive outside rivalry
- Need to move stock quicker
- Need for adaptable creation
- Development of production network organizations

In spite of the fact that India was a late participant to outsourcing contrasted with nations, for example, China and Singapore, it could rapidly build up itself as a pioneer in IT outsourcing by utilizing its qualities.

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REFERENCES


Rebuilding in Distribution Systems to Reduce Financial Losses Related to Process Trips

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ABSTRACT

An imperative step towards a brilliant lattice is the keen use of manual or mechanized sectionalizing switches, which can be worked in possibility conditions with a specific end goal to enhance the unwavering quality lists. In any case, electric utilities don’t have very much characterized criteria for designation of such gadgets. In this paper, Annual Financial Losses identified with Process Trips are surveyed considering in a probabilistic way Process Immunity Time of every client and the reclamation span of clients found upstream and downstream of the blamed area. AFLPT is utilized as a financial record alongside aggregate unwavering quality lists to choose a superior exchange off amongst advantage and speculation taken a toll amid the allotment of mechanized sectionalizing switches. Comes about demonstrate that the relationship amongst PIT and rebuilding span enables electric utilities to distinguish geographic territories where financial interest in current advances, as self-mending, can be organized.

Keywords: Financial Losses, Process Trips, AFLPT, financial record, aggregate.

INTRODUCTION

These days’ electric utilities confront issues which are established in incessant short out occasions in their dispersion frameworks. These issues happen because of common catastrophes, for example, high winds, lightning and snow tempests, and cause intrusions of ordinary electric administration creating noteworthy money related misfortunes for their clients. After the event of these occasions electric utilities endeavor fast rebuilding of vitality supply by applying sectionalizing switches with manual or computerized operation to segregate the broken segment from the sound areas [1-4]. Hence, so as to build the appropriation framework unwavering quality a self-recuperating idea might be investigated applying remote-controlled switches (RCSs) with the controller generally introduced in the substation level.

At the end of the day, when a short out influences the dispersion framework to bring about a Long Duration Interruption (LDI), the less the interim between the blame confinement and the heap exchange the less clients will be hindered.

As [1-6] a rule, electric utilities have couple of criteria to choose which MS can be supplanted by AS or which are the best possible positions to put in new AS all through the conveyance framework.

A few criteria like as minimization of dependability lists SAIDI, SAIFI and ENS are regularly utilized; however there are likewise other criteria as establishment and support gadget costs, normal repair and exchanging time, disappointment rate and sorts of burdens, and [6-8] so on. Prior research tends to utilize heuristic hunt approach or master frameworks, e.g.: mimicked strengthening, resistant calculation, hereditary calculation, fluffy set hypothesis, and so forth., to manage the huge number of conceivable outcomes and get arrangements in a worthy handling time.

PROPOSED METHOD

In this paper, another basis is proposed which connected two ideas: prepare invulnerability time and rebuilding term. This relationship considers business/modern affectability forms when electric flaws influence the appropriation framework. As it were, AFLPT can be likewise evaluated in clients situated in solid segments when MS or AS are connected to reestablish vitality supply.

Hence,[9] Quantum of Ebola Virus Disease Occurrence and Quantum of Research Publications: A Scientometric Analysis in the event of a LDI brought about by an electric blame, clients situated in solid areas with higher AFLPTLDI will undoubtedly have the need for interest in reclamation activities.
In spite of the fact that the proposed improvement method just can ensure close ideal arrangements, this approach is beneficial when connected in expansive dissemination frameworks since various PCs or diverse processors may do this strategy in parallel (for at least one essential feeders) part up the handling calculations and diminishing the relating time burned through. Different heuristics likewise might be adjusted to take care of this improvement issue by incorporating AFLPTLDI in their assessment capacities.

RESULTS AND DISCUSSION

In this paper, minimization of electric misfortunes and number of exchanging operations are not considered. The primary targets are the decrease of dependability lists and AFLPTLDI which affect straightforwardly, for example, in considerable punishments to electric utilities forced by administrative offices. In [10] a survey of big data analytics in healthcare and government that as it may, they can be effectively incorporated into the FO without influencing the proposed strategy.

CONCLUSION

This paper concentrates the monetary effect of robotized sectionalizing switches as far as diminishing yearly money related misfortunes identified with process trips. These gadgets are utilized to reestablish delicate clients after vitality supply interferences brought on by electrical unsettling influences. The idea of rebuilding term alongside process invulnerability time is fused in the proposed probabilistic system. This relationship acquires more reasonable and exact appraisal estimations of AFLPTLDI to delicate individual clients and the entire circulation organize. AFLPTLDI evaluated is utilized as another basis amid the selection of options for substitution of MS for AS inside the entire dispersion framework.

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Risk-Taking Proficiencies of Female Occupation Persons Following Occupational Evolution

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ABSTRACT

Risk-Taking capabilities affect well-founded execution and development. The motivation behind this paper is to report experimental research into the risk-taking skills revealed by female occupation people who are focused on the development of their occupation. Four principles bunch of abilities were recognized: specific and rapport, occupation and organization, risk-taking and human relations capabilities. While past research on the capabilities of occupation visionaries has distinguished the two bunches of occupation and organization, and risk-taking skills, the abilities in the other two groups have gotten less consideration and have not been recognized as groups. Seemingly, capabilities in these bunches are esteemed more vary by female occupation visionaries than by their male partners. A survey-based study of female occupation people in England and Wales was directed. The center of the survey was a rundown of risk-taking capabilities incorporated from past hypothetical and observational systems, combined with scales through which the occupation visionaries were welcome to rate their capacity in connection to every competency. FRC was directed keeping in mind the end goal to distinguish groups of abilities, and to recognize the capabilities that stacked onto those bunches.

Keywords: Risk-Taking proficiencies, Female businesspersons, Occupational evolution, Female.

INTRODUCTION

There is boundless affirmation that the achievement, execution and development is vigorously subject to the capabilities of the occupation person. The administration structure and autonomy of a little endeavor puts the occupation person in a basic position in the occupation operation. Further, a few analysts have proposed that a comprehension of capabilities that are practiced by the occupation visionaries driving fruitful independent ventures can be utilized to bolster the improvement of those skills, and can possibly, thus, drive occupation development.

While risk-taking abilities are vital for all the basic to build up the comprehension of such skills with regards to female-led organizations is especially solid. In [1-4] there are developing quantities of self-employed ladies in created economies, and a considerable lot of these organizations are exceptionally reliant on the proprietor and her abilities. Also, there is an across the board suspicion that a large portion of these organizations are way of life organizations, and all things considered their sense of duty regarding development might be generally low. In any case, governments and different organizations, in quest for monetary development are looking to assume a huge part. These motivations apply as much to those organizations driven by ladies as to those driven by men.

Albeit risk-taking skills are viewed as imperative to occupation development and accomplishment, as indicated the dialog of capabilities in the risk-taking writing is in its initial stages. For sure, [5-8] while throughout the years there have been some striking reviews that have looked to analyze the aptitudes and abilities of occupation visionaries, they are very few, and each is to some degree context-dependent. Specifically, just a single or two reviews have particularly focused on organizations claimed by ladies, in spite of the fact that there are different reviews that have examined ladies’ ability in particular zones, for example, money related administration and administration competency.

The structure of the rest of this article is as per the following. Initial, a writing audit contends the case for the significance of female occupation enterprise and the part of capabilities in its improvement, [9-10] and surveys
past hypothesis and research on risk-taking skills. The Findings segment that takes after presents the after FRC of the examination, and the Female Risk-taking Competence (FRC) structure that rises. The Discussion area then contrasts the FRC structure and past research on risk-taking capabilities. At last, the Conclusions area abridges the commitment of this exploration and offer suggestions for practice and for further research.

**PROPOSED METHODOLOGY**

**Survey Design:** A survey-based study was directed keeping in mind the end goal to gather information about female business people, their organizations and capabilities. A review was chosen as the examination technique for two principle reasons. Besides, a study enables the specialist to enroll an extensive number of plaintiffs, incorporating plaintiffs with organizations of various sizes, and in various areas.

The survey had three areas:

1. Profile of the business person
2. Profile of the business visionary’s business and
3. Risk-Taking skills.

Some fundamentally the same as proclamations of skills were merged, yet most were left as discrete things so as to enable the most imperative enunciations to surface in the investigation. At the highest priority on the rundown of capabilities plaintiffs were welcome to rate their capacity from a scope of abilities displayed.

Specific care was brought with the wording, format, and introduction of the survey, considering that the plaintiffs would not have any response to the analyst amid self-completion. Specifically, the survey was subjected to a two-stage steering process that included guiding with different scientists, and guiding with a chose gathering of female business people. Therefore of the guiding, some minor changes were made to wording and format.

**Statistics assortment and Scrutiny:** Surveys were appropriated to a comfort test. Accommodation inspecting is helpful where it is generally hard to inspire an adequate level of reaction. Introductory endeavors to inspire reactions from the SMEs recorded on particular databases met with just constrained achievement. This was somewhat because of the unpredictability of the prompting dated contact points of interest in the majority of the few databases of that were examined with the end goal of this exploration, and incompletely because of the trouble of distinguishing those organizations that were claimed by ladies from such records. In [11] a survey of big data analytics in healthcare and government, Members were recognized through ladies’ systems situated in England and Wales.

**Plaintiff’s contours:** Concerning period of plaintiffs, the most noteworthy reacting age bunch among plaintiffs was in the vicinity of forty-five and fifty-four, took after nearly by those matured thirty-six to forty-four. Generally, female business people inside this specimen were for the most part exceedingly taught, with thirty-three for each penny having an expert capability and forty-six for each penny a degree. This is reliable with affirmation that ladies businesspersons progressively have larger amounts of instructive accomplishment.

Most plaintiffs from the specimen revealed a few years of business experience preceding setting up their organizations, with just 17 for each penny of the plaintiffs demonstrating that they had no past involvement. This is not predictable with past research, which has recommended that numerous female businesspersons [8] need past risk-taking and administrative experience and this has an impact to on their capacity to survive.

**Sympathy of bunches of proficiencies:** Consider examination was utilized to decide the most modest number of variables to best speak to the inter-relationships among the arrangement of self-reported skills of the female business people, and to recognize the capabilities that stacked onto the key components. Calculate investigation was picked since it is reasonable for distinguishing relationship among factors in complex arrangements of information.

A screen plot was utilized to distinguish the quantity of variables; this brought about the recognizable proof of four elements. They chose four parts clarify a sum of forty-six for every penny of the change. The part network demonstrates a reasonable structure, with important solid loadings for each of the four segments, [10] however with a few things stacking onto more than one segment. This is not astonishing given that the exploration instrument was developed utilizing a greatly extensive variety of capabilities from prior reviews, with some potential redundancy, combined with the way that there is justifiable reason motivation to trust that the limits between various gatherings of abilities are penetrable.
RESULT AND DISCUSSION

The FRC system created in this examination is equivalent with different structures of arrangements of risk-taking skills produced by before specialists, in spite of the fact that it is imperative to recall that a large portion of these prior groupings taken a gander at business people as a rule, and, all things considered favored male business visionaries. One of the principle forerunners to this review in that it likewise focused on ladies was the review, they utilized variable examination to set up those risk-taking abilities and administrative aptitudes were separate components. This is reliable with prior reviews, for example, who expected that two classifications of aptitudes were required for the risk-taking part and the administration part, individually, and who proposed three classes of abilities or abilities, i.e. risk-taking, administration, and specialized capacity. This last classification does not emerge in this exploration since we didn’t particularly investigate any sector- or profession-specific aptitudes.

Table 1: Initial Eigen values for selected aspects

<table>
<thead>
<tr>
<th>Constituent</th>
<th>Sum</th>
<th>% of Variance</th>
<th>Total (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>8,962</td>
<td>13,546</td>
<td>13,546</td>
</tr>
<tr>
<td>2.</td>
<td>8,753</td>
<td>13,342</td>
<td>26,768</td>
</tr>
<tr>
<td>3.</td>
<td>6,869</td>
<td>10,289</td>
<td>37,265</td>
</tr>
<tr>
<td>4.</td>
<td>6,327</td>
<td>9,349</td>
<td>46,894</td>
</tr>
</tbody>
</table>

Then again, take note of that this review did not just produce the two elements related with risk-taking capabilities and business and administration skills, additionally surfaced two different bunches of abilities, identifying with individual and relationship abilities and human relations abilities, separately. Past analysts and proof have proposed that one of the zones in which female business people may eclipse men is in their capacities to manufacture solid inter-personal connections, so maybe it is not shocking that these two extra bunches rise in this study.

CONCLUSION

Business visionaries and the associations that support and exhort business visionaries are progressively focusing on the issue of learning, abilities and capabilities as they recognize the significance of the improvement of these for aggressiveness in the knowledge-based economy. This examination proposes the Female Entrepreneur Competence (FRC) structure, which envelops four, bunches of skills:

1. Individual and rapport abilities,
2. Occupational and administration abilities,
3. Risk-Taking abilities, and
4. Mortaldealing abilities.

Accordingly, the key recipients of this exploration incorporate government in their quest for monetary improvement, especially to train purposes, and female business people themselves in the quest for business achievement.

Ethical Clearance: Taken from AMET University

Source of Funding: Nil

Conflict of Interest: Nil

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Digital Knowledge Management in the University Library and Information Centers in Chennai (Madras): An Analytical Study

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ABSTRACT

Information is a pervasive element in the contemporary society. Every social trend causes some influence on the future shapes of information services in any information center, whether it is public or academic or special or similar services intuitions. On one hand, the information services are reacting to the changing trends and new dimensions in the society and on the other, the services are enhanced through the application of Information Technology (IT). The Information Communication Technology (ICT) offers avenues for easy access to information, crossing the barriers of communication.

Keywords: Digital Knowledge Management Systems (DKMS), Knowledge Access and Sharing Information for Resources Approach Objectives (KASIRAO)

PREAMBLE

Information is a pervasive element in the contemporary society. Every social trend causes some influence on the future shapes of information services in any information center, whether it is public or academic or special or similar services intuitions. On one hand, the information services are reacting to the changing trends and new dimensions in the society and on the other, the services are enhanced through the application of Information Technology (IT). The Information Communication Technology (ICT) offers avenues for easy access to information, crossing the barriers of communication.

DIGITAL KNOWLEDGE MANAGEMENT: AN OVERVIEW

Digital Knowledge Management is inevitable in the present digital technology era. It provides effective and efficient information and knowledge management services to the library user community in time on demand. The term knowledge management may be represented as a cross-disciplinary domain which can relate to a wide range of disciplines and technologies and some of which can include:

- Cognitive science
- Artificial Intelligence and Expert systems and Knowledge based Management Systems (KBMS)
- Groupware
- Library and information science
- Technical writing
- Documentation management
- Semantic Network
- Relational and Object-oriented database
- Simulation
- Management of Information
- Management of people

Definitional Analysis of Digital Knowledge Management and ICT: The concept “Digital Knowledge Management (DKM)” may be defined as a tool for supporting the creation, archiving and sharing of valued information, expertise, and insight within and across communities of people and organizations with similar interests and needs to facilitate the web-based solutions to know-how the technologies on Digital/Electronics learning [⁴] towards organizational
development. The term ‘ICTs’ may be defined as the use of hardware and software for efficient management of information, that is storage, retrieval, processing communication, diffusion and sharing of knowledge for socio-economic and cultural development.

Information and Knowledge: The term ‘Information’ may be defined as easy and quick approach to transfer information from one place to another and the term ‘Knowledge’ may be defined as slow to transfer knowledge from one person to another. The knowledge can be

- Explicit Knowledge
- Tacit knowledge
- Cultural Knowledge

The “Explicit Knowledge” can be easily described and specific enough to be documented and applied in education/training.

The “Tacit Knowledge” is harder to record and difficult to document or teach to others (heuristics often embedded in people’s experiences and life’s work). This is often the most elusive and most valuable type of knowledge. The different types of knowledge require different approaches to knowledge management [2] (KM). Each presents unique challenges and opportunities.

The term ‘Cultural Knowledge’ [3, 4] may be defined as knowledge which includes assumptions and beliefs. It is used to understand, describe and explain the reality as well as conventions. It is also useful to form the framework among organizational members, recognize the new information and evaluate interpretations and actions.

E-Learning: The term ‘e-learning/digital learning’ may be defined as the use of web-based technologies and applications for education and training combined approach with face to face classroom based teaching, education and training to the e-learning industry which includes organizations that support the establishment of learning infrastructures and networks for higher education institutions and corporations such as course management and delivery tools from Blackboard and WebCT that allow customers to create learning programmers directly on the web without investing in their own tools or infrastructure and some of the key characteristics of e-learning solutions can be identified towards organizations development.

- Relying on computer networking technologies so as to make it capable of instant updating storage/retrieval, distribution and sharing of instruction or information.
- Delivering to the learner via a computer that is connected to standard internet technologies
- Focusing on the broadest view of learning moves on education and training and delivery of information and tools to improve performance and competitiveness for information making aspects.

Digital Divide and e-learning: The term “Digital divide” may be defined as the disparity between the ‘haves’ and the ‘have-nots’ for economic development and digital equality in the technology revolution for e-learning or otherwise the gap between the individuals, households, businesses, geographic areas at different socio-economic levels with regard to both their opportunities to access with ICTs [5] (Information and Communication Technologies) and internet use in different activities towards rural sustainable development.

Digital Knowledge Management and Innovative Concept: KASIRAO: Based on the impact of ICTs on organizational, social and economic relations, the ‘Social and Educational Network Programs’ such as e-Governance, e-Culture, e-Health, e-Learning, e-Education, e-Commerce, Audio and video method of communication handling techniques, delivery strategies and pedagogical skills for teachers and instructors in the class room teaching etc., are promoting in relation to the innovative concept “KASIRAO” [6] (Knowledge Access and Sharing Information for Resources Approach Objectives) through ICTs application tools in education sectors for societal development.

Implications of Digital Knowledge Management and ICT in the University Library and Information Centers: The three stages have identified in the development of information technology (IT), the present digital knowledge environment the stage one portraits “Automated technology management”, the second stage characteristics “Information resource management” and the third stage concern with “knowledge management” based on the conceptual analysis view, the Digital Knowledge Management [7] (DKM) and ICT applications tools supporting for information storage, retrieval and dissemination systems and services in
the library, information and documentation knowledge resource centers for e-resources access to the library user community to fulfill their needs and demands in time.

From the above implications, the following inferences have been made in relation to the advantages of e-resources:

(i) e-resources provide user friendly interface.
(ii) User can access information 24X7 hours with remote access facilities
(iii) e-resources can be access by several user simultaneity.
(iv) e-resources have multidisciplinary approach.
(v) e-resources provide advance searching tools.
(vi) e-resources ignore missing issue problems.
(vii) Article on electronic form can be also print as a hardcopy.
(viii) Not required more timing for publishing and distributing Process.
(ix) e-resources is upgrade then Print version.

PROPOSED RESEARCH

The intellectual function of traditional libraries is transformed by Digital revolution. For a set of distributed activities Digital Libraries are setting up a base. For speed delivery in accurate fashion it provides a one step solution. The Concept of content management in library word the patrons demand is growing by digitalizing the library. By web the virtual references are being provided in the libraries. To create an organization the biggest challenge for the information manager in day today is to share knowledge. In a knowledge based society the workers has be innovative that is by thinking globally and designing it locally for a Quality library. In today’s world the information professionals have more opportunities who expand the digital content by getting and filtering the information which they get by which that gets elevated from managing corporate information centre to become chief information officers (CIO) with more responsibilities. Having the basic skills and attitude for such jobs the CIO’s the aspirants come out with a belief.

In different libraries the developments happens by documentation/ information centres, bibliographical services, etc., the library information is maintained at the local level as DELNET, CALIBNET and at national level it is maintained as ENVIS, NISSAT and INFLIBNE. For the benefit of the users in many libraries the access through information networks are communicated by NICNET, ERNET, SIRNET, NKN, NDL, SWAYAM and INDONET which is utilized in several countries such as CAS, SDI.

STATEMENT OF THE RESEARCH TITLE

“Digital Knowledge Management in the University Library and Information Centers in Chennai (Madras): An Analytical Study”.

Explanation of the Concepts

Digital Knowledge Management and ICT: The concept “Digital Knowledge Management (DKM)” may be defined as a tool for supporting the creation, archiving and sharing of valued information, expertise, and insight within and across communities of people and organizations with similar interests and needs to facilitate the web-based solutions to know-how the technologies on Digital/Electronics learning towards organizational development.

The term ‘ICTs’ may be defined as the use of hardware and software for efficient management of information, that is storage, retrieval, processing communication, diffusion and sharing of knowledge for socio-economic and cultural development. (More account on Digital Knowledge Management (DKM)” has been given in the Section 1.2)

University Library and Information Centers in Chennai: In the city of Chennai, there are about 24 university library and information centers comprising of State, Central and Deemed universities are considered for the study.

OBJECTIVES

The study has been conducted with the following objectives:

(i) To survey the University Library and Information centers on Digital Knowledge Management and ICT applications in and around Chennai (Madras).
(ii) To study the nature of Digital Knowledge Management Resource access facilities in libraries under survey.

(iii) To examine the availability of digital knowledge management information products and services.

(iv) To analyze the impact of Digital Knowledge Management on collection development and professional development policies in Library and Information Centers.

(v) To elicit the opinion of the Library user community and LIS professionals on digital knowledge management resources access facilities in the University Library and Information Centers.

(vi) To identify the constraints, if any, towards digital knowledge management resources access facilities in the University Library and Information Centers.

(vii) To offer suggestions for effective implementation of ICT applications tools for digital knowledge management services in the Library and Information Centers.

**HYPOTHESES**

Based on the observations, the following hypotheses were framed:

(i) Majority of the university library and information centers in Chennai have implemented ICT application tools for the provision of Digital Knowledge Management (DKM) information products and services.

(ii) Application of ICT is more prominent in state University libraries than the Deemed University libraries

(iii) Among the Central and deemed University libraries, the state university libraries are in better position in the adoption of ICT in Digital Knowledge Management services.

(iv) Majority of the University libraries and Information Centers are using commercially developed library software packages.

(v) There is an increasing trend in the provision of DKM information products and services.

(vi) The concept of resource sharing is not much prevalent/common among the library and information centers.

(vii) The ICT serves as a tool in the Collection Development Policy (CDP) programs in the library and information centers under survey.

(viii) The application of Information Technology (IT) influences the man power planning and development in library and information centers.

(ix) Library staff has passive attitude towards ICT applications towards DKM services in library and information centers.

(x) Factors like lack of finance, lack of training etc. hinder the promotion of ICT in library and information centers under survey.

**SIGNIFICANCE**

The study is significant in the following respects:

(i) The study of this nature brings the state-of-the–Art of the University Library and Information Centers in Chennai, projecting the Digital Knowledge Management (DKM) services.

(ii) It also examines a comparison of ICT application in state and deemed university library and information centers.

(iii) Results of the study would influence the top management so as to strengthen/streamline the existing set-up of library operation.

(iv) This study would pave the way to conduct similar studies in other geographical territories.

**LIMITATIONS**

(i) The research study excludes the library and information centers, which do not have application of ICT and Digital Knowledge Management information products and services.

(ii) The opinions/views are from the Head of the Library and Information Centers and the library user community are considered and not from the other staff.

(iii) It does not cover the public and school libraries.

**METHODOLOGY**

The research design/methodology involves in the following respects:
The literature on “Digital Knowledge Management, Information needs and seeking behavior of the user community in the University Library and Information Centers” has to study and review for facilitating the questionnaire construction. The Questionnaire methods serve as tool to collect data from the Library and Information Centers.

MAJOR FINDINGS
1. It is found that application of digital knowledge management is mostly seen in the state university libraries. Among the central university libraries and deemed university libraries have evinced interest in digital knowledge management and ICT applications.
2. Different types of services are being provided by the libraries under survey, which are broadly grouped as traditional, documentation and IT based services.
3. Majority of the libraries used commercial developed software packages.
4. It is found that a small proportion of staff are deputed for various professional advanced programs.
5. The applications of DKM and ICT have an impact on Collection Development Policy and professional Development Policy.
6. Libraries have positive attitude towards application of DKM and ICT. The staff in university libraries has shown a higher degree of positive attitude towards DKM and ICT.
7. However certain barriers such as insufficient funds, lack of adequate trained staff, lack of coordination, initiative on the part of library professionals and fear of modern information technology etc., have been identified that come in the way of DKM applications.

RESULTS AND DISCUSSION
1. It is suggested that university library and information officers shall strive a right choice between printed and electronic resources of publication.
2. It is suggested that the internet based services such as e-mail shall be made available to the clientele of the libraries, as being provided by the libraries in the West.
3. It is suggested that launching the under mentioned programmes to achieve the goals of man power development in the ICT era.
   - Recruitment of expertise in DKM and ICT.
   - Establishment of Digital Knowledge Centers.
   - Establishment of audio-visual and teleconference centers.
4. It is suggested that National Task Force (NTF) shall be implemented in action plan to motivate the LIS professionals.
   - Design and development of Mobile-OPAC and SMS alerts.
   - University library is to establish the digital knowledge resource center.
   - RFID technology and QR technologies.
   - Social network via services to the library users
5. It is suggested that the need of joining in a national knowledge network (NKN) NPTEL, SWAYAM and NDL to the university libraries
   - internet based Digital knowledge management services to the university libraries
   - internet based Research support services to the university libraries
6. It is suggested that the implementation of e-learning resource materials to the university libraries
   - the implementation of multimedia literature materials to the university libraries
   - the implementation of digital reference services
   - the implementation of federated search engine facility to the university libraries
   - Remote access facilities to the university library users.
   - the implementation of Digital notice board to the user communities
- Use of Cloud computing facilities to the User communities in the libraries
- The MoU with the foreign university libraries for the technological access facilities and services

CONCLUSION

The Web technology plays a vital role in Digital Knowledge Management for Knowledge Access Sharing Information for Resources Approach Objectives (KASIRAO) on academic related knowledge resources to provide web knowledge applications related services to the University library user community in an effective manner in the present web knowledge based society.

Ethical Clearance: Taken from AMET University

Source of Funding: Nil

Conflict of Interest: Nil

REFERENCES


Role of Information and Communication Technology (ICT): A Conceptual Analysis

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ABSTRACT

Information and Communication Technology (ICT) plays a vital role for knowledge indicators for knowledge access and sharing information for resource approach objectives (KASIRAO) in higher learning institutions for women’s empowerment and quality education towards sustainable development in the present network knowledge society.

Keywords: ICT, Knowledge sharing, educational policies, quality education

INTRODUCTION

Information and Communication Technology (ICT) plays a vital role for knowledge indicators for knowledge access and sharing information for resource approach objectives (KASIRAO) in higher learning institutions on Educational policy strategies (EPS) for women’s empowerment and quality education towards sustainable development in the present network knowledge society. The term ICT is generally used to utilize a board spectrum of industrial and business services namely computer science (CS), information systems (IS), information technology (IT), software engineering (SE), and e-business with both tough skills like a systems and programming enhancement) and soft skills in communication & interpersonal development\textsuperscript{[1]}. Here, attempt has been designed to analyze the response of the businessman towards ICT as a source of reliable and timely information behalf of best production \textsuperscript{[2]}. It farmer development through ICT, like practices, processing, marketing, input and output cost, financial and risk covering\textsuperscript{[3]} The main utilization of ICT is one of the important aspects of agriculture extension\textsuperscript{[5]} ICT is a vital investment which generates satisfactory returns for emerging economy enterprises. ICT actually improves more value to productivity when a focal emerging economy is less economically developed\textsuperscript{[4]}.

ICT AND HIGHER EDUCATION TOWARDS SOCIETAL DEVELOPMENT

The ICT plays a major vital role in teaching and learning and challenges facing higher education resolve around student diversity, which includes, amongst others, diversity in students’ academic preparedness, language and schooling background. Investigating of online information seeking behavior of the students is explained in \textsuperscript{[6]}. The education is perhaps the most strategic area of intervention for the empowerment of girls and women in any society and the use of ICT as an educational tool in the promotion of women’s professional advancement in view of socio-economic development. ICT provides the new ways in which people can communicate, enquire, make decisions and solve problems. They are the processes, tools and techniques for the following knowledge indicators for

- Gathering and identifying the information
- Classification organizing the information
- Summarizing and synthesizing information
- Analyzing and evaluating the information and
- Speculating and predicting the information

The ICT can improve the quality of education in the number of ways such as augmenting students’ enthusiasm by making possible the acquirement of fundamental skills and by improving teacher education and training in higher learning institutions towards sustainable development in the present digital knowledge society. User Study Satisfaction and Resource Center Services is illustrated in \textsuperscript{[7]}. DOI Number: 10.5958/0974-1283.2018.00092.0
BRIDGING DIVERSITY DIVIDE-
GLOBALIZATION AND RECIPROCAL
EMPOWERMENT IN HIGHER EDUCATION
–A DESCRIPTIVE ANALYSIS

The concrete approaches and tools are essential in the higher learning educational institutions to assist the educational leaders and educators in the creation of a genuinely inclusive campus culture. Based on the conceptual analysis in the changing landscape and the compelling need for diversity to provide an overview of forces that have historically inhibited the inclusion of women and minority faculty and staff in higher education and to discuss how globalization has reshaped the landscape for higher education and created a compelling mandate towards the attainment of inclusive compass environments.

WOMEN AND ICT: AN INDIAN SCENARIO

A large group of working women of India is in the rural and unorganized sectors. Socially the majorities of the Indian women are still in tradition way in information access and are in a disadvantageous position in equality in women’s access to information and participation in all communication systems, especially the media and their insufficient mobilization to promote women’s contributions in the society. Since the mobilization is opening up for advances in ICT towards information access in the knowledge network society, ICT policies, and guidelines should be focused for information access towards women’s environment in the present e-knowledge society.

CONSTRAINTS IN WOMEN’S EMPOWERMENT: A KEY NOTE

The constraints of Indian women over the ages are as indicated below:

- Patriarchy and social pressures
- Gender inequality
- Caste based discrimination and social restrictions
- Poverty
- Insufficient advancement facilities towards information access and the knowledge network environment

SCIENCE AND TECHNOLOGY FOCUS
AND LEADERSHIP ROLL IN HIGHER EDUCATION INSTITUTIONS

The leadership quality, leadership attitudes, leadership skills are essential for science and technology focus on knowledge dissemination and access. In view of this, the leaders should formulate the vision of their institutions to create the scientific knowledge awareness amongst staff, students and the public to know how and show how the knowledge on science and technology innovations and to apply the modern technology to tackle the socio-economic challenges in higher learning institutions towards sustainable development[8]

GENDER EQUALITY IN HIGHER LEARNING INSTITUTIONS: An ASSESSMENT APPROACH

The assessment approach is essential for the gender equality to identify its impact on higher learning institutions. Based on the conceptual analysis view, the international consensus on education priorities accord an important place to achieving gender justice in the educational sphere in relation to the Millennium Development Goals(MDGs) such as gender parity goals in view of achieving equal participation of girls and boys in all forms of education based on their proportion in the relevant age-groups in the population and the gender equality goals ensuing educational quality between boys and girls which in turn these have been characterized as quantitative and qualitative goals aspects.

CONCLUDING REMARKS

Based on the Conference theme “Women’s Empowerment(EW) and Quality Education(QE) in higher level institutions”, the following suggestions were identified towards concluding remarks aspects:

- Educational Policy Strategies(EPS): Realizing the importance of“Educational Policy Strategies(EPS), it is suggested that the state and central planning in the budget allocation should be redesigned to the Educational Policy Strategies(EPS) to promote gender equality for Quality Education(QE) in all areas of Education and with the aim of increasing female students participation in Higher Education(HE)[9].
• **Faculty Mentoring Programs**: Realizing the importance of “Faculty Mentoring Programs”, it is suggested that the top management should motivate this kind of programs in higher learning institutions to empower faculty and ultimately benefit the institutions and improve the quality of higher educations.

• **Knowledge Dissemination and Knowledge Sharing Values**: Realizing the importance of “knowledge dissemination and knowledge sharing values” in higher learning institutions, it is suggested that the top management should realize the knowledge sharing values and the vital role of the Information and Documentation knowledge resource centers and knowledge access. In view of this, the knowledge resource centers need to have ICT letter and ICT related provisions for information products and services in know how and show how the scientific innovations for women’s empowerment and quality education.

• **Educational System Planning Strategies and Quality Improvement in Higher Education**: In view of the changing scenario the higher education policy towards sustainable development in higher leaning educational institutions, it is essential that appropriate long-term planning strategies should be redesigned and developed on networks/collective approach knowledge resources access facilities in ICT environment towards Quality improvement in higher education.

• **Web-Knowledge Information Resources access facilities and social development programs**: Identifying the importance of web knowledge information resources and their access facilities in the information and documentation knowledge resource centers, it is essential that the higher education management should give more attention on web-knowledge access facilities in the institutions to generate innovative ideas for societal development programs concerning health, education, literacy, shelter, employment opportunities, family planning and population and gender for rural community sustainable development.

**DISCUSSIONS**

The Need for Information Communication Technology towards Women’s Empowerment: a Brief Note

The ICT related knowledge resources and the access towards women’s empowerment pertaining to offer the right platform for surviving in world(9):

• Resources
• Educational opportunities including abroad prospects
• Career advancement facilities
• Health and child care facilities
• Social support for working women on legal rights and provisions
• Information relating to the government programs for the rural poor and how to deal with the procedure
• Job opportunities in both formal and informal sectors.

The system revealed organizational culture significantly to influences knowledge contribution and job satisfaction(10). The knowledge sharing is vital role ole between organizational culture and job satisfaction.

**Ethical Clearance**: AMET University

**Source of Funding**: Self

**Conflict of Interest**: Nil

**REFERENCES**


Database Knowledge Indicators in Research and Development: A Scientometric Study

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ABSTRACT

The ‘Scientometric study’ is an analysis of Literature with mathematical and Statistical methods in information use and seeking pattern approaches in a particular field of Information products and services for ‘Knowledge Indicators’ towards Organisational Development. The Impact of Scientific Research on Scientific Community could be testified by citation analysis. The citation analysis is an analytical methodology under ‘Scientometrics’ used to evaluate research programmes.

In view of this, Indian Journal of Engineering and materials Sciences (IJEMS) Periodical Publication Knowledge Resources serve as a tool for Knowledge Indicators in Engineering and materials sciences research for sustainable development.

The present case study is dealt with IJEMS database on Scientometric analysis of literature in Engineering and Materials Sciences (EMS) during the period from (1994 -1997) in IJEMS database. The design of the study is a Citation Analysis Approach (CAA). The purpose of the study is to investigate through citation analysis on dissemination of Knowledge in Engineering and Materials Sciences towards organisational development. Descriptive statistics was used in analysing the data. About 14 sub-fields were identified under EMS under study. Based on the study, out of 224 citations 59 citations (26.3%) are from (I) Mechanical Engineering Knowledge Resources’ 31 citations (13.83%) are from (II) physics and 19 citation (8.48%) are from (III) Electrical and Electronic Engineering (EEE). The highest number of research contribution totalling 59 (26.3%) has been emanated from Mechanical Engineering under survey.

The document-wise distribution of research contributions indicated that out of 224 citations, 72(32.14%) are from Research Articles/Papers. About 73 citations (32.58%) were identified from universities/higher education institutions under institution-wise distribution of research contributions, 55 citations/research contributions (13.83%) are from academic institutions colleges. The highest number of research contributions has been emanated from higher education institutions / universities.

It is evident from the study that majority of the Research Contributions/Papers 190 (84.83%) are from co-authored pattern collaborative efforts in Engineering and Materials Sciences research. The analysis indicated that the Scientists preferred to publish research papers in Joint authorship (84.83%) having 0.84. degree of collaboration. The scientometric software ‘Scientosoft’, technology application tools used for this purpose. The single authored research contributions 34 (15.17%) is also well recognised feature in Engineering of Materials Sciences research innovations towards organisational development.

The study encourages the researchers to initiate collaborative efforts for inter-disciplinary research activities particularly Applied Chemistry, Applied Physics, Applied Mechanics, Mining and Petroleum Engineering for sustainable development.

Keywords: Scientometric study, impact on Engineering and materials sciences, Indian Journal of Engineering and Materials Sciences (IJEMS) database, Knowledge Indicators/Dissemination, Engineering and Materials Sciences Research, sustainable development.
INTRODUCTION

The Information and Documentation Knowledge Management play a vital role in content analysis and content management for subject inclusion in leather and allied fields including the present paper theme concept study on Engineering and Materials Sciences (EMS) in Indian Journal Engineering and Material Sciences (IJEMS) International Periodical Publication Science (PPS). The IJEMS Periodical Publication Knowledge Resources serve as tool for knowledge Indicators both for current as well as retrospective R&D supporting services for Knowledge Access and Sharing Information for Research Approach Objectives (KASIRAO) towards sustainable development in engineering and allied fields.

SCOPE AND OBJECTIVES

The scope and objectives have been ‘identified through ‘Scientometric studies’ impact on Engineering and Material Science (EMS) knowledge indicators towards sustainable development.

The scope and objectives as indicated in the following respects:

- To identify the sub-fields-wise distribution resource contributions/citations in EMS in IJEMS database.
- To identify the rank-wise distribution of knowledge resources/contributions in IJEMS database.
- To identify the Documentation-wise distribution of research contributions in IJEMS database.
- To evaluate the institution-wise distribution of research contributions in IJEMS database.
- To identify the geographical-wise distribution of research contributions in IJEMS.

HYPOTHESES

Based on the Objectives, stated in the ‘Scientometric Studies’ in relation to Engineering of Material Sciences (EMS) [1] research contributions using IJEMS database, the following hypotheses were framed:

- There exists a considerable level of various in different sub-fields in EMS research aspects.
- There exists a significant level of difference between the engineering and materials sciences research contributions from India and other countries in relation to EMS towards sustainable development.

Limitations of the Study: The study is confined to the ‘Scientometric Analysis’ of literature in EMS research contributions covered in the Indian Journal of Engineering and Materials Sciences (IJEMS) database from the period from 1994 -1997.

Significance of the Study

- The study of the nature brings the state-of-the-Art of the Engineering Research activities in engineering related fields and its (scientometric study) application in engineering sub-fields for knowledge indicators towards sustainable development in engineering research.
- The study would pave the way to other academic and R&D institutions to provide similar services in their respective discipline towards organizational development.

METHODOLOGY

The study is an exploratory research and relies upon review of literature/data available with Knowledge resources in IJEMS database. The IJEMS database knowledge resource was selected as a tool for data collection, analysis and interpretation towards this research study.

Indian Journal of Engineering And Materials Sciences (IJEMS): The Indian Journal of Engineering of Materials Sciences (IJEMS) is the bimonthly Periodical Publications Services (PPS) in association with the Indian National Science Academy. The IJEMS periodical publication services as a tool for knowledge indicators in Engineering and Materials Sciences for Knowledge Access and Sharing Information for Research Approach Objectives (KASIRAO) towards organisational development.[8] Divulging the teacher’s job satisfaction effect on better work performance. Integrated environmental management[9] for sustained development is discussed in this literature for employee satisfaction. Analyzing the motivational spirit of employees after training period in mahanagar telephone nigam limited (MTNL) and its evaluation is reported[10].
DISCUSSION WITH RESULTS

The ‘Scientoemtric Study’ serves as a tool for scatterings of research articles over journals, growth of literature, and productivity of impact of research. Based on the impact of research, the application of ‘Scientometric Study’ serves as a tool for knowledge indicators in EMS research contributions with access to IJEMS database on Subjects, Authors, Documentation, Institutions and Geographical-Wise distribution of research contributions pertaining to volume (1-4) and the year from 1994-1997 under survey. The research study results and discussed in the ensuing sections from 8.1 - 8.5

Volume-wise and total break up of Authorship Pattern research contributions in Engineering Materials Sciences (EMS)

Table 1 provides the authorship pattern research contributions in relation to Engineering Materials Sciences (EMS).

The author-wise analysis of citations indicated that the majority research papers/contributions 190 (84.82%) are from co-authored pattern/collaborative efforts in Engineering and materials Sciences Research. The analysis is also indicated that the scientist preferred to publish the research papers in joint authorship (84.82%) having 0.84 degree of collaboration. The ‘Scientosoft’ technology [2] tools used for this purpose. The single authored research contributions 34 (15.17%) is also well regained features in the EMS. The single author and co-author patterns presented in Table 1 establish that the number of multi-authored research contribution (‘N’ marc) in Engineering and Material Sciences (EMS) contributions are more under survey. Based on the study, the number of single authored research contributions (‘N’ sarc) in relation to Engineering and Materials Sciences fields is low. The degree of collaboration calculated using V. KASIRAO formula invented by the author. V. KASIRAO formula may be stated as follows:

\[ DC = \frac{N \text{ marc}}{N \text{ marc} + N \text{ sarc}} \]

Where DC = Degree of Collaboration in particular discipline

‘N’ marc = No of multi-authored research contributions in a particular discipline for certain period of study.

‘N’ sarc = No. of single-authored research contributions for the same period

How the Degree of collaborations (DC) can be calculated in a particular field of database sources of study is indicated below:

Database Name (for example); Leather Science Abstract [3] (LESA) and Indexing Monthly International Periodical publication services in leather and allied fields towards leather industries development in CLRI. Here, Indian Journal of Engineering and Materials Sciences (IJEMS) database used as a tool for the study.

Table 1: Volume-wise and total break up of Authorship Pattern research contributions in Engineering Materials Science (EMS)

<table>
<thead>
<tr>
<th>S. No</th>
<th>Vol. No</th>
<th>Year</th>
<th>Single Authors</th>
<th>Two Authors</th>
<th>Three Authors</th>
<th>More than Three</th>
<th>Citation from Periodical Sources</th>
<th>Total of Multiple Authors</th>
<th>Percentage</th>
<th>Total of research contribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>1</td>
<td>1994</td>
<td>7</td>
<td>27</td>
<td>12</td>
<td>7</td>
<td>10</td>
<td>56</td>
<td>28.12</td>
<td>63</td>
</tr>
<tr>
<td>2.</td>
<td>2</td>
<td>1995</td>
<td>8</td>
<td>22</td>
<td>10</td>
<td>8</td>
<td>6</td>
<td>46</td>
<td>24.15</td>
<td>54</td>
</tr>
<tr>
<td>3.</td>
<td>3</td>
<td>1996</td>
<td>10</td>
<td>13</td>
<td>14</td>
<td>10</td>
<td>10</td>
<td>47</td>
<td>25.44</td>
<td>57</td>
</tr>
<tr>
<td>4.</td>
<td>4</td>
<td>1997</td>
<td>9</td>
<td>15</td>
<td>11</td>
<td>6</td>
<td>9</td>
<td>41</td>
<td>25.44</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>34</td>
<td>77</td>
<td>47</td>
<td>31</td>
<td>35</td>
<td>190</td>
<td>100</td>
<td>224</td>
</tr>
</tbody>
</table>
Table 2: Subject-wise distribution of research contributions in EMS in IJEMS

<table>
<thead>
<tr>
<th>S. No</th>
<th>Subject coverage in IJEMS</th>
<th>Coverage for Total No. records n=224 (Year - 1994-1997)</th>
<th>RANK</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1994</td>
<td>1995</td>
<td>1996</td>
</tr>
<tr>
<td>1.</td>
<td>Mechanical Engineering</td>
<td>22</td>
<td>14</td>
<td>19</td>
</tr>
<tr>
<td>2.</td>
<td>Automobile Engineering</td>
<td>5</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td>3.</td>
<td>Civil Engineering</td>
<td>4</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>4.</td>
<td>Metallurgical Engineering</td>
<td>3</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>5.</td>
<td>Structural Engineering</td>
<td>2</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>6.</td>
<td>Applied physics</td>
<td>2</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>7.</td>
<td>Physics</td>
<td>2</td>
<td>10</td>
<td>2</td>
</tr>
<tr>
<td>8.</td>
<td>Applied Mechanics</td>
<td>5</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>9.</td>
<td>Chemical Engineering</td>
<td>1</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>10.</td>
<td>Mining Engineering</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>11.</td>
<td>Electrical &amp; Electronic Engineering</td>
<td>4</td>
<td>9</td>
<td>4</td>
</tr>
<tr>
<td>12.</td>
<td>Petroleum Engineering</td>
<td>2</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>13.</td>
<td>Chemistry</td>
<td>3</td>
<td>3</td>
<td>8</td>
</tr>
<tr>
<td>14.</td>
<td>Applied Chemistry</td>
<td>4</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

It is observed from Table 2 with regard to sub-field area wise distributions of research contributions/citations analysis of records in IJEMS database in EMS indicate that out of 224 citations in Engineering and Materials Sciences research contributions for in engineering and materials sciences towards sustainable development. Table 2 provides the subject-wise distribution of research contributions in EMS under study. Based the citations study, 59 records (26.3%) are from Mechanical Engineering, 31 records/citations (13.83%) are from physics, 19 records/citations (8.48%) are from Electrical and Electronics Engineering (EEE) and followed by other sub-fields knowledge indicators in EMS as stated in the above table. The research contributions are more from ‘Mechanical Engineering Knowledge Resources’ and stand at number one in ranking under survey.

Institution-Wise Distribution Research Contributions/Knowledge indicators in Engineering and Materials Sciences (EMS) access with (IJEMS) database

Table 3 provides the Institution-wise Distribution Research Contributions/ Knowledge indicators in EMS under study.

Table 3: Institution-wise Distribution Research Contributions/Knowledge indicators in Engineering and Materials Sciences (EMS) access with (IJEMS)

<table>
<thead>
<tr>
<th>S. No</th>
<th>Types of Institutions</th>
<th>Coverage for Total No. records n=224 (Year-1994-1997)</th>
<th>RANK</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1994</td>
<td>1995</td>
<td>1996</td>
</tr>
<tr>
<td>1.</td>
<td>Technology Oriented Institutions</td>
<td>20</td>
<td>14</td>
<td>10</td>
</tr>
<tr>
<td>2.</td>
<td>College</td>
<td>5</td>
<td>13</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>University</td>
<td>14</td>
<td>21</td>
<td>14</td>
</tr>
<tr>
<td>4.</td>
<td>Research Laboratories</td>
<td>8</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>5.</td>
<td>Space Center</td>
<td>2</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>6.</td>
<td>Atomic Research Center</td>
<td>1</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>7.</td>
<td>Others</td>
<td>7</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>224</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table - 3 provides the institution-wise distribution of research contributions from IJEMS database (1994-11997) under study. It is observed from Table - 3 in relation to institution-wise citation analysis of contributions in IJEMS database indicate that out of 224 citations 73 citations nearly (33%) are from University’s contributions, 55 citations nearly (25%) are from Technology oriented institutions and followed by other sources as stated in the above table. The research contributions are more from universities and stand at number one in ranking under study.

Table 4: Document-wise distribution of citations/research contributions in IJEMS database in EMS.

<table>
<thead>
<tr>
<th>S. No</th>
<th>Types of Institutions</th>
<th>Coverage for Total No. records n = 224 (Year-1994-1997)</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1994</td>
<td>1995</td>
</tr>
<tr>
<td>1.</td>
<td>Article</td>
<td>19</td>
<td>15</td>
</tr>
<tr>
<td>2.</td>
<td>Review Papers</td>
<td>12</td>
<td>4</td>
</tr>
<tr>
<td>3.</td>
<td>Conference Reports</td>
<td>10</td>
<td>6</td>
</tr>
<tr>
<td>4.</td>
<td>IPR New</td>
<td>12</td>
<td>13</td>
</tr>
<tr>
<td>5.</td>
<td>Technical Notes</td>
<td>9</td>
<td>6</td>
</tr>
<tr>
<td>6.</td>
<td>Annual Reports</td>
<td>8</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table - 4 provides the document-wise distribution of research contributions/citations in IJEMS database in EMS. The document-wise distribution of Citations/research contributions in IJEMS database in relation to EMS related fields indicated that out of 224 records, 72 citations (32.14%) are from research papers, 37 citations (16.51%) are from IPR related Knowledge resources, 32 citations (14.28%) are from reviewed papers and followed by other sources as stated in the above table. The contributions are more from research papers are stand at number one in ranking.

Table 5: Geographical - Wise distributions of research contributions in IJEMS database

<table>
<thead>
<tr>
<th>S. No</th>
<th>Types of Institutions</th>
<th>Coverage for Total No. records n = 224 (Year-1994-1997)</th>
<th>RANK</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1994</td>
<td>1995</td>
<td>1996</td>
</tr>
<tr>
<td>1.</td>
<td>Bangladesh</td>
<td>3</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>2.</td>
<td>Canada</td>
<td>4</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>3.</td>
<td>Egypt</td>
<td>13</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>4.</td>
<td>Ethiopia</td>
<td>2</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>5.</td>
<td>India</td>
<td>15</td>
<td>23</td>
<td>16</td>
</tr>
<tr>
<td>6.</td>
<td>Israel</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>7.</td>
<td>Japan</td>
<td>2</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>8.</td>
<td>Mizonam</td>
<td>2</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>9.</td>
<td>Nigeria</td>
<td>6</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>10.</td>
<td>Saudi Arabia</td>
<td>5</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>11.</td>
<td>Singapore</td>
<td>2</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>12.</td>
<td>Tanzania</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>13.</td>
<td>Yugoslavia</td>
<td>3</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

The Geographical-wise distributions of research contributions in IJEMS database with access to Engineering and Materials Sciences (EMS) Knowledge resources/ citations in IJEMS database, 80 records/citations (35.71%) are from India, 22 citations (9.82%) are from Egypt and 15 records citations (6.69%) are from Japan and other Knowledge resources as indicated in the above Table 5. The research contributions are more from India and stand at number one in ranking.
FINDINGS OF THE STUDY

- The study shows that the publications of research papers/articles are more (32.14%) under study in IJEMS database in relations to EMS and this kind of knowledge resources have witnessed an escalating trend from the study for the period from 1994-1997.

- The study shows that majority of the researchers preferred to publish research papers in Joint authorship 190 having 0.84 degrees of collaborations.

- About 14 sub-fields were identified in relation to IJEMS in EMS out of 224 citations/research contributions, 59 citations (26.3%) are from ‘Mechanical Engineering Knowledge Resources’ under survey.

- The highest numbers of citations totalling 73 (32.58%) have been emanated from higher education institutions/universities.

- The research contributions are more 80 (35.71%) are from ‘India’ and stand at number one in ranking under geographical-wise distributions of research contributions under study.

CONCLUSION

The Research study reported the following concluding remarks:

- The Indian Journal of Engineering and Materials Sciences periodical publication Knowledge disseminations resources for Knowledge Access and Sharing Information for Research Approach Objectives (KASIRAO) in Engineering and Materials Sciences (EMS) related fields towards sustainable development.

- The Citations Study Approach (CSA) is an imperative measure to identify the research trends in the fields of Engineering Science knowledge resources towards organisational development.

- The ‘Scientometric study’ would create an awareness concerned scholars regarding core authors, core journals that publish the literature, areas where more research is being conducted and areas where more research needs to be done towards organizational development.

- The Indian Journal of Engineering and materials sciences periodical publication services of this kind of covered in this study will enable the academic and R&D institutions to provide similar services in their respective fields towards organisational development.

- The ‘Scientometric study’ as a tool for knowledge indicators “Impact Factor” (IF) analysis in a particular field of research interest towards organisation development. The impact factor is quality indicator to evaluate the researchers, scientific journals and institutions. It is also useful in comparing various journals that are in the same field. In view of this the present study in relation to EMS innovations in engineering research as the supporting sources for sustainable development.

Ethical Clearance: Taken from AMET University

Source of Funding: Self

Conflict of Interest: Nil

REFERENCES


of Indian Leather Technologist’s Association (JILTA), 59:317-327.


Developing Electronic Libraries in The Professional Colleges

K. Sekar¹, V. Kasirao², G. Loganathan³

¹²LibrarianAMET University Central Library, AMET University, Kanathur, Chennai;
²Scientist, CSIR- CLRI, Ministry of Science and Technology, Govt. of India, Adyar, Chennai-600020

ABSTRACT

Information Technology (IT) and network technology have been boost to the development of Electronic publishing and have converted the traditional libraries to electronic libraries. Electronic / digital resources are revolutionizing libraries across the world and there is a sharp transformation in the nature of library collections. In order to keep pace with this trend and meet user needs it is essential that libraries must incorporate criteria for the selection of materials in new formats, while also maintaining traditional collections. The librarian is also forced to use IT tools effectively to render services and to redefine the process of collection development. There are various issues related to the acquisition, preservation, copyright, licensing and access to these electronic resources which are more critical that the print format. In this paper, attempt have been made to highlight some of these key issues.

Keywords: Electronic libraries, electronic resources, ICT (Information and Communication Technology) etc.

INTRODUCTION

The growth of internet and the availability of enormous volume of information in electronic/digital form have necessitated the growth of e-libraries. By adopting emerging technologies, libraries are reshaping its collections and services by organizing, managing and disseminating information in an electronic format. Building an electronic library collection is described in¹. Due to an explosion of electronic resources in the form of journals, books, newspapers, magazines, data, images, music and other audio, videos etc. it has become essential for libraries to store information electronically. Electronic resources: Collection development is discussed in². As the electronic resources change at a very rapid pace, finding ways to manage them effectively, from selection to licensing is becoming a major challenge for libraries. The Kovacs guide to electronic library collection development is determined in³. There are certain issues related to e-resources like acquisition, access restrictions, authentication, copyright, preservation, software and the user interface. In addition to acquiring and managing e-resources, it is also essential that library professionals must educate users on the usage and access to electronic resources. Digital information systems and services is illustrated in⁴.

Libraries have evolved from paper based storehouse of books and journals, into distributed network of electronic information and knowledge, now known as electronic libraries (E-libraries). Advances in digital library initiatives: a developing country perspective is explained in⁵. In electronic, information is stored electronically and made accessible to the users through networks. Because of the user preference for the electronic format, these resources are becoming essential in library collection. Information Processing and Management is explained in⁶. The collections in E-libraries are developed and maintained to meet the information needs of a given user community. “Electronic resources” refer to those materials that require computer access and may either be accessed locally or remotely via the internet. OCLC Online Computer Library Center is said in⁷.

E-Resources and Collection Development: The libraries, along with their traditional holdings have now added various types electronic information resources like E-Journals, E-books, Full-text databases. E-reports, CD ROM and DVD-ROM databases, online databases, and internet resources as depicted in Fig. 1.

Libraries have started subscribing the e-resources because of their multi dimensional features compared to the print sources. Different skills and systems are required to handle and manage these resources. Some of the advantages of e-resources are they allow remote access across geographical barriers, can be simultaneously accessed by more than one user,
support searching capabilities with unique features ie. multimedia information, and save physical storage space and do not require physical accessing e.g. receiving and binding.

Although e-resources offer above mentioned advantages, there are certain issues like infrastructure costs, need of technical support/training, concerns about copyright issues and archiving, complex licensing agreements and lack of uniformity and consistency in the format/user interface etc.

Collection development is the process of systematically building library collections to serve the needs of the users. It is essential to answer certain questions before developing an e-library like “why do we need an e-library collection?”, “Who are our users and what are their needs?”. How the collections will be organized and accessed. Due to budget constraints, it is essential to evaluate e-resources before purchase, based on an in-depth knowledge of the user’s needs and availability of electronic resources enables remote access to the information, it also simultaneously presents certain issues and challenges not encountered with traditional materials.

Availability of Electronic Resources: Electronic Resources are subscribed by the professional colleges are mandatory. Some of the E-resources subscribed by the professional colleges are e-journals, e-books and e-services. Available E-journals, e-book packages are IEEE, ASPP, ASCE/ASME, Science Direct, Springer, McGraw Hill, J Gate, GREENR, ASTM, N-LIST, NPTEL, ACI, DELNET, KNIMBUS etc. in the professional colleges.

The e-services provided are Library’s e-group is e-mail group and library OPAC though the intranet connected systems within the campus. The communications, circulars and other important infrastructures are sent through the library e-groups services collectively.

Use of ICT in the E-libraries: Through digital forms these devices, tools, content, resources, forums and services that are electronic can be converted and delivered in Information and Communication Technologies. Interactive digital content, satellite communication, web based content repositories, interactive forums are included in this. In this Learning management systems and management information systems are included. For effective utilization of enhancing access to resources, realizing the goals and teaching learning process, management of the professional education system and building capabilities these are deployed.

Web-enabled Collective Intelligence in Professional Education: The concept of collective intelligence is coming more and more to the force for growing interest in complex adaptive systems. Web-enabled collective intelligence is based on linking knowledge workers through social media a group of individuals can be smarter in many ways, this being a basic motive.

Professional Development and ICT: For the purpose of having reciprocal interactions and developing a sense of community, both of which facilitate professional connectedness ICT can be used as a link for assisting professional students. For providing opportunities to enhance the professional development of students in their profession through offline and online modes Digital resources and technologies can be used effectively as a catalyst for better opportunities.

Educational Innovation and ICT: ICT has proved to be one of the most effective modes of dissemination of knowledge in the formal, non-formal and informal sectors of education. ICT can be an effective tool is supporting various aspects in professional education institutions, if used appropriately for specific purposes in a specific content.

Issues and Challenges in developing e-libraries: The challenges of integrating electronic resources and technologies are many and need to be considered including content, functionality, pricing, infrastructure,
access, technological obsolescence, licensing ownership and copyright. Therefore, before purchasing e-resources it is essential to evaluate and form policies to integrate this new technology as described below.

Content and pricing: It is essential to determine the media/format in which the content should be acquired, frequency of updates, the availability of back issues, archiving policies etc.

As the pricing models of electronic resources vary significantly, libraries while subscribing should consider the cost and other additional benefits like savings in physical storage, increased availability, improved access or functionality. In terms of access and archival, the best model which meets the needs of the library should be considered.

Infrastructure requirements: It is essential to ensure that library has proper infrastructure i.e. hardware and software and has the capability to provide and effectively maintain access to resources on an ongoing and cost effective basis.

The various methods of access either IP-authentication or login/password need to be considered. Access via IP filtering is often preferable because it provides simultaneous access to multiple users. Also, IP-address recognition allows authorized library users to access content from outside the physical boundary of the library via a proxy server. The resources should be compatible across a wide range of platforms and web browsers. Library should also provide training to its users about the resources and browser requirements.

ANALYSIS AND DISCUSSIONS

Functionality and reliability: The interface should be user friendly, easy to navigate, and users should be able to save search history etc. It should offer a powerful and flexible search engine with features like keyword and Boolean searching, full-text searching, truncation, relevancy ranking etc. The system on which the e-resources are hosted should be available 24/7 and reliable with minimum downtime.

Technological obsolescence: The biggest challenge in e-collection development is the obsolescence of hardware/software required to access electronic information. In order to ensure longer life of the electronic information, a continuous development and upgradation of information storage and access to techniques and technology is a must. It is also essential to consider the provision for migrating files to new formats/platforms, to keep up with technological advances.

Archiving/preserving e-resources: A major concern, is archiving and preserving e-resources for the future use, because libraries do not have ownership of the e-resources, but can only access them. Libraries may want a guarantee that if they cancel or terminate their subscriptions, they have the right of perpetual access to previously subscribed contents. Consideration should be given to whether the content provider is complaint to LOCKSS, Portico or other similar types of archival products.

Copyright: An original work exclusive right for a certain time period in relation to that work, including its publication, distribution and adaptation, after which time the work is said to enter the public domain the author has been given the right for Copyright is a form of intellectual property.

Licensing issues for e-resources: Unlike print publications, e-resources are not purchased outright and usually require a license agreement to the signed. Prior to the purchase, the license agreement must be reviewed and negotiated as it describes the authorized uses and users of licensed information. The library should ensure that as a part of the license agreement, the vendor provides sufficient advance notification in relation to renewals to allow for sufficient lead time to undertake an effective review of the resource.

Renewal and Review of uses: Before renewal of any resource, the library should review usage statistics to determine effective use of the resource. The library should demand from the vendor statistical reporting i.e. COUNTER (Counting Online Usage of Networked E-resources) and / or SISHI (Standard Usage Statistics Harvesting Initiative) complaint usage of e-resources. The library should be able to ensure that library budgets continue to be spent on resources that support the overall mission and objectives of the organization and remain relevant and cost effective.

Future Outlook: In connection with modern technology for the knowledge of library professionals the success of electronic library depends upon the computers, communication skills. For the transformation of libraries as institutions there is a need for extensive research in
electronic libraries. To communicate the scope and significance of our work for advance of research and practice in electronic libraries the present ambiguity of terminology is hindering.

A brief list of potential area of concern could include (Goldner 2010).

1. Most library computer systems are built on pre-web technology. Transformation is required in terms of deployment of web 2.0 architecture.

2. System distributed across the net using pre-web technology is harder and more costly to integrate. Security issues are needed to address.

3. Libraries store and maintain much of the same date hundred and thousands of times Collection assessment is required across the E-library database.

4. With library data scatter across distributed systems the library’s web presence is weakened. A comprehensive framework needs to install.

5. With libraries running independent systems collaboration between libraries is made difficult and expensive. Inter-library cloud is required to be installed.

6. Information seekers work in common web environments and distributed systems make it difficult to get the library into their workflow.

7. Many systems are only used to 10% of their capacity. Combining systems into a cloud environment reduces the carbon footprints, making libraries greener.

CONCLUSION

The development of an electronic library is a long and challenging process and libraries need to apply proper skills in planning the collection and manage both print and e-resources. During the last decade, the status of libraries has drastically changed due to emergence of e-resources. Also, there is a rapid urge of the user community to get more information in e-format. Replacing printed resources with electronic materials can reduce the cost of processing, shelving and binding.

Moving towards electronic library from the traditional library needs a balanced collection between printed and electronic forms.

Since a vast amount of information is available in electronic formats on Internet, Librarian must not only identify and facilitate access to electronic information resources, but also educate library users about their availability and use patterns. Protection of intellectual property, security of electronic resources, user training etc. should also be considered as effective management of information within the electronic library.

Ethical Clearance: Taken from AMET University

Source of Funding: Self

Conflict of Interest: Nil

REFERENCES


Usage of E-Resources in Global School Libraries
CPS Global School - A Study

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²Scientist, CSIR-CLRI, Ministry of Science and Technology, Govt. of India, Adyar, Chennai-600020

ABSTRACT

After various change in the functions of libraries amongst the library users E-Resources have played a significant role. In order to gauge the electronic resources pattern which is made available in international schools a detailed study has been done. This is based on data’s received from International School, review method. The survey attempts to capture the value and impact of e-resources. This study mainly focused on how electronic resources are supported to the teaching and learning process in International schools and how the users (Librarians, Teachers and Students) are effectively using these resources apart from print.

Keywords: E-resources, International School, Digital.

INTRODUCTION

Information and Communication Technologies (ICTs) can be defined as the techniques, methods and tools used to access information and to communicate with others. These are the technologies whereby the information is accessed and used in electronic format through the use of computers.

Electronic information services are attracting reader’s attention in today’s networked environment. E-journals and E-databases bring new challenges before the library and information professionals to give full text access to scholarly publications both in print and electronic version to its end users.

E-RESOURCES –A BRIDGING SPACE

Teachers and librarians have become motivators, facilitators, and providers in the learning process. The involvement of students in this process, and the incorporation of monitoring resources usage would help to maintain active repository of e-resources. Librarians become partners with the students and work collaboratively to enrich the e-resources within the school library. The benefits of this collaboration are:

- Develops collections that meet curricular needs of the students.
- Creates a pro-reading environment.
- Encourages the usage of school computer network to conquer the limitation of school library.
- Provides professional development e-services to students.

Main Features of E-Resources

- 24 × 7 (Any Time Information available).
- E-Resources are huge information reservoirs.
- E-Resources provide up to date information.
- E-Resources are many times in multimedia format & are interactive.
- E-Resources provide quick information.
- E-Resources have multidisciplinary approach.
- E-Resources are peer reviewed information sources.
- E-Resources provide easy citations
- E-Resources occupy very less space as compare to conventional library

AIMS

The aims of the survey were focused on the following topics.

- To achieve an understanding of how International school Students, Librarians and staff make use of library E-Resources to use.
To determine the level of usage of the different access pathways, and the physical location of users

**LITERATURE REVIEW**

Ojo and Akande (2005) in a survey of 350 respondents examined student’s access, usage and awareness of electronic information resources at the University College Hospital (UCH) Ibadan, Nigeria. The study revealed that the level of usage of the electronic information resources is not high. A major problem however identified is lack of information retrieval skills for exploiting electronic resources, thus making the level of usage of resources by medical students very low.

Jagboro (2003) had also highlighted the emerging reliance and attitude of users to electronic resources. In a study she conducted in some Nigerian Universities, it was found that 45.2% of respondents accessed electronic resources from cybercafés. Though this attitude, according to her is due to the proximity of cybercafés to user facilities.

Ajuwon et al (2003) also carried out a study of uptake of ICTs by health science students at the University College Hospital, Ibadan. This study found that 57% of students sampled could not use a computer, that the use of the database was poor, due to lack of awareness, lack of access to computers, insufficient training and the high cost of provision.

In effect, all the studies reviewed above are implemented on the assumption that uptake of electronic resources is highly desirable in that it leads to increased productivity of work, learning, teaching and research.

**CPS GLOBAL SCHOOL:** For shaping the children to fit into the world of tomorrow a balanced focused environment is provided by CPS Global School. The main features of the schools are one of the best in class infrastructure in and around the city. A few to name are Smart Interactive touch screen boards, 3D projectors, Wi-Fi hotspots, RFID access/transaction, 3D Sci-fi Theatre, etc. With the international standards of education particularly in the field of advanced sciences children can gain hands on experience.

**CPS GLOBAL SCHOOL-A STUDY**

**Types of e –resources used in CPS**

- Electronic Books (e-Books)
- Electronics Journals (e-Journals )
- Electronic Databases
- CD-ROM
- Software to avoid plagiarism
- Website
- Online Repositories
- Blogs
- Library Software’s
- Digital Library Software’s


**Electronic Journals (E-Journals):** E-Journals are available in the electronic form and can be accessed using computer and communication technology. Eg :- Project Muse it is superior database for online Journals which the titles are arranged alphabetically from A-Z and we also get back issues based on subscription. Ebsco Host it is good database platform specifically for International Schools

**The Electronic Journals Library:** It was founded in 1997 by the University Library of Regensburg in cooperation with the Technische Universität München University Library within the framework of a project. The aim of this project was to present e-journals to the library users in a clearly arranged user-interface and to create for the EZB member libraries an efficient administration tool for e-journal licenses.

**Electronic Databases:** Electronic Database consists of organized pieces of information placed into records. Within an electronic database a computer program assists the user in selecting desired pieces of data. Eg :- Jstor and Proquest are database which have consortium of e–Journals which are useful for International Schools.
CD-Rom: CD–ROM is a Non volatile optical data storage medium using the same physical format as audio compact disc, readable by a computer with a CD-ROM drive. International Schools periodically subscribe CD-Roms according to its requirement, some CD Roms are book accompanied and some CD-Roms can procure according to requirements.

Websites: Info web. news bank .com: Here we can get E- International Magazines and newspapers

Interactive Bulletin Board: it is a website for secondary school mathematics

Online Repositories

Digital repository of the Raman Research Institute: The RRI it collect, preserves and disseminate in digital format and research out put of RRI community to deposit preprints, post prints, and other publications using web interface runs on D space an open source software.

Digital Library of India: It is hosted by ER Net and contains e books, e journals, e news papers and Manuscripts on all Indian languages on almost all subjects

National Library of India: A National Library of India had a website which constitutes of digital books, In house availability of online Journals and directory of online journals 2012 the website designed and hosted by national informatics centre

Asiaing.com: Asiaing.com is an free online repository website which gives sources in categories like e book categories, Magazine category, News paper category, Report category, Zinio category, Reading category and Files category

Library Spot.com: Published by Start Spot Media works, Inc. in the Northwestern University/Evanston Research Park in Evanston, Ill., LibrarySpot.com is the first in a family of vertical information portals designed to make finding the best topical information on the Internet a quick, easy and enjoyable experience. it contain sources like different kinds of libraries reading rooms and reference desks.

Blogs

Library Junction: It contains book reviews done by students, thoughts of the day quotations, Question postages and opinions of the students and teaches on specific questions, and it also deals with subjects like Maths, Physics, Chemistry, Biology, computer science, Humanities and Language and literature, and give awareness on various issues like environment, global warming, child abuse etc.

Biography Online: This blog is most useful for the students which makes them inspire in their life and are helpful in preparing their speeches, and essay writing competitions, and sending articles to the magazines it contains 100 people who changed the world, woman who changed the world, Inspirational people, and selected biographies it contains.

Software to avoid plagiarism: In international Schools it is mandatory to maintain a software which avoid plagiarism. Students have to submit extended essays in IB curriculum after checking in plagiarism softwares some important software’s which international schools maintain are Turnitin, Viper anti plagiarism scanner, online plagiarism detection software, etc.

Digital Library Softwares: In international Schools it is compulsion to be maintain digital library, since every students and teachers have there laptops, hence the librarian is key in maintaining digital library and update their e- books, e-Journals, e-prints, and theses etc with different formats like word, PDF, HTML,PS etc according to the terms and syllabus to provide online resources to the student and teaching community. Some of the, Muse search, Insight, Acado, Arno, CDS ware, open source like E-prints, GSDL, E-grandhalaya, I-Tore, Mycore etc

Library Management Softwares: Library Management software’s help the librarians to do daily routine activity like check in check out books, renewals of the books, reservations of the books, automatic calculating overdue fines, sending reminders , Invoice processing, payment processing in system and maintain database of the resources of library and made available by OPAC and WEB OPAC some of the library management software’s popularly use in international schools are eg: VTLS, SLIM, LIBSYS and open sources software’s like KOHA, New genlib, Emilda etc.

E-RESOURCES Usage in CPS Global School: The sample covers the whole of CPS Global School, which has 110 Global students in academic year 2011/2012. Study was taken among the Faculty’s and students.
Table 1: Duration of Internet Usage

<table>
<thead>
<tr>
<th>No.</th>
<th>No of hours Searching the Internet</th>
<th>Students Usage</th>
<th>Teachers Usage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>1-2 hours</td>
<td>35</td>
<td>65</td>
</tr>
<tr>
<td>2.</td>
<td>2-3 hours</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>3.</td>
<td>3-4 hours</td>
<td>55</td>
<td>45</td>
</tr>
<tr>
<td>4.</td>
<td>More than 4 hours</td>
<td>85</td>
<td>75</td>
</tr>
</tbody>
</table>

Table 1 shows, Students are surfing for long hours than teachers as they have to research on their subjects.

**Students Percentage**

Figure 1: Citation Statistics of e-books

Figure 1 shows that e-books are equally used by teachers as well as students.

Table 2, Table 3, Table 4, Table 5 and Table 6 shows the citation statistics of e-Journal articles, websites, repositories, blog and software to avoid plagiarism respectively.

Table 2: Citation Statistics for e-Journals

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Name of the Source</th>
<th>Students Usage</th>
<th>Teachers Usage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Project Muse</td>
<td>22%</td>
<td>40%</td>
</tr>
<tr>
<td>2.</td>
<td>Ebsco Host</td>
<td>15%</td>
<td>39%</td>
</tr>
</tbody>
</table>

Table 3: Citation Statistics for Websites

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Name of the Source</th>
<th>Students Usage</th>
<th>Teachers Usage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Infoweb.Newsbank.com</td>
<td>22%</td>
<td>36%</td>
</tr>
<tr>
<td>2.</td>
<td>Interactive Bulletin Board</td>
<td>32%</td>
<td>36%</td>
</tr>
<tr>
<td>3.</td>
<td>CPS Library webpage</td>
<td>45%</td>
<td>50%</td>
</tr>
</tbody>
</table>

Table 4: Citation Statistics for Repositories

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Name of the Source</th>
<th>Students Usage</th>
<th>Teachers Usage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Digital Library of India</td>
<td>35%</td>
<td>45%</td>
</tr>
<tr>
<td>2.</td>
<td>National Library of India</td>
<td>30%</td>
<td>40%</td>
</tr>
<tr>
<td>3.</td>
<td>Asiaing.com</td>
<td>22%</td>
<td>30%</td>
</tr>
</tbody>
</table>

Table 5: Citation Statistics for Blog

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Name of the Resource</th>
<th>Students Percentage</th>
<th>Teachers Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Library Junction</td>
<td>55%</td>
<td>70%</td>
</tr>
<tr>
<td>2.</td>
<td>Biography Online</td>
<td>39%</td>
<td>65%</td>
</tr>
<tr>
<td>3.</td>
<td>Cps Blog</td>
<td>40%</td>
<td>45%</td>
</tr>
</tbody>
</table>

Table 6: Citation Statistics of Software to avoid plagiarism

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Name of the Source</th>
<th>Students Percentage (Librarian)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Turnitin</td>
<td>0%</td>
</tr>
</tbody>
</table>

**CONCLUSION**

The above Study confirms that, the library changed from books, which are preserved and locked to open access and to digital library to virtual libraries. So it is the necessary for the librarians to update with latest technologies frequently relevant to current environment, the librarians working in international schools have to update with latest e-technologies, e-resources, to run library smoothly in current environment.

**Ethical Clearance:** Taken from AMET University

**Source of Funding:** Self

**Conflict of Interest:** Nil

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8. Prpquest: http://www.proquest.co.uk/en-UK/
11. Digital Repository of Raman Research Institute: http://dspace.rrri.res.in/
Underwater Acoustic Communications with Design of System-Level Simulator Architecture

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ABSTRACT

The development on the underwater communication network for sea observation is on the rise due to increasing importance of its applications such as oceanography, marine commercial operation and military surveillance. In this paper, we design the system-level simulator (SLS) architecture for the underwater acoustic communications which can be the basis for the design model of future application-specific underwater network deployment.

Keywords: Underwater Acoustic Networks; SLS Architecture; Channel Model; Cell Layout.

INTRODUCTION

The interest on the study of underwater communication network for ocean observation has been increased due to expansion in the importance of its applications such as oceanography, marine commercial operation and military surveillance. The underwater acoustic propagation channel presents formidable challenges, including slow propagation of acoustic waves, limited bandwidth, high and variable propagation delay. Furthermore, it is affected by fading, Doppler spread and multipath propagation. Underwater acoustic communication channels are characterized by a path loss that depends not only on the distance between the transmitter and receiver, as it is the case in many other wireless channels, but also on the signal frequency. The signal frequency determines the absorption loss which occurs because of the transfer of acoustic energy into heat. This fact implies the dependence of acoustic bandwidth on the communication distance.

The absorption loss increases with frequency as well as with distance, eventually imposing a limit on the available bandwidth within the practical constraints of finite transmission power. Consequently, a shorter communication link offers more bandwidth than a longer one in an underwater acoustic system. For example, transmission over 100 km can be performed in one hop, using a bandwidth of 1 kHz, or by relaying the information over 10 hops, each of which is 10 km long, but offers a bandwidth on the order of 10 kHz. Hence, in exchange for a more complicated system of relays, significant increase in information throughput can be obtained. The past, present and future of the offshore wind power technology—a review, we design the SLS architecture for the underwater acoustic communications in order to assess the future application-specific underwater network deployment.

The rest of the remote operated underwater welding vehicle paper is organized as follows. Section II provides the overview of underwater acoustic communication system model which describes the cell layout and channel model in detail. In section III, design of SLS architecture and implementation requirements for underwater acoustic network is discussed a proposed system of ship trajectory control using particle swarm optimization. Section 4 gives the performance evaluation of SLS architecture. Finally, section V concludes the paper.

UNDERWATER ACOUSTIC COMMUNICATIONS SYSTEM MODEL

In this paper, we focus on the cellular type of underwater acoustic network. The first task in the design of a cellular network is the selection of network topology, i.e., determination of the cell size (radius) and inter site distance between the Buoys. In other words, the practical questions that one wants to answer are the following: For a given distribution of users and
the desired information throughput, what should be the coverage area of one base station? What should be the distance to another base station operating in the same frequency band? According to what pattern should the frequency bands be reused?

Network Setup for Underwater Acoustic Communications: We consider a downlink (DL) system of underwater acoustic network. The system layout follows the basic cellular concept of spatial frequency reuse that comes with time-division multiple access (TDMA) or frequency-division multiple access (FDMA) [1, 2]. The reference architecture for two-dimensional underwater networks is shown in Fig. 1. A group of users (UEs) are connected to underwater base station (UBS). UEs can connect with one or more UBS by means of wireless acoustic link 2. UBS are connected with underwater base station controller (UBSC) or Buoy via link

1. To represent the cell layout in Fig 1, the four distances can be defined in Table 1: UBSC-to-UBSC (R1), UBSC to UBS (R2), UBS-to-UBS (R3), UBS to UE (R4). This makes it very simple to build a seamless SLS architecture to support the underwater acoustic network scenarios.

Figure 1: Cell layout for underwater acoustic communications.

Channel Model for Underwater Acoustic Network

1. Transmission Loss: Transmission loss is mainly caused by two phenomena: geometric spreading loss and attenuation. Transmission loss for a signal of frequency f [kHz] over a transmission distance d [m] can be expressed in [dB] as [3]:

\[ A(d, f) = A_0 d^\alpha (f) \gamma \]

2. Noise: Acoustic noise in the underwater communication channel can be either natural. The contributions of the major noise sources can be expressed through empirical formulae [3, 4], which provide power spectral densities of each source relative to frequency f [kHz]:

\[ 10 \log N_t(f) = 17 - 30 \log f, \]
\[ 10 \log N_s(f) = 40 + 20(s - 5) + 26 \log f - 60 \log (f + 0.03), \]
\[ 10 \log N_w(f) = 50 + 7.5w^{0.5} + 20 \log f - 40 \log (f + 0.04), \]
\[ 10 \log N_{th}(f) = -15 + 20 \log f, \]

3. Fading Channel: Table 2 shows the 12-path Rician channel model parameters. The each path has different K value with Doppler spread is 4 Hz and maximum delay is 14.78. Moreover, the coherence bandwidth and coherence time is 16 Hz and 250 ms, respectively.

While link-level simulations are suitable for developing receiver structures, coding schemes or feedback strategies, it is not possible to reflect the effects of issues such as cell planning, scheduling, or interference using this type of simulations. Simulating the totality of the radio links between the UEs and underwater base stations is an impractical way of performing system level simulations due to the vast amount of computational power that would be required. Thus, in system-level simulations the physical layer is abstracted by simplified models that capture its essential characteristics with high accuracy and simultaneously low complexity. Hence, in system level simulations, the performance of a whole network is analyzed. In underwater acoustic communications, such a network consists of a multitude of base stations that cover a specific area in which many UEs are located.

Fig. 2 depicts a schematic block diagram of the SLS architecture of underwater acoustic communications. Similarly to other system-level simulators, the core part consists of: (i) a link measurement model and (ii) a link performance model. The simulation is performed by defining a region of interest (ROI) in which the
underwater base stations and UEs are positioned and a simulation length in transmission time intervals (TTIs). It is only in this area where UE movement and transmission of the downlink shared channel (DLSCH) are simulated.

![Figure 2: System-level simulator architecture for underwater acoustic networks.](image)

The link measurement model abstracts the measured link quality used for link adaptation and resource allocation. On the other hand, the link performance model determines the link Block Error Ratio (BLER) at reduced complexity. Hence, the link performance model predicts the BLER of the link, based on the receiver SINR and the transmission parameters. It means that AWGN-equivalent SINR ($g_{SINR}$) is obtained via mutual information effective signal to interference and noise ratio mapping (MIESM) and $g_{SINR}$ is mapped to BLER via AWGN link performance curves. The simulation output consists of traces, containing link throughput and error ratios for each user, as well as cell

**DISCUSSION**

We assume the fixed network topology along with the specific parameters, i.e., carrier frequency is 5.5 kHz, bandwidth is 5 kHz, and transmission power is 50 watt. Fig. 3 shows the SINR color map. In this figure, dark red color shows the existence of UBSC or Buoy and UBSs.

![Figure 3: SINR color map.](image)

**CONCLUSIONS**

In this paper, we present a system-level simulator architecture for underwater acoustic network. The main purpose of this simulator architecture is to assess the future application-specific underwater network deployment. In SINR color map of the single cell underwater acoustic network deployment, the dark red color indicates one Buoy and three UBSs are connected via link 1. However, in order to assess the inter-cell interference between multiple cells, we need to deploy the complex scenarios of underwater acoustic networks by proposing the scheduling and power allocation algorithms. This scenarios will be considered in our future work.

**Ethical Clearance:** Taken from AMET University.

**Source of Funding:** Self

**Conflict of Interest:** NA

**REFERENCES**


Transmission and Reception Delays for Investigating reservations in Underwater Acoustic Networks

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ABSTRACT

The delay vulnerabilities of a genuine underwater framework on sending and accepting acoustic signs are contemplated in this paper. In view of trial information, the delay is first disintegrated into seven segments; the highlights of every part are contemplated. As per the investigation, it is energizing to infer that the worldly example of some delay parts is unsurprising to a specific degree, which can be used to diminish the delay vulnerabilities. The time synchronization is given for instance to demonstrate how the delay vulnerabilities influence the execution of an underwater application underwater acoustic network.

Keywords: underwater, underwater acoustic network, time synchronization.

INTRODUCTION

Underwater Acoustic Networks (UANs) have an expansive scope of applications that includes monitoring the environment, tracking targets etc. The correct sending and accepting time of bundles are basic in these applications for exact localization and proficient collision avoidance. Because of the variation of environment and hardware constraints, uncertainties in delay stay alive at dissimilar stages in delivering the packets. This may make the collision avoidance mechanism worthless or acquaint errors to localization and organization.

MAC protocols are originally designed for Radio Frequency (RF) in-air wireless communications. The benefits of synchronization of slotted ALOHA are completely lost in underwater environments due to the distance-dependent delay.

Related works: The sensing capabilities of nodes include cameras, water temperature and pressure. The mobile nodes can find and drift over the static nodes for information reflecting and they can perform arrange support capacities, for example, sending, movement, and recuperation. CUMAC uses the collaboration of neighboring nodes for crash discovery and a straightforward tone gadget is intended for conveyed impact warning, giving better framework productivity while keeping general cost low.

An engendering delay-tolerant crash shirking convention named PCAP was presented and demonstrated that by considering the proliferation delay, PCAP offers higher throughput than the conventions that are broadly utilized by traditional remote correspondence systems. A simple mathematical analysis and simulations show the performance of Aloha and Slotted Aloha in the acoustic environment.

At each layer, an arrangement of new outline challenges are appeared and is presumed that UANET and UWSN are challenges that must be replied by between disciplinary endeavors of acoustic correspondence, flag preparing and portable acoustic system convention plan. An energy-productive directing convention for submerged sensor systems was composed in view of the experiences picked up. This convention is tried in various important system situations, and appeared to altogether beat ravenous least connection energy conventions, and to give close ideal aggregate way energy consumption.

VBF is a position based routing approach: nodes close to the “vector” from the source to the destination will forward the message. RTS/CTS is suitable for dense networks with high date rate, low/medium transmission range and bursty traffic.

The difficulties of displaying dispute based medium access control conventions and exhibiting a model for breaking down Aloha variations for a straightforward string topology as an initial move toward dissecting the execution of conflict based recommendations in multi-hop underwater acoustic sensor networks. A consecutive
calculation for joint time-synchronization and restriction for underwater networks was produced and depended on bundle trades amongst stay and UL hubs, makes utilization of directional route frameworks utilized in hubs to acquire precise here and now movement gauges, and endeavors the lasting movement of nodes.

**Transmission and Reception Delays for investigating reservations:** To think about the vulnerabilities of transmission and gathering delays in seas, two orthogonal frequency-division multiplexing (OFDM) acoustic modems are sent. In the examinations, every modem set 20 meters beneath the ocean surface was associated with a smaller scale controller to run a system stack. Timestamps with 1 microsecond determination were recorded at each phase of information exchange.

Packet delivery time is the time devoted on pushing the gathered parcel from the control framework to the information support of an acoustic modem through a serial port. Affirmation delay is the time a modem expended on producing and conveying an affirmation of fruitful bundle gathering and the decoded parcel to the control framework through a serial port. Input delay is the ideal opportunity for a modem to create and send a criticism to the control framework telling fruitful parcel recognition. The time it takes for the modem to send or to receive a packet is called packet transmission time.

**DISCUSSION**

The simulation is conducted using the NS2 simulator. The number of normal sensor nodes is 100. The nodes are communicated with each other by using User Datagram Protocol (UDP). All the nodes receive the signal from all directions by using the omni-directional antenna. The transmission radius of each node is set as 50 m.

**CONCLUSION**

The uncertainties of transmission and reception delays in an underwater sensor network are explored in this paper. Packet detection delay and the packet transmission time are predictable through analysis. The uncertainty in the network is reduced considerably. The processing time is indeterminable to transmit data in the communication network. Also, TSHL demonstrate the accuracy of time synchronization lower than the expectations in underwater environments due to a higher uncertainty.

**Ethical Clearance:** Taken from AMET University.

**Source of Funding:** Self

**Conflict of Interest:** NA

**REFERENCES**


Design of Marine Broadband System for Beach front Angling and Its Applications

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ABSTRACT

In this paper, we report on an evaluation of the Marine Broadband Framework that was implemented in 2008, as well as a real-time aquatic resources evaluation system that uses the Marine Broadband Framework. The Marine Broadband Framework is a wireless LAN environment with xDSL equivalent transmission speeds that can be used over a range of approximately 20 km from the coastline, which is the main operating environment for small fishing vessels. As a result of the progress in semiconductor technology in recent years, the nautical instruments and operational measurement devices installed on small fishing vessels now have advanced features and high precision. However, there are no means to proactively share and reuse the information acquired by these devices, primarily because a network environment that can be easily used in costal sea areas is not available. To address this issue, we developed a remote LAN condition utilizing an IEEE 802.11j particular remote LAN framework that can be utilized from little angling vessels in seaside ocean territories to unreservedly get to the Internet. We assessed the proposed Marine Broadband Framework by building a system of sensors that naturally measure the flag quality and real throughput of the remote LAN. Therefore, we affirmed a steady throughput of more than 10 Mbps inside a scope of 3 km, and more than 8 Mbps inside a scope of 5 km. Additionally, we affirmed that by utilizing the Marine Broadband Framework, pictures from the fish-discoverer introduced on little angling vessels could be transmitted continuously. In 2009, we introduced portable terminals on little angling vessels for contributing operational records, and we are as of now attempting to build up a continuous sea-going assets assessment framework that gathers operational records alongside situating data from the GPS.

Keywords: GPS; Marine Broadband framework.

INTRODUCTION

We have attempted the errand of convey data innovation to beach front angling with a specific end goal to enhance the efficiency of the angling business and to advance the reasonable utilization of oceanic assets. A year ago, we proposed a remote LAN condition for beach front ocean regions we report the consequences of analyses assessing the Marine Broadband Framework that was executed in 2008, and also the ongoing sea-going assets assessment framework for which innovative work is currently continuing. Framework for coastal fishing and its applications is explained by[1,2]. In 2008, we constructed a wireless LAN environment on the Rumoi coast in western Hokkaido. We evaluated the Marine Broadband Framework by developing a network of sensors that automatically measures the signal strength and actual throughput of the wireless LAN used by small fishing vessels while they are in operation. An overview of tools for assessing groundwater-surface water connectivity and An approximate formula for the calculation of the horizontal electric field from lightning at close, intermediate, and long range are discussed by[3,4].

At present, we are leading innovative work on a continuous oceanic assets assessment framework that uses the Marine Broadband Framework. Radio propagation above 40 MC over irregular terrain is described by[4]. In particular, it gathers GPS situating data, profundity and water temperature data from fish-discoverer, operational records and catch data continuously on the server for various little angling vessels that perform ocean cucumber dig net angling. High-impedance electromagnetic surfaces with a forbidden frequency band and Radio propagation for vehicular communications are discussed by[6,7]. Future subjects of this review incorporate the assessment of ocean cucumber assets progressively.
**MARINE BROADBAND FRAMEWORK**

The Marine Broadband Framework was developed utilizing a remote LAN framework utilizing the IEEE 802.11j standard. The IEEE 802.11j standard was set up in November 2004, and in this manner is a moderately new standard. In Japan, this standard uses the 4.9 GHz and 5.0 GHz groups, for a sum of 7 relegated channels of frequencies. What’s more, since these have a high transmission energy of 125 mW, they are appropriate for long separation transmission outside.

On July 16, 2008 we installed a base station on the Rumoi coast in western Hokkaido and started operation of the Marine Broadband Framework. The base station was installed at Uminofurusato-kan, which is located on high ground on the coastline. The OWS2400 was equipped with three wireless modules and thus could use three flat-panel antennas to cover the sea area along the Rumoi coast. We installed a xSDL line with an assigned fixed IP address in the base station and used a virtual private network (VPN) to connect with Future University-Hakodate and Tokyo University of Agriculture.

**MONITORING SYSTEM**

For the monitoring system experiments, we constructed a ship-wide LAN environment in the mobile station. We collected catch information from the various measurement devices including the GPS, the fish-finder, the water temperature gauge, the exhaust-gas analyzer and the tidal current gauge, as well as the catch information from the automatic squid fishing machines. This data was then delivered to land in real time through the Marine Broadband Framework.

It was conceivable to peruse the pictures from the fish-discoverer of the No. 5 Kosho-maru continuously. Besides, we additionally prevailing with regards to showing data in tables or diagrams from every estimation gadget, the operational records and the data from the nautical instruments progressively.

**REAL-TIME AQUATIC RESOURCES EVALUATION SYSTEM**

In 2009, we installed a mobile terminal on a small fishing vessel for inputting operational records. Then, by constructing a network of sensors that could collect operational records along with positioning information from the GPS, we conducted a real-time evaluation of aquatic resources. In addition to the No. 27 Tokuryomaru that used the Marine Broadband Framework on the Rumoi coast, we also installed OWS2400 and added new mobile stations to two other sea cucumber dredge net fishing vessels: the 4.9 ton Kofuku-maru and the 4.9 ton Ryutoku-maru.

**DISCUSSION**

The continuous amphibian assets assessment framework is developed from an electronic database server and a portable terminal. We developed a database on a server facilitated on the Internet and utilize a waterproof touch-board PC introduced on the little angling vessels to get to the facilitated server. We put away the digging begin and end times, and the catch in the database.

**CONCLUSION**

The Marine Broadband Framework has the potential not exclusively to enhance the profitability of the angling business and add to the supportable utilization of oceanic assets, additionally to be valuable in controlling the operation of little angling vessels and helping the early identification of untamed ocean mishaps, for example, man-overboards. In addition, this framework will likewise be helpful in ocean protect bolster missions and different intends to enhance wellbeing. The OWS2400 is a work sort remote LAN framework. Since various free remote modules can be introduced, the transfer speed does not diminish when multi-bounce steering is utilized.

Directly, a preparatory permit for the trial stations is being gained to permit facilitating of controls forced by Japan’s radio laws with respect to transmission control and the utilization of multi-bounce steering on the ocean. Later on, we will work to execute the Marine Broadband Framework with an administration region scope of roughly 20 km from the coastline, while additionally putting the proposed ongoing amphibian assets assessment framework into commonsense utilize.

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REFERENCES


Real Time Algorithm Based Support on Ship Handling System Under Damage

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ABSTRACT
This paper shows a choice emotionally supportive network, named Bridge Officer Support System that continually screens the heap and draft states of a ship, utilizing information accessible through the ship’s stage control framework, by means of OPC. The framework has an easy to understand interface, and in typical conditions gives the client two sorts of data: the security circumstance, and current mobility conditions. On the off chance that harm happens, the framework changes to harm control mode, and prompts the team as to which moves ought to be made to increase most extreme dependability. The tests performed demonstrate that the framework works effectively, and can give a word of wisdom to reproduced harm conditions.

Keywords: Damage stability, Ship handling, and Genetic algorithms

INTRODUCTION
Weight appropriation impacts vessel’s strength, auxiliary honesty, her execution and consequently her wellbeing. If there should be an occurrence of harm, it turns out to be considerably more critical to have a la mode learning of the ship’s heap condition since each activity done to expand her solidness must have it into record, or her capacity to survive can be radically diminished, basic ship theory is explained [1]. These reasons are sufficient to propel the improvement of a framework to screen stack condition and intermittently confirm its operational information, and watch that in place and harm solidness criteria are met. UA supporting the automated engineering of production monitoring and control systems is discussed [2]. We reason to present such an instrument, supplemented with a choice bolster apparatus to choose what game-plan ought to be followed if there should arise an occurrence of flooding, and displaying alternatives to expand the vessel’s strength in such cases. Under-reporting of maritime accidents is described [3].

Standing out from the practices being used in the current past, when load conditions amid an adventure were evaluated utilizing the tanks’ level readings and after that in place soundness criteria was checked by hand figurings or utilizing solidness number crunchers, today it is conceivable to fuse data from stage administration frameworks with PC frameworks that play out the fundamental estimations. Stability and buoyancy criteria for naval surface ships and knowledge-based decision support system for shipboard damage control are described [4],[5]. In any case, current frameworks, to the extent we know, don’t give any counsel on the best way to oversee payload or how to build solidness for any given load condition, neither exhortation on the most proficient method to continue if there should arise an occurrence of harm. Ship design and performance for masters and mates is discussed [6]. The framework has been dealing with utilisations draft perusing sensors, and tank level sensors. The draft perusing sensors can be supplanted by direct draft readings before starting the adventure. Having this information from the sensors, when load conditions change, diverse autonomous schedules can be called to ascertain in place security and harm solidness, to perform basic uprightness check, and to decide moving, ocean keeping and collaboration attributes. In such circumstances, if any solidness criteria is not met or flooding happens, an improvement procedure having the heap condition as an information variable is utilized to encourage on the most proficient method to balance, to change liquids between tanks, or to release liquids over the edge. On account of flooding case out framework can play out an examination of the stream gulf, with information controlled by the team’s gauge or by weight sensors readings, and suggest on how crediting seepage gear keeping in mind the end goal to
lessen the outcome of flooding. Ship Trajectory Control Using Particle Swarm Optimization is explained by[7].

The technique has been actualized in a Portuguese Navy vessel that utilizes Open network principles in her stage administration framework, which takes into consideration the data trade amongst it and the Bridge Officer Support System, talked about in this paper. In the following segments, a concise best in class will be introduced, trailed by an investigation of the BOSS design and, specifically of the enhancement procedure used to expand vessel’s security if there should arise an occurrence of harm. At last, the actualized apparatus will be displayed and a few conclusions are drawn.

State of the art: Dependability has dependably been a worry of each administrative body identified with ocean route and wellbeing adrift. Since the main Safety of Life at Sea tradition of 1914, a few criteria have emerged, for example, the deterministic criteria of 1960’s SOLAS tradition, the International Maritime Organization code of 1993, or the new probabilistic approach of SOLAS 2009. To the extent military vessels are concerned, naval forces having their own particular criteria, a large portion of them created from reference. Still, we should uncovered at the top of the priority list that amid the ship’s development just a couple stack conditions are dissected, which implies that whatever steadiness criteria is utilized, it may not be met in all middle of the road stack conditions amid ordinary operation of the vessel. Hence, soundness adding machines are regular on board delivers and there are a few business items accessible. Among these mini-computers, the United States Navy created Flooding Casualty-Control Software is likely one of the more entire ones that can assess the ship demeanour, hydrostatic, steadiness and quality status.

Bridge Officer Decision Support Tool: The Bridge is the choice station for all that is connected with route and how the ship relates with the encompassing medium, while the Machinery Control Room is the station that arrangements with overseeing impetus, vitality generation and harm control, and the Command Center, in the warship case, manages fighting.

Route security is an extension officer’s primary concern and because of the considerable number of reasons said before this is, without a doubt, a hard undertaking, inclined to a few blunders. In this way, in the wake of concentrate the issue, we accompanied the possibility of a choice bolster apparatus with the design appeared in Figure 1. The process begins by observing the vessel stack condition, with the utilization of information from the stage administration framework, and afterward checking soundness and quality criteria, and in addition giving data to the vessel operation. This procedure is rehashed in time interims in which vast contrasts of weight circulation are not anticipated. In a case, stack conditions, freely from readings should likewise be conceivable.

![Fig. 1: Decision Support Software Architecture](image)

Stability Criteria and Operational Analysis: The neural system utilized as a part of this case is a Multilayer Perceptron, with fifteen sources of info and two units in the concealed layer. A large portion of the data sources are utilized as a part of different techniques, however four information sources have been included that are not normally considered:

**Speed:** ordinarily, turning measurements are thought to be free for direct Froude numbers, however amid ocean trials it is watched that an expansion in speed brings about a bigger turning breadth.

**Meta-centric Height:** amid model tests it is realized that when a model is kept from moving as it turns, a considerably bigger distance across is watched.

**Side to which the vessel turns:** ocean trials appear there is dependably a side to which the vessel turns better,
presumably because of the transverse focal point of gravity position.

**Wind drive connected to the ranges above waterline:**
IMO informative notes expresses that wind, waves and ebb and flow can altogether influence trial comes about; consequently, this parameter is utilized to present the wind impacts.

Data about the moving attributes is made accessible onscreen, may later be encouraged to programmed pilots or ECDIS frameworks that help the team when executing a route arrange. Figure 2 explains the neural network architecture with several layer details.

**Response to Damage:** At the point when the group demonstrates that harm has happened, and ideally has presented some data about what happened, the framework tries to discover a game-plan that will prompt an expansion of solidness. Since time is vital, the framework will furnish the group with the best arrangement it has discovered so far after just 30 seconds. It will, however proceed to attempt and enhance the arrangement, and advise the team when a fundamentally better arrangement is found. The general procedure for flooding response optimization problem is portrayed in Figure 3.

**Optimization:** Dissecting boat’s dependability and harm reaction as an advancement issue requires a strict numerical plan. In like manner we have characterized as information factors the vessel’s qualities:

1. Light ship uprooting and focus of gravity position;
2. Structure shape that enables us to acquire her hydrostatics and cross bends;
3. Internal tank and watertight compartments subdivision;
4. Other strong weights and liquids in tanks that may change with time.

\[
LC_t = f(LC_0, C(TK_i)) \quad \text{for } t > 0 \quad \ldots (1)
\]

Where f is a known capacity and I distinguishes the diverse tanks. In place strength and basic criteria check can specifically be figured utilizing the present load condition. Be that as it may, harm steadiness depends, rely on upon the heap condition, as well as on which watertight compartments are overflowed. Expression (2) makes an interpretation of this into science:
\[ ST(LC_o, C(TK)) > 0 \]
\[ ST_j(LC_o, C(TK), C(WC)) > 0 \quad \text{for} \quad t > 0 \quad \ldots(2) \]

However, there are also other constraints besides expression (2) that ensures that the stability criteria are met:

1. Tanks and watertight compartments are filled/ flooded from 0 to 98% of their capacity
   \[ 0% < C_i(TK) > 98\% \]
   \[ 0% < C_i(WC) < 98\% \quad \ldots(3) \]

2. Fresh water tanks must have the same amount of water or less since no ballast was considered to fill them up
   \[ \sum_{i \in FO} C_i(TK_i^{FW}) \leq \sum_{i \in FO} C_i(TK_i^{FW}) \quad \ldots(4) \]
   Where \( t_1 \) is the time when damage occurs and \( t_2 \) is sometime after.

3. Fuel can be changed between tanks but it can’t be discharged overboard
   \[ \sum_{i \in FO} C_i(TK_i^{FO}) = \text{constant} \quad \ldots(5) \]

4. Lub oil and miscellaneous tanks are not changed
   \[ C(TK_i^{LO} \cup M) = \text{constant} \quad \forall i \in LP \cup M \quad \ldots(6) \]

5. When one of two compartments with a cross-flooding pipe connecting each other is flooded, so is the other
   \[ C_i(WC) > 0 \quad \Rightarrow \quad C_i(WC_i) > 0 \quad \ldots(7) \]

6. No watertight compartments that were not flooded due to damage are going to be flooded
   \[ C_i(WC) = 0 \quad \Rightarrow \quad C_i(WC) = 0 \quad \ldots(8) \]

7. Only if drainage flow of the available equipment is bigger than the flow of water ingress, is equipment used to drain the compartment
   \[ (WQ_i) > Q_i \quad \ldots(9) \]

8. Only if damage stability criteria are met after drainage, is equipment used to drain the compartment
   \[ \lambda_j(WC_j) = 1 \quad \Rightarrow \quad ST_j(LC_o, C_j(TK), C_j(WC_j)) > 0 \quad \ldots(10) \]

\[ k_i[ST_j(LC_i)] + k_i \left[ \sum_{i \in WC} \frac{1}{Q_i - WQ_i} \right] \]
\[ + k_i \left[ \sum_{i \in TK} \frac{C_i(TK_i^B) - C_i(TK_i^B)}{TQ} \right] \quad \ldots(11) \]

To the extent how different hopefuls, next to the underlying populace, are united, this execution utilized three hereditary administrators: elitist determination, transformation, and hybrid. The 10% chromosomes with the best estimates were passed straightforwardly to the people to come (elitism); 10% of the guardians endured a uniform transformation by arbitrarily changing the estimations of a few alleles of the chromosome, and the other 80% where produced utilizing scattered hybrid between guardians’ estimates.

**DISCUSSION**

The proposed system expressed effective solution for handling the ship during critical situations. The method explained the effective process to minimize the risk during ship accident. Fig. 4 displays the damage interface window of ship in details. Where, Fig. 5 explains the fitness value of two-step generation, straight generation and generation for LC4 and damage areas B1+B2+H1.
CONCLUSION

We exhibited in this paper a choice emotionally supportive network, named Bridge Officer Support System that continually screens the heap and draft conditions utilizing existing sensors, accessible through the ship’s stage control framework. The framework has an easy to understand interface, and in ordinary conditions gives the client two sorts of data: the strength circumstance, and current mobility conditions. On the off chance that harm happens, the framework changes to harm control mode, and prompts the group as to which moves ought to be made to increase greatest dependability. The tests performed demonstrate that the framework works accurately, and can give a word of wisdom to mimicked harm conditions.

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REFERENCES


Ship Detection and Recognition in Marine Environment
Using Camera Image

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ABSTRACT

It is very important to realize the safer marine transportation system. This paper describes a novel method to detect and track ships using a machine vision to reduce marine accidents. The proposed method has two stages; detection and tracking. In the detection stage, edges on a sea image are calculated and bounding rectangles that have the many pixels with the strong edge are selected by morphological processing. Then, the bounding rectangles are judged “ship” or not by the Support Vector Machine (SVM). In the tracking stage, the ship was tracked by the particle filter based on a color histogram inside the bounding rectangle. Experimental results show that ships are detected and tracked on movie images in marine environment.

Keywords: image processing, navigation, marine transportation, ship, support vector machine, particle filter.

INTRODUCTION

Recently, the number of marine accidents with ships is decreasing because quality of electronic devices that support safe navigation, for example, an Automatic Identification System, AIS, or a radar system, has been improved. However, the number of collision accident, especially with small ships, is not decreasing. The major reason is insufficient lookout around the ship by a navigation officer. Because small ships are not obligated to install AIS and sometimes cannot be discriminated by radar, if a small ship enters a blind spot from a large ship while an officer does not watch it, collision of both ships will happen[1]. Therefore, our research group has been considering a new technology supporting lookout by an officer using a machine vision technique to improve the safety on the sea lane[2].

DETECTION OF SHIPS

Our final goal is to keep the safe and secure marine transportation. In order to realize it, we have proposed making use of image processing technique. First of all, ships and other obstacles on the sea are automatically detected. Our final goal is to keep the safe and secure marine transportation. In order to realize it, we have proposed making use of image processing technique. First of all, ships and other obstacles on the sea are automatically detected.

1. Laplacian filter: In order to detect ships, we must find characteristic regions in the image. Therefore, edges, where intensity of image changes sharply, are obtained by the Laplacian filter. The Laplacian filter calculates second spatial derivative of an image.

2. Morphological processing: Mathematical morphology is a theory and technique for basic image analysis [3]. The basic morphological processes are erosion, dilation, opening and closing. In this paper, morphological calculations are applied to the binary image.

(a) Input Image

(b) Edge image of an input image

Figure 1
3. Machine learning with SVM: Although these rectangles are candidates of ships and other obstacles, there are much false detection such as waves and sea reflections as shown in Fig.1 (a). The proposed method uses SVM, to reduce the false detections. SVM is a kind of supervised machine learning techniques, and it can classify data into two categories, “sea or sky” and “ship or obstacles” in this paper.

Tracking of ships: A particle filter is often used for tracking a moving object in the field of image processing. A number of particles are scattered on the image based on the state equation and probability. The particles are renewed by likelihood of the particles.
RESULTS AND DISCUSSION

All experiments are tested based on our marine ship images database, and all training sets are random selected from the database. We examined about 20 scenes and the proposed method could detect ships in many cases as shown in Fig. 3. In this case, we can use a stereo vision and obtain information of the distance in order to separate a ship from a background. Tracking ability by the particle filter was confirmed in the same conditions as Experiment 1. In many cases, the proposed method worked well as shown in Fig. 6. It is the following frames of Fig. 7 (b) and it indicates detection results as well. It is difficult to separate the ship from the background as mentioned above.

CONCLUSION

This paper described a novel method to detect and tracking ships using a machine vision for a part of the safe marine transportation system. In the detection stage, edges on an image are calculated and bounding rectangles that have the many pixels with the strong edge are selected by morphological processing. Then, the bounding rectangles are judged “ship” or not by the SVM. In the tracking stage, the ship was tracked by the particle filter based on a color histogram inside the bounding rectangle.

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REFERENCES


Literature Review on the possibility of MALL in Just Beginning the Vocabulary Skills among Non-English Speaking Migrant and Refugee Women

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ABSTRACT

When landing in Australia, the ladies are facing non-English talking vagrant and for this learning of English and getting into that language becomes necessary. In order to to improve and build up these ladies’ dialect attitudes this paper audits the writing to investigate the possibility of utilizing portable helped dialect learning (MALL). By the discovery through this paper audit few women favour non-formal as opposed to formal adapting despite the fact that support for dialect learning is accessible. The social cultural components and individuals influence these ladies. Among non-English speakers the writing additionally demonstrates that vocabulary attitude is a huge branch of dialect learning in creating capability. When connected the shopping centre recommends the under pins distinctive regions of dialect attitudes advancement and education. With regards to coordinating MALL into vagrant and evacuee ladies’ dialect learning inside a non-formal getting the hang of setting the writing survey additionally shows that no examination has attempted. With a neighbourhood group focus to investigate and answer four research addresses that produced from this writing survey an exploration venture is being attempted.

Keywords: migrant, refugee, women, mobile-assisted language learning (MALL), vocabulary, language learning, nonformal learning.

INTRODUCTION

Settlement into another life in Australia by vagrants and evacuees includes: learning and adjusting to another culture; managing sociocultural and financial difficulties; Exploring intricate and new administration frameworks particularly for displaced people; managing extra enthusiastic and mental impacts; firstly, the overall and rising above issue for both transients and homeless, getting and learning English [1]. English dialect abilities are testing however basic for the individual, social and financial prosperity of vagrants and evacuees since they lead to building a comprehensive Australia [2] Like this, the Australian Government focused on giving necessary support to qualified vagrants and displaced people to secure practical English or potentially to enhance their English dialect abilities. Dialect learning backing is provided by the Department of Immigration and Citizenship through its settlement program, and by non-benefit associations, for example, the group focuses, multicultural discussions and religious foundations [3]. The previous gives formal English training through the Adult Migrant English Program (AMEP). The last provide non-formal instruction, for example, sessions for rehearsing conversational English.

DISCUSSIONS

Personal Factors

Family dependability and its impact: Both men and ladies vagrants and displaced people’s full investment in business might confine because of constrained English capability, an absence of Australian work involvement and lack of information on the Australian working environment culture. Ladies stand up to further difficulties that spill out of their family duties and furthermore the gendered way of the work showcases in their nations of origin [5]. Upon landing in Australia, men’s business by and large accept need while the lady’s turned out to be auxiliary and they are influenced to juggle domestic duties to encourage the move to the settlement of the family into another condition. Ladies likewise have poor access to and absence of data on socially appropriate childcare which turns into a boundary to taking an interest in work and preparing.
Local Language Literacy point: English tongue learners’ instruction levels are changed and can assemble in perspective of their sociolinguistic establishments. The combination of nearby vernacular capability that typically found in an English class for non-English talking grown-up learners. The neighborhood tongue capability typology above is a part that may influence English-lingo learning. Furthermore sub-segments fuse the level of oral and created capacity in the community language, Prolog to and association with capability in and outside of formal direction settings (for example, some years of formal mentoring in the country of inception) and learner motivation.

Sociocultural Factors: Social Inclusion versus Social Exclusion, The government, detailed a Social Inclusion Agenda to guarantee that all Australians, especially the individuals who are most in need and who begin a stage behind, approach the assets and openings they need, to shape their own particular life and to satisfy their potential. The vision of a socially inclusive society is that all Australians feel esteemed and have the chance to take an interest completely in the life of the general public. All things considered, all Australian will have the assets, openings and ability to: learn, accordingly take an interest in instruction and preparing; work, in this way take an interest in business, paid, unpaid or intentional; draw in and associate with individuals; utilize nearby administrations; take an interest in neighbourhood, cultural, civic and recreational exercises; and be heard where they have a voice to impact choices that influence them. Studies quickly tended to political consideration in connection to transients and outcasts. Boese and Phillips watched that, all in all, the Australian writing on social concern has not referenced the particular hindrances experienced by migrants and displaced people, and that social rejection holds on. Social prohibition characterized as the “confinement of access to circumstances and restriction of the abilities required to gain by these.” As indicated by Hayes, Gray, and Edwards, social avoidance is not what might as well be called destitution or insufficient financial assets, or absence of socially saw necessities. It is a common drawback that is brought about by a lack of connectedness and investment. Vagrants and displaced people do not seize a large number of the chances to be socially comprehensive in Australian culture because of progressing obstructions and disservices. As people from culturally and phonetically different Backgrounds, they are burdened in business and lodging and, as a rule, oppressed, contrasted with standard Australians. Boese and Phillips contend that the linkage and the potential between the Social Inclusion Agenda and multiculturalism in Australia remained underexplored, in this way proceeding with restricted effect on vagrants and evacuees unless longstanding obstructions, for example, prejudice and adequate arrangement of English dialect instructing are tended to, and that reliable information with which to gauge the effects gotten.

Support for English language teaching and learning: Despite the fact that the AMEP has been the instrument to bolster English education in Australia, there is as yet a boundary to accomplishment among the selecting understudies; there is a requirement for reasonable educational modules content for previous outcasts who have no or insignificant past tutoring. Because of the blend of educated and preliterate learners in formal English classrooms, preliterate students deserted. In that capacity, educational programs architects and educators need to take into account these shifting capabilities and non-capacities of understudies. Another run of the mill issue in the AMEP is that various substitutes don’t finish the 510 hours of study gave allowed to them. The explanations behind this incorporate work duties, poor long haul wellbeing, being pregnant or having an infant, and the nonattendance of youngster care or socially suitable kid mind. Hence, a request exists for non-formal English classes keep running by non-benefit associations due to their dynamic and loose setting.

CONCLUSION

When landing in Australia there has been investigation about the non English talking transient and evacuee ladies who found it difficult to learn English and settle there. These women are influenced by individual variables thus incorporate their family duty in their local dialect at education level and move towards learning inclinations amongst the grown up learners. For dialect learning the social cultural elements include consideration and prohibition issues. Among non English speakers vocabulary attitudes is viewed as a capability for their noteworthy branch. The MALL recommends potential advantages for discourse of writing followed by a CALL. MALL benefits include unconstrained learning, openness and transportability of learning material, mixed direction in-class or on the web,
intuitive UI and shared learning and correspondence. In the neighbourhood group for testing the capability of MALL an exploration venture is proposed as a team which is connected in transient and in light of examination address figured in the writing survey of displaced person ladies while learning the dialect.

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**REFERENCE**


Alternate Fuels For Emission Reduction:
Internal Combustion Engines

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ABSTRACT

Biodiesel alludes to a vegetable oil-or creature fat-based diesel fuel comprising of long-chain alkyl esters. Biodiesel is ordinarily made by synthetically responding lipids (e.g., vegetable oil, creature fat) with liquor. Biodiesel generation is an advanced and innovative territory for specialists because of consistent increment in the costs of oil diesel and natural points of interest.

The utilization of unsaturated fats methyl esters either in blends with fossil diesel or in immaculate state in diesel motors is related to a progression of specialized issues which are to be considered keeping in mind the end goal to not ruin the imperative ecological and social focal points that this sort of bio-combustibles reports. All through this work, the most basic parts of biodiesel use and additionally their quick results are presented. When all is said in done, this work tries to be a guide, which permits recognizing the most sensible zones inside the motor, and in addition the reasonable means and answers for the right utilization of biodiesel in pressure start motors (diesel motors).

Keywords: alkyl esters, fossil diesel, diesel motors, biodiesel.

INTRODUCTION

Biodiesel is a spotless devouring diesel fuel included substance made from soybean and other vegetable oils as opposed to oil [1]. Biodiesel is conveyed from vegetable oils by changing over the triglyceride oils to methyl (or ethyl) esters with a strategy known as transesterification [2]. Figure 1 shows the transesterification mechanism.

Biodiesel is used as a piece of weight begins (diesel) engines to update engine consuming execution, upgrade engine oil, and decrease air and water pollution caused by the exhaust [3]. Biodiesel blends work in diesel engines, from light to overpowering commitment, much the same as oil diesel fuel [4]. No engine changes are required by any methods, unless an engine has old fuel lines. It is a maintainable privately made liquid fuel that can help diminish the countries dependence on outside oil imports.

Fig. 1: Mechanism of Trans-esterification Reaction

Catalyst Use in Transesterification Reaction:
KOH/NaOH
A reaction of the trans-esterification process is the era of glycerol. For every 1 ton of biodiesel that is made, 100 kg of glycerol are made. At first, there was a critical market for the glycerol, which helped the money related issues of the methodology all things considered. Regardless, with the development in overall biodiesel era, the market cost for this harsh glycerol (containing 20% water and force stores) has pummelled\(^5\). Research is being coordinated globally to use this glycerol as an engineered fabricating square\(^6\). One movement in the UK is The Glycerol Challenge.

A variety of oils can be used to make biodiesel. These include:

- **Virgin oil feedstock: rapeseed and soybean oils are most conventionally used, soybean oil alone speaking to around 90% of all fuel stocks in the US. It in like manner can be gotten from field pennycress, Jatropha Curcas, Karanja and distinctive items, for instance, mustard, flax, sunflower, palm oil, coconut, hemp;
- **Waste Vegetable Oil (WVO);
- **Animal fats including fat, fat, yellow oil, chicken fat, and the reactions of the production of Omega-3 unsaturated fats from edge oil.
- **Algae, which can be produced using waste materials, for instance, sewage and without evacuating land at introduce used for food era.
- **Oil from halophytes, for instance, Salicornia Bigelovii, which can be produced using saltwater in shoreline front extents where standard harvests can’t be created, with yields proportional to the yields of soybeans and diverse oilseeds created using freshwater water framework

**USE IN DIESEL ENGINES**

Included substances are endlessly delivered and mixed with IC engine fills to meet the most ideal execution of fuel in engine\(^7\). Included substances act like impulse with the objective that they enable start, to control release, control fuel quality in the midst of transport and limit and diminish refiners working cost.

The execution of diesel engine using diesel included substance and methyl-ester of Jatropha oil as the fuel was surveyed for its execution and exhaust outpourings. The fuel properties of biodiesel, for instance, kinematic thickness, calorific regard, streak point, carbon development and specific gravity were found. Results demonstrated that B25 have closer execution to diesel and B100 had cut down brake warm viability for the most part due to its high consistency appeared differently in relation to diesel\(^8\). The brake warm capability for biodiesel and its blends was seen to be hardly higher than that of diesel fuel at attempted load conditions and there was no complexity between the biodiesel and its blended forces efficiencies. Its diesel blends showed sensible efficiencies, cut down smoke, CO2 and CO. Multi-DM-32 included substances with methyl ester of Jatropha offer fuel security and decrease defilement.

[Fig. 2: Carbon build-up on the injector nozzles]

**ANALYSIS AND DISCUSSION**

Put away on the surfaces persevering through a game plan method of coke and buildup. Buildup stores are the delayed consequence of the imperfect fuel consuming (as a result of the high limit), yet moreover now and again has their origination in drying and later carbonization of remains of lubing up oil is showed in Figure 2. Explanation of staying material on the surfaces of mechanical pieces furthermore grasps a minute sort of structure surrounded by completes the process of (lacquering); portrayed these ones as hard, dry stores, generally gleaming and insoluble in oil, and that likewise they are not easily shed water\(^9\).

Of course, as a response for this point, biodiesel refining strikingly decreases the slant of stores plan, by taking out the less unsteady parts from biodiesel. As a conclusion, it is watched that at full load biodiesel all around has a more perfect start, which clearly recommends a lower debilitating rate of methyl esters into the lubing up oil and reduction in the store advancement.

On the other hand, it is to a great degree outstanding that low temperature lead and the amazing oxidative
and limit wobbliness are among the two most basic particular inconveniences in association with biodiesel use. The last property makes the fuel oxidation conveying corruptions, for instance, hydro peroxides or carboxylic acids, which create rubbers, introducing on the bio-combustible a plastic and thick lead\(^{[10]}\). A possible response for improve biodiesel low temperature direct in Figure 3 meanwhile to diminish its percolating and gleam point would contain in the development of certain alcohol (methanol, ethanol) in a variable rate according to the specific and regular particulars in which engine operation is put on a show to be reviewed\(^{[11]}\). The speedy result is an adjustment in the already specified issues of lube oil debilitating and stores course of action; yet certain influence hardship would moreover be enrolled as an objective and negative outcome, continually in respect to the measure of included alcohol.

**Fig. 3: Biodiesel in other countries and India**

### ADVANTAGES

**Emissions Reduction:** Since Biodiesel is made totally from vegetable oil, it doesn’t contain any sulfur, fragrant hydrocarbons, metals or grungy oil stores. The nonattendance of sulfur infers a reduction in the improvement of destructive rain by sulfate releases which create sulphuric destructive in our atmosphere. The decreased sulfur in the blend will moreover reduce the levels of ruinous sulphuric destructive accumulating in the engine crankcase oil after some time. The nonappearance of deadly and malignancy causing aromatics (benzene, toluene and xylene) in Biodiesel suggests the fuel mix start gasses will have reduced impact on human prosperity and the earth.

**Smoke and Soot Reductions:** Smoke (particulate material) and dregs (unburned fuel and carbon developments) are of extending stress to urban air quality issues that are causing a broad assortment of hostile prosperity impacts for their locals, especially to the extent respiratory weakening and related sicknesses \(^{[12]}\). The nonappearance of considerable oil stores in the vegetable oil esters that are normally found in diesel fuel suggests that a diesel engine working with Biodiesel will have less smoke, and less deposit conveyed from unburned fuel. Further, since the Biodiesel contains oxygen, there is an extended efficiency of consuming despite for the oil some portion of the blend. The improved copying viability cuts down particulate material and unburned fuel releases.

**Environmental Effects:** The surge of eagerness for biodiesels has included different biological effects related with its use. These conceivably join diminishes in ozone hurting substance releases, deforestation, tainting and the rate of bio-corruption.

### CONCLUSION

As a substitute for quick draining petroleum derivative, Biodiesel had come to remain. In future, it ought to likewise serve to decrease and keep up the cost of fuel. The under a bused and unexploited vegetable oils are great wellsprings of bio-fuel. Our nation is blessed with numerous such plants. Research is being done now to change over vegetable oils into biodiesel through biotechnological forms utilizing biodiesel. With a concentrated and composed exertion, wide utilization of bio diesel in our nation will be a reality in the days to come.

Diesel frames almost 40% of the vitality devoured as hydrocarbon powers, and its request is assessed at 40 million tons. The national interest for fuel in India is six times that of different nations. Along these lines, biodiesel can open up new approaches in fuel utilization and takes care of the consistently rising requests of fuel in the nation.

India has tremendous extends of corrupted land, for the most part in regions with unfavorable agro-climatic conditions, where types of Jatropha, Manhua and so on can be developed effectively. Indeed, even 30 million hectares planted for bio-diesel can totally supplant the present utilization of bio-powers. The generation of Bio
energizes will likewise help the country economy which will acquire more energy more than one billion lives in the region.

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### REFERENCES


Analysis of Bicycle Frame Using Composite Material

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ABSTRACT
The casing of the bike is the fundamental structure to help the outer burdens. Conventional materials of the bike outline are steel or aluminum amalgam. With the end goal of lessening weight, the carbon/epoxy composite materials are presently generally used to make the bike outlines. The auxiliary examination of the casing is an essential stage in the outline procedure of the bike. Limited component technique was embraced to examination the basic practices of composite bike outline. Distinctive stacking succession and fiber heading have diverse effect on the disappointment list, i.e. the worry to quality proportion at various stacking conditions. Thus an ideal handle configuration must be finished. The quality estimations of T300 carbon/epoxy composite are utilized as a part of this examination. On the premise of Maximum anxiety rule, an ideal utilize outline for various stacking conditions has been recommended in this work. The best stacking arrangement of the composite edge is recommended on the premise of Failure list of the previously mentioned criteria. Singular Ply disappointment is considered and the employ disappointment will happen when disappointment list esteem is more noteworthy than one. Bike outline demonstrating was done in CATIA V5 programming. Shell component is utilized to demonstrate the composite bike outline. Two testing techniques for the bike outline, i.e. frontal and vertical burdens are embraced in the examination. From the limited component investigation comes about, feeble areas, that is locales with higher anxiety focus are recognized on the bike outline. With a specific end goal to diminish this anxiety fixation, Structural changes are done on the edge work. Limited component investigation is again done on the casing work to approve the discoveries.

Keywords: aluminum amalgam, carbon/epoxy composite materials, CATIA V5, T300 carbon/epoxy composite.

INTRODUCTION
A Composite is an auxiliary material that comprises of at least two distinct materials which are consolidated together to make a one of a kind and prevalent third material[1]. Composite materials which are made out of fortified strands and plastics grid have unrivaled properties like low thickness, high quality to-weight, high firmness to-weight proportions, consumption resistance, wear resistance, long weakness life and natural steadiness [2]. Due to above properties, the overlaid fiber-strengthened composite materials, for example, carbon/epoxy composites have wide applications [3]. A portion of the essential territories that are connected are in flying machine, aviation, military, car, marine, and games structures. Presently composite materials are utilized for the make of elite games bikes. The edge of the bike is the fundamental structure that help the different outside burdens that are following up on them. Steel or Aluminum composite are the customary materials that are utilized for the produce of bike outline. With the end goal of decreasing weight, the carbon/epoxy composite materials are presently generally utilized for the produce of bike outlines. In the plan procedure of the bike, basic examination of the bike outline is a critical stage. Prior to the fabricate of bike model and business items, the quality and solidness of the bike structures can be anticipated and adjusted to an ideal outline with the guide of hypothetical and numerical counts [4]. The limited component technique is one of the numerical strategies connected in different physical issues. Utilizing FEA techniques we can ascertain the anxiety and distortion of the structures. Diverse stacking grouping and fiber bearing have distinctive effect on the outline parameter, R, i.e. the quality to push proportion at various stacking conditions. Consequently an ideal handle plan regular for various stacking condition must be finished. The quality estimations of T300 carbon/epoxy composite are utilized as a part of this investigation. On the premise of Maximum Stress model, an ideal handle plan for various
stiffening conditions has been proposed in this work. The best stiffening grouping of the composite casing is proposed on the premise of Failure file of the previously mentioned criteria. Singular Ply disappointment is considered and the handle disappointment will happen when disappointment file esteem is more prominent than one. Bike outline demonstrating was done in CATIA V5 programming. Limited component investigation was finished utilizing ANSYS 15 programming. Shell component is utilized to show the composite bike outline. The bike outline comprise of tubular structures made of carbon epoxy composite material. The composite structure comprise of 8-handle cover having an individual utilize thickness of 0.3 mm. Two testing strategies for the bike outline, i.e. frontal and vertical burdens are received in the investigation. From the limited component examination comes about, frail areas, ie; locales with higher anxiety fixation are distinguished on the bike outline. With a specific end goal to lessen this anxiety focus, Structural changes are done on the edge work. Limited component investigation is again done on the casing work to approve the discoveries.

METHODOLOGY

With the end goal of decreasing weight, the carbon/epoxy composite materials are presently broadly been generally utilized for the fabricate of bike outlines. “R” is characterized as the outline parameter. Diverse stiffening grouping and fiber bearing have distinctive effect on the outline parameter R, ie the quality to stretch proportion. Bigger estimation of Rmin suggests higher factor of security of the bike outline. Consequently the proposal go for finding an ideal employ plan for the composite bike outline at different stiffening conditions. Likewise auxiliary changes are done on the bike outline with the goal that the plan parameter Rmin could be expanded.

The anxiety focus at the joints of a bike outline is the principle explanation behind the disappointment of a bike outline after delayed utilize. On the off chance that basic changes are done close to these associating areas utilizing auxiliary elements like stiffeners, misshapening and stretch focus occurring at these districts can be decreased fundamentally.

BICYCLE FRAME MODELLING

The Bicycle outline displaying was done in CATIA V5R18 programming. The fundamental measurements of the bike outline are appeared in the table given underneath. The bike outline comprises of many tubes made of carbon/epoxy composite overlays.

Fig. 1: Bicycle model

At first the CAD displaying was done in wire edge and surface outline. This was done as such that shell thickness of 2.4mm can be connected on the following stage. The fundamental parts of the bike casing can be isolated into top tube, situate tube, front tube and back tubes. The length of back tubes are taken as 320mm.

Limited ELEMENT ANALYSIS The limited component programming ANSYS is utilized as a part of this postulation work. Propelled composite pre post, ACP is utilized for the investigation. All the composite structures in the bike outline are made of 8 handle carbon-epoxy composite covers. Each utilize thickness is 0.4mm. The course of worldwide arrange arrangement of the body is taken as the bearing of foremost material facilitate arrangement of each ply. The thickness of carbon epoxy composite material is taken as 1600kg/m3. Orthotropic Elastic properties of carbon/epoxy composite are taken as demonstrated as follows.

RESULTS AND DISCUSSION

Front loading

Fig. 2: Normal stress
Under the frontal stacking, the first or eighth layer was observed to be the frail layer and the feeble locale was seen at the front joint which is the front tube-top tube association area. Typical anxiety acting in Y course, $\sigma_2$ is the disappointment stretch. Be that as it may, under vertical stacking, the powerless area was moved to the back joint which is the seat tube-top tube joint district. After various stacking conditions cover is observed to be the ideal employ outline. Furthermore, powerless locales ie, areas with higher anxiety fixation are found to happen at three interfacing districts in the edge work. Auxiliary changes are done close to these associating districts utilizing basic components like stiffeners, so twisting and stress fixation occurring at these areas can be diminished fundamentally.

New Rmin esteem for frontal stacking is 0.44 and vertical stacking is 16.5 which are higher esteems contrasted and old Rmin esteems. Add up to twisting if there should be an occurrence of frontal load is 44.38mm and 0.1424 if there should arise an occurrence of vertical stacking. This shows lesser distortion from the principal demonstrate.

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**REFERENCE**


Analysis of Static Stability for Ship in Different Conditions

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ABSTRACT

The vessel’s focal point of gravity distinctly affects the correcting lever also, thus the capacity of a vessel to come back to the upright position. The bring down the focal point of gravity, the greater is the correcting lever. Should the vessel’s focal point of gravity be close to the metacentre (M) the vessel will have just a little metacentric tallness and the correcting lever will additionally be a little esteem. Accordingly, the snapshot of statical soundness to restore the vessel to the upright position will be extensively not as much as that of the past illustration. Stability bends (GZ bends) are utilized to demonstrate graphically the solidness levers applied by a vessel to return itself to a place of harmony from the different states of foot rear area. The bends have a few general attributes. The state of the correcting lever bends is subject to the type of the vessel’s structure and its stacking. The state of the bend at little edges of foot sole area for the most part takes after the slant of the line plotted to the underlying metacentric stature. In such manner, the freeboard and the proportion between the vessel’s expansiveness and profundity are likewise extremely imperative.

Keywords: Statical, Vessel, Surface Boats, Meta centric stature

INTRODUCTION

Having talked about the essentials of in place strength of surface boats, we are presently at a phase to examine the same. The least demanding and handiest apparatus for breaking down a surface ship’s security, is by charts or bends [1-3]. Truth be told, a ship planner or an officer on-board ought to have the capacity to know the solidness attributes of a ship just by taking a gander at the bends. Since the solidness of a ship can be straightforwardly remarked on by the nature and estimation of its metacentric stature, an immediate strategy to track the dependability of a ship for a scope of foot sole area edges would be, to produce a bend that relates this parameter to the edge of rear area. Since metacentric tallness is specifically identified with the correcting lever and point of foot sole area, the bend of static solidness is a plot between the correcting lever and edge of rear area [4-5]. On the off chance that the bend converges the cause, it implies that there is no correcting lever when the ship is upright. At the end of the day, the ship has inborn positive starting strength.

As the edge of foot sole area increments, there comes a moment that the deck of the ship submerges. This edge is known as the edge of deck submersion, and the comparing point on the bend is called purpose of emphasis. How would you perceive this point just by taking a gander at a GZ bend? To know this current, we should first comprehend the marvel of deck inundation from a steadiness perspective. At the point when the
deck of a ship submerges, the rate of move of focus of lightness (and furthermore the correcting lever) with additionally obeying changes. This outcomes an adjustment in concavity of the bend. This can obviously be noted at point “An” in the above bend. Purpose of emphasis does not assume an imperative part in operational purposes, but rather it encourages fashioners to roll out preparatory expectations in regards to what improvements in steadiness would be realized whether the plan of a structure frame is changed.

The aggregate territory under the static security bend gives the measure of vitality that the ship can ingest from outside obeying powers (winds, waves, weight shifts, and so on.) till it upsets. In this manner, it ought not be expected that a ship is sufficiently steady just if the estimation of the greatest GZ is high. A GZ bend with a high greatest esteem won’t not have the adequate range, and thus, the ship will overturn effortlessly in light of the fact that it wouldn’t have the capacity to ingest enough vitality before upsetting. In the event that a digression is attracted to the GZ bend at the inception, and an ordinate is drawn at 57.3 degrees (1 Radian), at that point the purpose of convergence of the digression and the ordinate would give the estimation of the underlying metacentric stature of the ship, as appeared in the above figure. This can be demonstrated scientifically, however as opposed to going into that, we will see how this critical property of the bend is connected for useful purposes.

**METHODOLOGY**

GZ bends are created mulling over different conditions for one ship, amid the plan procedure. In spite of the fact that the qualities followed by the bend might be distinctive for each situation of stacking, however the shape or ebb and flow of the bend will barely change, since it relies upon the geometry of the structure. Along these lines, the frame creator should dependably contemplate the underlying arch of the GZ bend once it has been produced for a solitary load case.

How about we consider two ships having the same metacentric stature, however unique structure shapes, with the end goal that the arch of the GZ bend close to the starting point for Ship An is sunken upward and the ebb and flow for Ship B is inward descending as appeared in figures individually. For each ship the GZ bends are plotted for:

**Loadcase 1:** Normal Departure Condition (low CG)/ Sufficient GM.

**Loadcase 2:** When CG is higher, or GM is decreased.

![Figure 1: GZ curves of Ship A for two loadcases (Concave Up)](image)

![Figure 2: GZ curves of Ship B for two loadcases (Concave Down)](image)

**RESULTS AND DISCUSSION**

The vertical position of focus of gravity of the ship is not generally settled. It changes with each voyage, contingent upon the stacking conditions and the measure of stabilizer. The CG of the ship likewise changes when the ship is in travel. This changing nature of CG makes it troublesome for the fashioner to expect the stacking conditions at which GZ bends ought to be gotten, on the grounds that diverse estimations of KG would bring about various metacentric statures, and since correcting lever is straightforwardly identified with GM, the soundness bends for each of the stacking condition would be extraordinary.
Keeping in mind the end goal to make things simpler, a couple of well established certainties were considered before building up the idea of cross bends of steadiness:

- KG will differ as per the stacking condition.
- The KG of the ship is constantly known to the architect, and furthermore the ship’s skipper, for each stacking condition.
- The edge of foot sole area at any condition is likewise known to the creator and the ship’s commander.

![Figure 3: KN for a ship at any angle of heel.](image)

So as to see how, contemplate the above figure. The point “K” speaks to the bottom of the ship. On the off chance that at any edge of foot sole area (Θ), a line parallel to that of GZ is drawn from ‘K’, at that point the purpose of crossing point of this line with the vertical line of activity of lightness, is spoken to as ‘N’.

Righting Lever (GZ) = KN – KG sin θ

From the above figure, the accompanying articulation can be inferred for correcting lever: The just obscure in the above articulation is the estimation of KN. In this way, a PC produced plot of KN esteems for a scope of relocations is acquired for various foot rear area edges, and the resultant bends are aggregate called KN Curves or Cross Curves of Stability, as appeared in Figure 4 underneath.

![Figure 4: Cross Curves of Stability for a surface ship.](image)

**CONCLUSION**

At the point when a ship enters a dry-dock she should have a positive starting GM, be upright, and trimmed somewhat, for the most part by the stern. The dock entryways are then finished and pumping off initiates. As the water level falls in the dry-dock there is no impact on the ship’s steadiness inasmuch as the send is totally waterborne, however after the stern grounds on the obstructs the draft toward the back will diminish and the trim will change by the head. This will proceed until the point when the ship takes the pieces general all through her length, when the draft will then decline consistently forward furthermore, toward the back. The interim of time between the stern post arriving on the squares and the ship taking the squares by and large is alluded to as the basic time frame. Amid this period part of the heaviness of the transport is being borne by the pieces, and this makes an upthrust at the stern which increments as the water level falls in the dry-dock. The upthrust causes a virtual misfortune in metacentric tallness and it is basic that positive powerful metacentric tallness be kept up all through the basic time frame, or the ship will heel over and maybe slip off the pieces with unfortunate outcomes.

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An Analysis of Longitudinal Stability of Ships

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ABSTRACT

The idea of hydrostatics and security can be considered as a standout amongst the most imperative ranges of center in deliver plan and operation, not exclusively to guarantee the wellbeing of the ship, payload, team and travelers, yet additionally to empower legitimate conditions for fulfillment of the considerable number of procedures on a ship. This arrangement of articles will initially talk about the idea of hydrostatics of a ship, and gradually progress into a presentation of ship soundness. Once that is done, we will perceive how the ideas are connected progressively and likely circumstances to investigate the security of the ship, how a planner applies ideas of hydrostatics and dependability to build up a body shape, Some trademark parameters figured for a drifting boat, which can either specifically be utilized to remark on the idea of strength of the ship or be utilized to assess other soundness parameters, are called dispatch hydrostatics. For an originator to have the capacity to build up a body frame, or a ship’s commander to comprehend the strength parameters, it is critical for both to have the capacity to comprehend the importance and handy criticalness of each hydrostatic parameter of a surface ship. We will initially list the hydrostatics of a surface ship.

Keywords: Statical, Vessel, Surface Boats, Meta centric stature

INTRODUCTION

The essential elements of trigonometry, the wording utilized for send security, the impacts of lightness and gravity on send soundness, and the impacts of weight moves on transport dependability. To grasp the standards of ship strength completely, you should have an essential comprehension of trigonometry and the elements of right triangles [1-3]. As a rule, the heaviness of a ship in the water is “driving” straight down, and the seawater that it dislodges is “driving” straight go down. At the point when no other powers are following up on the ship, every one of these powers scratch off each other out and harmony exists. In any case, when the focal point of gravity moves from straightforwardly over the focus of lightness, there is a “slanting minute.” At the point when this happens, this power is thought to be at right edges to the powers of gravity and lightness. An comprehension of trigonometry is required to comprehend the impacts and consequences of these actions.Trigonometry is the investigation of triangles and the interrelationship of the sides and the points of a triangle. In deciding boat steadiness, just that piece of trigonometry relating to right triangles is utilized. There is a settled connection between the edges of a right triangle and the proportions of the lengths of the sides of the triangle [4-6]. These proportions are known as trigonometric works and have been given the accompanying names: sine, cosine, digression, cotangent, secant, and cosecant. The three trigonometric capacities required for deliver solidness work are the sine, cosine, and digression. Notwithstanding the span of a power and its course of activity, the area of the power is critical. For case, if two people of a similar weight sit on inverse finishes of a teeter-totter, similarly inaccessible from the bolster, the teeter-totter will adjust. Be that as it may, in the event that one individual moves, the teeter-totter will never again remain adjusted. The individual most distant far from the help will move down in light of the fact that the impact of the power of his/her weight is more noteworthy.

The impact of the area of a power is known as the Snapshot OF FORCE. It is equivalent to the power duplicated by the separation from a hub about which you need to discover its impact. The snapshot of a power is the propensity of the power to deliver revolution or to move the protest around a pivot [7-8]. Since the power is communicated in terms of weight units, for example, tons or pounds, and the minute is compel times separate, the units for minute are communicated as foot-tons, foot-pounds, or inch-ounces. "Buoyancy" might be characterized as the capacity of an protest skim. In the event that a question of a given volume is set submerged and the heaviness of this protest is more noteworthy than the heaviness of an equivalent volume of water, the protest will sink. It sinks in light of the fact that the Power that floats it up is not as much as the heaviness of the question. In any case, if the heaviness of the protest...
is LESS than the heaviness of an equivalent volume of water, the question will rise. The question rises on the grounds that the FORCE that floats it up is more noteworthy than the heaviness of the protest; it will keep on rising until the point that it is incompletely above the surface of the water \([9]\). In this position the protest will skim at such a profundity, to the point that the submerged piece of the protest uproots a volume of water EQUAL to the weight of the question.

To comprehend the hydrostatics, we have to familiarize ourselves with a couple of fundamental ship wordings regularly show up during the time spent comprehension and assessment of hydrostatics and security parameters of a surface ship. Take after the figure beneath with reference to the phrasings portrayed underneath.

**METHODOLOGY**

**Metacentric Radius (BM):** The metacentric stature of a ship is the vertical separation between its focal point of lightness and metacenter. This parameter can be pictured as the length of the string of a swinging pendulum of the focal point of gravity of the pendulum corresponds the focal point of lightness of the ship. At the end of the day, the ship carries on as a pendulum swinging about its metacenter. The metacenter of the ship changes itself, each minute. Since with each edge of foot sole area, the transverse move in focal point of lightness will shift, thusly making another metacenter.

\[
\text{Transverse Metacentric height (BM)} = \frac{\text{Transverse moment of Inertia of Waterplane}}{\text{Volume Displacement of ship}}
\]

The significance of this parameter can be acknowledged when the scientific articulation of metacentric range is researched.

```
Figure 1: Water plane at a particular draft, and its centroidal axis
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Presently, Allude to the figure beneath. A ship drifting at a specific draft, has a one of a kind water plane. At the point when the ship comes in the condition, on the off chance that one looks from the best, the whole water plane territory appears to waver about its longitudinal centroidal pivot. The range snapshot of latency of this waterplane territory about its centroidal hub is the transverse snapshot of dormancy of waterplane at the relating draft.

**Metacentric Height (GM):** The vertical separation from the focal point of gravity to the metacenter is known as the metacentric stature. You will run over this term various circumstances in this article, and an originator is presumably most worried about this parameter amid the whole plan process. IMO Codes of Stability for Ships have laid solidness criteria for ships that are for the most part in view of this parameter. All in all, would it be that makes this parameter so indispensable? That is something we will talk about for most piece of the later piece of this article, and the following couple of parts of this arrangement.

The estimation of GM should be acquired at different stages, appropriate from beginning plan arrange, to structure configuration organize, amid dependability examination of a recently outlined frame, after the development of a ship, and amid operations adrift. The strategies utilized as a part of these stages are unique in relation to each other, on the grounds that:

- At each stage, the reason behind the assessment of GM contrasts.
- The known parameters required to assess the GM likewise fluctuate at each stage.

For the time being, given the way that we know the parameters: BM, KB, and KG, how about we simply welcome the most essential equation used to assess the metacentric stature of a ship

\[
\text{Metacentric height (GM) } = KB + BM – KG
\]

**Moment to Change Trim by 1 Centimeter (MCT):** For a specific draft, it is the longitudinal minute (about the LCF) required to achieve a trim of 1 centimeter. This parameter assumes imperative part particularly when the team on board requires stacking payload in any one hold or counterbalance, or de-balancing, and anticipating the resultant trim caused by the activity. Since the declaration of this parameter does not assume any critical part in understanding the ideas of ship soundness, we will skip it. In any case, do recall that, MCT is an imperative hydrostatic parameter required by solidness investigation virtual products and team operations.
**Tonnes per Centimeter Immersion (TPC):** For a specific draft the weight required to be included onto the ship in order to cause a parallel sinkage of 1 centimeter, is communicated as the TPC. This, like MCT, is utilized widely by the group to anticipate the new drafts after any operation that includes expansion or expulsion of weights from the ship. Following is the articulation used to assess the TPC of a ship at any given draft:

\[
TPC \text{ in sea water} = \frac{1.025 \times \text{Area of Waterplane}}{100}
\]

\[
TPC \text{ in fresh water} = \frac{\text{Area of Waterplane}}{100}
\]

**RESULTS AND DISCUSSION**

TPC of a ship skimming in water of uniform thickness, depends entirely on the zone of waterplane. The parallel sinkage coming about because of a specific stacking in new water would be progressively if a similar stacking was done in ocean water. The team must recalculate the anticipated new drafts in the wake of stacking or emptying when the ship moves from crisp water to ocean or the other way around, to evade sudden perceptions. All the hydrostatic parameters are figured by a dependability examination programming and plotted on a chart against various drafts. This diagram is aggregately called hydrostatic bends, and the same for a 200 traveler dispatch is demonstrated as follows.

**Hydrostatic Curves:** This chart is utilized by the team on-board to quickly get the estimation of a hydrostatic parameter of the ship for a given draft. In any case, one should be cautious about the multi-scale level hub that is utilized here, since various parameters with various units are plotted on a similar diagram.

![Figure 2: Hydrostatic curves for a 200 pax passenger ship.](image-url)
The main hydrostatic parameters that decline with increment in draft are tallness of metacenter from the bottom (KM), and longitudinal focal point of lightness (LCB). Keep in mind, here, the LCB is ascertained from the forward opposite (read even hub in the diagram), which implies, a diminishing LCB with expanding draft infers, the LCB pushes ahead with increment in draft. Be that as it may, let us contemplate this further. Does it remain constant for all boats? While, the nature of KM is for the most part the same, the nature of progress of LCB with draft will differ as per the type of the body.

CONCLUSION

In spite of the fact that these parameters are not essential for the group, they assume imperative part in streamlining the structure shape, and fairing the body to a fine shape. On the off chance that you see the idea of the bends in the figure, the bends are not smooth. This suggests the frame at this phase of configuration, is not totally smooth, and would bring about expanded resistance. The same likewise applies to all the hydrostatic bends. Both these bends, alongside the sectional region bend of a ship are at the same time alluded to, at each phase of body alteration, until the point when smooth arrangements of bends are gotten. The comprehension of which will assume a key part in concentrate the soundness of boats. You would now be able to perceive each hydrostatic parameter that seems further, its noteworthiness, and how it is spoken to on the soundness book of a ship in type of bends.

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REFERENCES


Design and Fabrication of Spring Rolling Machine

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ABSTRACT

This paper is to examine to outline and manufacture of a manual spring moving machine by a basic system game plan for the creation of shut and open loop helical springs. This machine is worked by manual technique. This machine produces shut curl helical spring of various width and distinctive length. Rolling is the way toward bowing metal wire to a bended shape. The article in the state of round is made by spring roller shaft. Moving operation should be possible close by or control worked moving machine. It can make a spring from a pole. A pole is a pivoting machine component which is utilized to transmit control starting with one place then onto the next. A course is machine component which underpins another moving machine component. Guider is utilized to manage the crude material (spring wire). This guider precedes onward the pole consequently. This self-development is accomplished by the lead of spring. Handle is utilized to work the moving machine physically, without electric power outline is conveys an all parts of the machine, it is comprised of mellow steel. A work holding system is utilized to hold the mandrel; it is connected to the principle shaft of machine. Mandrel is fitting in the work holding instrument, the mandrel’s external distance across is known as inward breadth of the spring.

Keywords: Fabrication, Spring Rolling Machine, Mandrel, Helical Springs

INTRODUCTION

A spring is a gadget that progressions its shape in light of an outside constrain, coming back to its unique shape when the compel is evacuated. The vitality exhausted in disfiguring the spring is put away in it and can be recouped when the spring comes back to its unique shape. The measure of twisting is specifically corresponding to drive applied. Spring moving industry is a vast and developing industry. There is numerous unique reason machines utilized as a part of this industry to-day. The correct choice of the machines relies on the kind of the work under – taken by the specific business. There are numerous cases of spring moving work incorporate iron, copper, tin, aluminum, stainless and metal. This venture the “SPRING ROLLING MACHINE” finds enormous application in all spring moving industry. Rolling is the way toward bowing metal wire to a bended shape. The article in the state of round is made by spring roller shaft. Moving operation should be possible close by or control worked moving machine. In framing round spring shapes a continuous bend is to be placed in the metal as opposed to sharp curves. The crevice between the springs can be directed by appropriate game plan. Spring is flexible bodies that can be wound, pulled or extended by some constrain. They can Return to their unique shape when the compel is discharged. At the end of the day it is likewise named as a flexible part. A spring is characterized as a versatile machine component, which redirects under the activity of the heap and comes back to its unique shape when the heap is expelled. Mechanical springs are utilized as a part of machine outlines to apply constrain, give adaptability, and to store or retain vitality. Springs are made for various applications, for example, pressure, augmentation, torsion, power, and consistent compel. Contingent upon the application, a spring might be in a static, cyclic or dynamic working mode. A spring is typically thought to be static if an adjustment in diversion or load happens just a couple of times, for example, less than 10,000 cycles amid the normal existence of the spring. A static spring may stay stacked for drawn out stretches of time. The disappointment methods of enthusiasm for static springs incorporate spring unwinding, set and crawl.

SCOPE

The objective of this venture is to outline and creation of a manual spring moving machine by a straightforward instrument course of action for the generation of shut and open loop helical springs. The particular attributes being variable spring breadths, variable spring loop widths of different materials by manual moving
procedure. The extent of this venture is the use of this “MANUAL SPRING ROLLING MACHINE” in little scale enterprises for the generation of open and shut helical springs of shifting spring curl measurements and fluctuating spring width, without much cost in a little scale level. The significance of this examination was that to think about the diverse springs that are utilized as a part of many car parts and different systems, and the pivotal part that they play in various components. The spring machine is made by an extremely straightforward course of action. This machine is worked by manual technique. This machine produces shut curl helical spring of various distance across and diverse length. In our venture is the spring moving machine. Rolling is the way toward bowing metal wire to a bended frame.

**WORKING**

At the point when the hand wheel is pivoted, the pole will run. The primary shaft is coupled to the holding on for the assistance of mellow steel plate course of action. The principle shaft is pivoted with help of hand wheel turn. Prior to the hand wheel pivot, the spring wire bolted to the secure nut in the spring mandrel. The spring wire is provided by applying the heap through a guide which is settled in the edge stand. The guide will turn openly as per the speed of the spring moving shaft. The fundamental shafts one end is coupled to the throw and flip side is coupled to the hand wheel. An axle shaft or mandrel (different measurements) is connected to the hurl and it turns. The spring moving shaft is pivoted when the hand wheel is turns. The spring is moved with the spring moving shaft. The adjustment in the length of spring because of the revolution of the spring is chosen by the administrator. In the wake of making the required length of the spring the hand wheel is revolution is ceased. Subsequent to delivering the completed result of spring, the method is rehearsed for large scale manufacturing. The Figure 1(a), 1(b) & 1(c) are the sample output of solid works design.

**DISCUSSION**

The spring rolling machine result analysis is done in Solid work tools with Intel Core Dual processor, 2 GB RAM, and 500 GB memory with Windos7. The result displays the various measurements of metals with good accuracy. Fig. 2(a) & 2(b) expresses the report of spring rolling machine design analysis.
Springs are generally produced using combinations of steel. The most well-known spring steels are music wire, oil tempered wire, chrome silicon, chrome vanadium, and 302 and 177 stainless. Different materials can likewise be framed into springs, contingent upon the qualities required. A portion of the more typical of these intriguing metals incorporate beryllium copper, phosphor bronze, Inconel, Monel, and titanium. Fig. 3 explains the fabrication model of spring rolling machine with component details.

**Fig. 2: (b) Analysis view of spring rolling.**

**Fig. 3: explains the fabrication model of spring rolling machine**

**CONCLUSION**

Subsequent to finishing the work, it is presumed that work is basic in development and minimal in measure for utilize. Indeed, even without control supply it can be worked physically, and furthermore assembling of machine is simple and cost of the machine is less. The machine can manufacture jump up to 3mm wire breadth of spring with less generation time effortlessly by mass or bunch creation. The work can be actualized in little scale enterprises.

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printing (Doctoral dissertation, Massachusetts Institute of Technology).


Fabrication of 360 Degree Automatic Machine Gun Rover for Advanced Defence

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ABSTRACT

Machine gun defence is a system, weapon, or technology involved in the detection, tracking, interception, and destruction of attacking enemies. Automatic shooting system is normally constructed using GPS, radar and other form of inertial guidance mechanisms. The paper proposed a new method of shooting system that is purely based on a high speed camera and embedded image processing techniques running at extremely low power. The project aim is to design and develop a very low power embedded system for tracking and shooting moving enemies using a high speed video camera integrated with a high performance microcontroller. Higher velocities of the moving target and the interceptor missile demands higher data update rates from the sensors, processing elements and control system. Using the selected components a 10 Hz update rate (100 ms) is achievable. The microcontroller firmware is developed to handle the real-time needs of the embedded software for the onboard computer, which is designed to achieve deterministic response times for the accurate control and precise scheduling of firing mechanism.

Keywords: Fabrication, Defence, Machine gun, GPS, microcontroller

INTRODUCTION

The Indian military have been occupied with various significant military operations, including: the Indo-Pakistani wars of 1947, 1965 and 1971, the Portuguese-Indian War, the Sino-Indian War, the 1967 Chola episode, the 1987 Sino-Indian encounter, the Kargil War, and the Siachen struggle among others [1-3]. India respects its military and military staff every year on Armed Forces Flag Day, 7 December. Since 1962, the IAF has kept up close military relations with Russia, including helpful improvement of projects, for example, the Fifth Generation Fighter Aircraft (FGFA) and the Multirole Transport Aircraft (MTA). Equipped with the atomic triad, [4-5] the Indian military are consistently experiencing modernisation, with interests in territories, for example, cutting edge fighter frameworks and rocket safeguard frameworks.

The Department of Defence Production of the Ministry of Defence is in charge of the indigenous generation of hardware utilized by the Indian Armed Forces. It involves the 41 Indian Ordnance Factories under the control of the Ordnance Factories Board, and eight Defences PSUs to be specific: HAL, BEL, BEML, BDL, MDL, GSL, GRSE and Midhani. India was the biggest merchant of guard hardware in 2014 with Russia, Israel, France and the United States being the best remote providers of military equipment [6][7][8]. The Government of India has propelled a Make in India activity to indigenise fabricating and diminish reliance on imports, including safeguard imports and acquirement.

MATERIALS AND METHODOLOGY

STM32F429: The STM32F429/439 lines offer the performance of the Cortex-M4 core (with floating point unit) running at 180 MHz while reaching lower static power consumption (Stop mode) versus STM32F405/415/407/F417.

ARM Cortex-M4: The ARM Cortex™-M4 processor is the most recent inserted processor by ARM particularly created to address advanced flag control advertises that request a productive, simple to-utilize mix of control and flag handling abilities. The ARM® Cortex®-M4 processor is a superior implanted processor with DSP directions created to address computerized flag control advertises that request an effective, simple to-utilize mix of control and flag preparing abilities. The
processor is exceedingly configurable empowering an extensive variety of usage from those requiring gliding point operations, memory security and capable follow innovation to cost delicate gadgets requiring insignificant range. Fig. 1 expresses the sample Architecture of ARM Cortex-M4 with their functionality and description.

**Fig. 1: Sample Architecture of ARM Cortex-M4**

**Cortex-M4 with FPU and Signal Processing Technologies:** The Cortex-M4 processor has been composed with a substantial assortment of very proficient flag preparing highlights pertinent to computerized flag control markets. The processor highlights expanded single-cycle increase amass (MAC) guidelines, streamlined SIMD math, immersing number-crunching directions and a discretionary single exactness Floating Point Unit (FPU). These components expand upon the creative innovation that portrays the ARM Cortex-M arrangement processors. Fig. 2 explains the component of ARM Cortex-M4 Architecture with processing flow.

**Fig. 2: Component and processing steps of ARM Cortex-M4 Architecture**

OV2640 Camera Sensor: The OV2640 CAMERACHIPTM is a low voltage CMOS camera sensor that gives the full usefulness of a solitary chip UXGA (1632x1232) camera and picture processor in a little impression bundle. The OV2640 gives full-outline, sub-inspected, scaled or windowed 8-bit/10-bit pictures in an extensive variety of configurations, controlled through the Serial Camera Control Bus (SCCB) interface. Fig. 3 describes the working model with PIN details of OV2640 Camera Sensor to detect and shoot the enemies from long distance.

**Fig. 3: working model of OV2640 Camera Sensor**

**WORKING**

The automatic machine gun is made by combination of embedded and mechanical setup. The gun rotating movements are done by using servo motors. The servo motors are more suitable for 360 degree rotation. The servo motor stand has wheels for moving. The wheels are controlled by the electric motors. The robot will carry the weight of 25 kgs as five separate weights. The weights are used to detonate the landmines.

The microcontroller does the heavy task of embedded vision processing. The project uses an STM32F429
microcontroller to track an object, using the images it gets from an OV2640 camera sensor. The camera is configured to output pictures in RGB565 format at QVGA (320 x 240) resolution. Fig. 4 expressed the graphical representation of Fabrication of 360 Degree Automatic Machine Gun Rover with working details in step-wise.

**DISCUSSION**

Once the target is selected, its colour defines the threshold of the pixels in the image that is processed further. The process of separating a region on interest in a digital image based on the given colour is called image segmentation. After the image segmentation is done, an algorithm recognizes the contour of the image and its centre, once located a control system calculates the movement of 2 servos (pan, tilt) in order to target the object precisely and another servo to trigger the interceptor firing towards it using a special gun shooting mechanism.

**CONCLUSION**

The automatic machine gun rover is successfully fabricated using paint gun. It can be controlled by the microcontroller PIC16F877A. By using this advance shooting equipment, Indian army is able to attack the enemies without any human effort. This automatic machinegun has no loop holes for hacking because it does not have any WI-FI communication. And the machine is equipped with 4mm thick steel plate for shielding the whole setup. It also used to detect and destroy the landmines without any damage to it. It not only used to defeat the enemies but also used to protect the soldiers.

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**REFERENCES**

Mooring Analysis of Pipelaying Barge & Fuel Consumption

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ABSTRACT

Oil organizations utilize immense measures of pipeline to transport raw petroleum from the seaward fields to shore offices. The laying procedure of such pipelines needs unique vessels outfitted with every one of the offices to join fragments of pipelines and to lay the pipeline onto the seafloor. Amid the laying operation, it ought to be legitimately moored to the seabed to constrain the movements of the vessel. This paper portrays the itemized mooring examination of a pipelay freight boat utilizing 8 point grapple mooring framework appropriate for development work in shallow water situations and indicates legitimate mooring rope/wire for the operation. The canal boat displaying is done in ANSYS Design Modeler and hydrodynamic examination did in ANSYS AQWA. The RAO information is then contribution to ORCAFLEX where a model with mooring lines connected according to the proposed grapple design is examined.

Keywords: ANSYS, ORCAFLEX, MOOR, LARSTRAN and FLOATMOOR.

INTRODUCTION

A stay mooring fixes a vessel’s position in respect to a point on the base of a conduit without interfacing the vessel to shore. Appropriate mooring line materials and setup guarantee that heaps don’t surpass the breaking point esteems[1-3].

A level bottomed vessel is a watercraft with a level bottomed, two-chined structure, which permits it be utilized as a part of shallow waterways, for example, streams, since it is less inclined to ground[4-6].

The level body additionally makes the pontoon steadier in quiet water, which is useful for huntersand fishers. However this outline turns out to be less steady in uneven water. This is on account of it makes the pontoon go on the water, rather than through it, as a watercraft with an adjusted or V-formed structure would[7-10].

Level structures are easy to develop, making them prominent with watercraft building specialists.

A canal boat is a level bottomed vessel, fabricated mostly for stream and trench transport of substantial merchandise. A few freight boats are not self-moved and should be towed or pushed by towboats [11-12]. Trench canal boats, towed by draft creatures on an adjoining towpath, fought with the railroad in the early Industrial Revolution, yet were outcompeted in the carriage of high-esteem things because of the higher speed, falling expenses and course adaptability of rail lines[13].

Fig. 1: Layout of s-lay barge
MOORING SYSTEM

A Mooring alludes to any lasting structure to which a vessel might be secured. Illustrations incorporate quays, wharfs, piers, docks, stay floats, and mooring floats. A ship is secured to a mooring to prevent free development of the ship on the water. There are different sorts of mooring game plans viz. Catenary Anchor Leg Mooring, Single Anchor Leg Mooring, Turret Mooring, Spread Mooring, Taut Leg Mooring and so on. A grapple mooring fixes a vessel’s position in respect to a point on the base of a conduit without associating the vessel to shore [14]. In a catenary mooring framework, the grapple chains or links expect the state of a catenary under its own particular weight and upheld at the finishes. This is the most well-known kind of mooring framework being used for seaward oil and gas exercises [15].

![Fig. 2: Catenary mooring system](image)

LITERATURE REVIEW OF MOORING SYSTEM

Mcnatt (1982) depicted a general outline strategy for sea catenary mooring frameworks and furthermore featured the requirement for a far reaching configuration approach. The different plan prerequisites like outline criteria, ecological definition, execution investigation and so forth are depicted. Techniques for dynamic mooring examination utilizing devices like LARSTRAN and FLOATMOOR are portrayed and a few particular territories are distinguished which require varying investigation approaches. Lastly, the requirement for framework testing as a plan confirmation device is given and challenges little scale display testing is delineated [16].

Schellin et al (1982) portrayed two numerical models to represent the issue while mooring the vessels, for example, development vessels, crane freight boats or pipelaying scows in shallow, unprotected waters. The principal strategy models the vessel conduct specifically by comprehending the movement conditions affected by the consolidated first order wave and second request wave (float) powers. The second strategy computes first request wavering wave movements and second-arrange float movements of the moored vessel independently and superimposes them to get add up to vessel movements. Line strains because of the aggregate vessel movements are ascertained quasistatically with the two strategies. The time arrangement indicating vessel reaction and relating strains of the most exceedingly focused on mooring lines are figured for 300s interim.

SPECIFICATION OF BARGE

- Length: 80.44m
- Breadth: 35.46m
- Depth: 4.67m
- Draft: 2.60/3.03

<table>
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<tr>
<th>S N</th>
<th>Part</th>
<th>Weight [t]</th>
<th>LCG [m]</th>
<th>TCG [m]</th>
<th>VCG [m]</th>
<th>kxs [m]</th>
<th>kys [m]</th>
<th>kzs [m]</th>
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</thead>
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<tr>
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<td>Lightship (incl consumables)</td>
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<td>46.26</td>
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<td>3.7</td>
<td>II.</td>
<td>III.</td>
<td>IV.</td>
</tr>
<tr>
<td>2</td>
<td>Crane</td>
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<tr>
<td>3</td>
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<td>500</td>
<td>9.4</td>
<td>0</td>
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<td>8.80</td>
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<td>4.78</td>
<td>10.10</td>
<td>27.10</td>
<td>25.60</td>
</tr>
</tbody>
</table>

Table 1

![Fig. 3: Surface model](image)

![Fig. 4: Meshed model](image)
RESULT AND DISCUSSION

The mooring lines are checked for their security according to API RP 2SK rules. The unearthly reactions of freight boat are additionally broke down with and without mooring.

Fig. 5: Model of barge

CONCLUSION

On examination of the outcomes, the accompanying conclusions were made. For the mooring investigation, the free gliding reaction of the freight ship is taken so the greatest loads on the mooring lines can be found. The mooring examination is performed in given natural conditions and the outcomes are dissected. The most extreme line powerful pressures for the given case are observed to be inside points of confinement. The pressures are again checked for various wave heading edges and observed to be protected according to API RP 2SK. The most intensely stacked line contrasts from case to case contingent upon the wave heading and line length.
It is watched that, as the measurement diminishes from 82 mm to 38 mm

- MBS is decreased by 80.84%
- Maximum pressure is lessened by 81.66%
- Weight per unit length is decreased by 78.03%
- Axial solidness is lessened by 70.84%
- FOS is practically same

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**Source of Funding:** Self

**Conflict of Interest:** NA

## REFERENCES


Oil Water Separation System Based Filters for Marine Applications—Emissions Reduction

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ABSTRACT

In this paper, the water is to be separated from the immiscible content with the oil in the locations of the bilge. This immiscible content of oil is presented in the bottom compartment of the ship to the directions of the waste-oil tank. In this work, the oil and water is separated by using the micro controllers in terms of electronic components. The micro controllers are interfaced with the oil sensors and relays to evaluate the water separation operations. By using the microcontrollers, the water is separated from the oil for the harmless marine eco systems. The proposed microcontroller based water separations from oil is offer the advantages over the traditional approaches. This work is performed with the International Standards such as MARPOL (Marine Pollution) and MEPC (Marine Environment Protection Committee) to remove the various effects of marine systems.

Keywords: Marine eco system, oil sensors, oil and water separators.

INTRODUCTION

An oily water separator (OWS) is a bit of shipboard hardware that enables a vessel’s team to isolate oil from bilge water before the bilge water is released over the edge. Bilge water is a practically unavoidable item in dispatch operations. Bilge water that is created in nearness to shipboard hardware, (for example, in the motor room) regularly contains oil and its immediate release would bring about undesirable exchange of waste oil to the marine condition [1-3]. By worldwide understanding under the MARPOL tradition, vessels should be fitted with a slick water separator to expel oil contaminants before bilge water is pumped over the edge. Slick water can be discovered locally available each vessel. It is depleted to the bilge tank and must be dealt with in a slick water separator before it can be released into the ocean. If not, the sleek water contaminates the marine condition [4-7]. For the transportation business, the greatest test with bilge water emerges from breaking down water separators. These are utilized to isolate oil from water before the cleaned water can be released. Bilge water that has not been experiencing a slick water separator is a terrible contamination to the marine condition and may in this way never be released overboard [8-10].

When cleaning the motor room, slick water is delivered. Slick water is likewise produced from separators and condensate from A/C units. Contingent upon the plan and capacity of the ship, bilge water may likewise contain hints of cleansers, solvents, chemicals and particles. Oil in water happens ordinarily in marine bilge frameworks and waste water from modern procedures. The release of oil in water is for the most part undesirable since it hurts nature, so controls on sulllying levels are progressively strict. In numerous mechanical procedures, cleansers and high-pressure washing makes oil blend with water [11-13]. In marine bilge frameworks, oil is blended with water and different materials in the bilge water tank. In the light of such events, International Maritime Organization has made it compulsory for vessels to lessen the measure of oil in the bilge water of the ship to less than 15ppm, preceding discharging the last into the ocean. As an expansion to the use of this venture, we have likewise presented a temperature sensor which can be extremely helpful in certain temperature basic operations, where if the temperature surpasses a specific esteem, the fluid must be depleted out instantly. A PC interface is likewise actualized which can be utilized to plan applications and monitor the status of the whole framework with no manual obstruction [14].

PRESENTLY USED SYSTEMS

API Separator: The API separator outlined by the American Petroleum Institute as the name proposes, is
a gravity partition gadget composed by utilizing Stokes law to characterize the ascent speed of oil beads in light of their thickness and size. The API separator is shown in Figure 1. The plan of the separator depends on the particular gravity contrast between the oil and the wastewater since that distinction is substantially littler than the particular gravity distinction between the suspended solids and water. In light of that plan standard, a large portion of the suspended solids will settle to the base of the separator as a residue layer, the oil will ascend to best of the separator, and the wastewater will be the center layer between the oil to finish everything and the solids on the base. Regularly, the oil layer is skimmed off and along these lines re-prepared or discarded, and the base residue layer is evacuated by a chain and flight scrubber (or comparable gadget) and a slime pump. The water layer is sent to encourage treatment comprising generally of a broke down air buoyancy (DAF) unit for assist expulsion of any remaining oil and after that to some kind of organic treatment unit for evacuation of undesirable disintegrated substance mixes.

This strategy offers a higher level of division when contrasted with the gravity separators. In any case, it additionally requires a huge zone and cumbersome types of gear which require consistent support.

Gravity Separator: Gravity separators are the most normally utilized OWS. They work on the basic rule that if a blend of oil and dilute is permitted to settle in a vast tank, oil being lower in thickness than water naturally rises upward and shapes a thick layer over the water surface. The surfaced can be skimmed off and the isolated water is pumped over the edge.

This strategy is the most straightforward of all the oil-water separator strategies. In any case, it has some real disadvantages. The main drawback is that the level of detachment offered by this technique is low, infrequently under 15p.p.m, which is not satisfactory since it is risky for marine biological communities. Further; these separators require gigantic tanks which make the framework massive and immovable.

Parallel Plate Separator: Parallel plate separators are like API separators yet they incorporate tilted parallel plate congregations (otherwise called parallel packs) and it is shown in Figure 2. The underside of each parallel plate gives more surfaces to suspended oil beads to combine into bigger globules. Any dregs slides down the topside of each parallel plate. Such separators still rely on the particular gravity between the suspended oil and the water. Nonetheless, the parallel plates upgrade the level of oil-water partition. The outcome is that a parallel plate separator requires essentially less space than a customary API separator to accomplish a similar level of division.

Now and then, wind and rain can disturb the fluid surface, which prompts turbulence and meddles with oil skimming. This can be counteracted by developing a rooftop over the bowl, however this is expensive. Additionally impediments are that the API separators by and large emanate an unsavory smell and the isolated oil may require advance detachment.

Parallel plate separators however have a noteworthy downside. The oil particles which get aggregated in the middle of the parallel plates debase the nature of the whole framework each tie partition is performed. Henceforth, the framework requires steady cleanup and
support. Besides, despite the fact that the space required is moderately little, it is still impressively vast.

**Centrifugal Separators:** A radiating water-oil separator is a gadget intended to isolate oil and water by centrifugation and Figure 3 shows the centrifugal separator. It by and large contains a round and hollow compartment that pivots inside a bigger stationary holder. The denser fluid, normally water, aggregates at the outskirts of the pivoting holder and is gathered from the side of the gadget, though the less thick fluid, typically oil, amasses at the revolution hub and is gathered from the inside. Radiating oil-water separators are utilized for squander water handling and for cleanup of oil slicks on ocean or on lakes.

![Fig. 3: Centrifugal separator](image)

Aside from the undeniable drawback that these separators are cumbersome and require an immense zone, there is an additional issue in the working of radiating separators that their plan works proficiently just when the influent oil/water proportion is under the 25% territory. At a 25% oil/water proportion, the focal center of oil in the separator involves a large portion of the general range. At the point when the influent oil/water proportion ascends to half the focal center of oil will move to possess around 70% of the sweep. In one trial of the unit where the oil substance of the influent was 76%, the water in the profluent oil went up to an unsatisfactory level of 86%.

**METHOD**

This venture proposes to utilize an electronic strategy for the detachment of oil and water. This is finished by utilizing an oil sensor interfaced to AT89s52 family microcontroller. Since the essential undertaking of this Bilge Oil and Water Separator, as proposed by the name, is to empower detachment of oil and water, we have to build up a sensor in such manner. The oil sensor for this venture has been outlined on the rule of the distinction in the measure of light permitted by water to go through it and the measure of light permitted by oil to go through it. The sensor has been created utilizing a light identifying resistor as its primary part in blend with IC LM324 which is a quad operational speaker. As raw petroleum is dark in shading, the entry of light through it winds up plainly troublesome. This property of sleek water is tapped and the oil sensor is composed in light of the same. A little glimmer light has been utilized as light hotspot for exhibit purposes. At the point when a straightforward pipe with a straightforward fluid like water set in it is kept over the sensor and light was gone through it, the resistance of the sensor diminished and the voltage acquired crosswise over it had an incentive in the scope of 20-24 mV. At the point when bilge oil, which is typically exceptionally dull in shading, is put in the straightforward compartment and light was gone through it, the resistance of the sensor expanded and the voltage acquired crosswise over it had an incentive in the scope of 500-660mV. They got comes about obviously demonstrate that the outlined oil sensor is effectively ready to separate the section of oil from that of water. This oil sensor is interfaced with an ADC (0808/09) which is associated with the microcontroller. The readings from the sensor are observed and the division happens by coordinating oil through one pipe and immaculate water through the other. A remote framework has additionally been produced utilizing TX/RX 433 sets which passes on the present status of the framework from the bilge to the coastguard’s lodge. The accompanying demonstrates the working of the transmitter and recipient segment individually.

**RESULT AND DISCUSSION**

**Transmitter and Receiver:** The transmitter adequately transmits the sensor yield to the beneficiary which thusly shows every one of the outcomes on the LCD screen. The drift watch can consistently screen the operations at his control room without squandering his opportunity to go and assess the real site

**Output:** Be it diminish light or full enlightenment, the sensor works precisely in all conditions and in this manner gives great division between the oil and water. The water isolated from the blend is tried and the oil substances are observed to be under 15ppm, which is totally safe for the marine environments. The oil can be
securely reused for grease reason in the motor. Along these lines, the framework gives a precise and proficient method for isolating oil and water and the side-effects can be reused without bringing about any unfavorable consequences for the framework or the earth.

CONCLUSION

An application in light of the readings of the separator can be composed in future. This application will be outlined with the end goal that the coastguard can screen the present status of the whole framework from his lodge and if vital, can take relating activities in the event that anything turns out badly. This application will make it workable for the coastguard to deal with the whole framework from one place. Likewise, a spillage ready capacity can be actualized in light of an indistinguishable guideline from that of the oil sensor. If there should be an occurrence of any oil spillage, plans can be made so as to check the same.

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REFERENCES


Seawater Surveillance Robot

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ABSTRACT

The principle objective is to make an interface that enables a man to drive a robot in water and catching the view during a time camera. Versatile automated stages are ending up increasingly well known, both in logical research and in business settings. Automated frameworks are helpful for heading for good things or performing undertakings that are not appropriate for people to do. Robots are frequently ready to accurately perform convoluted or risky assignments with almost no human contribution. Be that as it may, before a portable automated stage can be sent, it must have a method for distinguishing where it is in connection to articles and snags around it. Regularly, it is being performed by utilizing a visual framework, for example, a camera. Be that as it may, simply wiring a camera onto a robot is not adequate. With a considerable lot of the errands that are given to a mechanical framework to play out, a lot of exactness is required to attractively total these assignments. This exactness requires that the robot be given precise data by the camera.

Keywords: Robots, PC frame work, ROV, coveted H-connect.

INTRODUCTION

A robot is a mechanical or virtual manufactured specialist, typically an electro-mechanical machine that is guided by a PC program or electronic hardware. Robots can be self-sufficient or semi-self-governing. The branch of innovation is arrangements with the plan, development, operation, and use of robots. It is also used PC frameworks for their control, tangible criticism, and data preparation for Robotics[1-3]. These advancements manage mechanized machines that can replace people in unsafe conditions or assembling forms, or take after people in appearance, conduct, and additionally comprehension. The world’s seas are home to the most peculiar and astonishing animals. What do researchers think about these remote ocean creatures and how might they examine them effectively? Undersea operations are an awesome application for mechanical autonomy to supplant people[4-5]. Working submerged is both unsafe and troublesome for people. One approach to find out about these creatures in their homes is to utilize submerged robots. Submerged robots can record information that would be troublesome for people to assemble[6-8].

The intention of the paper is to grow such a robot which can work submerged and additionally ashore with live spilling on a remote screen. These days, Mobile automated stages are winding up increasingly well known, both in logical research and in business settings. Automated frameworks are valuable for performing undertakings that are not appropriate for people or require less human exertion[9-12]. Robots are frequently ready to correctly perform confused or hazardous undertakings.

LITERATURE SURVEY

[13] Specified in their diary that it can drift in a place like a helicopter - a precious instrument for profound water oil adventurers, marine archaeologists, oceanographers and others. Odyssey IV is the most recent in a progression of little, modest misleadingly wise submarines created in the course of the most recent two decades by the MIT Sea Grant College Program’s Autonomous Underwater Vehicles Laboratory. The Odyssey arrangement upset submerged research in the 1990s by presenting the thrifty and very proficient submerged robots. Yet, the past Odyssey vehicles still had one noteworthy constraint: Like sharks, they could just work while consistently advancing[13].

[14] Introduced a submerged interchanges re-enactment structure intended for the Unified System for Automation and Robotics Simulator (USARSim). This re-enactment device is fit for demonstrating arranged correspondences between, or with, AUVs by precisely describing the submerged acoustic channel. Points of interest on this
Design and Implementation: This venture can be utilized to complete undersea operations. There are different risky spots where sending a man can be perilous. This robot can be utilized for the same. It could be sent to certain profound dim trenches for the examination purposes. ROVs are additionally utilized broadly by the science group to think about the sea. Various remote ocean creatures and plants have been found or concentrated in their indigenous habitat using ROVs: illustrations incorporate the jellyfish Bumpy and the eel-like halosaurs. This venture can be utilized for the same. Fig. 1 expressed the sample model of Seawater Surveillance Robot.

Block Diagram: The contribution to the robot is given through a remote transmitter where it is encoded and transmitted to the recipient who is available in the ROV. The decoder deciphered the rationale from the flag and passes it to the double H spans which help to run the engine. All the while the remote camera in the ROV streams the video to its recipient which is associated with a screen. The process diagram is demonstrated in Fig. 2 with process details and components.

The voltage controller is intended to consequently keep up a consistent voltage level. It might utilize an electro-mechanical instrument for electric-electronic parts. Transmitter and beneficiary modules are tuned to work effectively at 433.92MHz. At the point when a rationale transmitted is gotten by the collector, it is passed to the decoder. The decoder translates the rationale and passes it on to the coveted H-connect (L298 IC) which runs the engine associated with it. An extra 12V supply input is given to the L298 IC with the goal that the
rationale works at a lower voltage. The remote camera is controlled by a 12v battery and streams live video through its radio wire. There is a committed collector for the camera which is associated with the screen for show.

HARDWARE AND COMPONENTS

**ARDUINO Board:** The ARDUINO Mega 2560 is a microcontroller board in light of the ATmega2560 which is shown in Fig.3. It has 54 advanced information/yield pins (of which 15 can be utilized as PWM yields), 16 simple sources of info, 4 UARTs (equipment serial ports), a 16 MHz gem oscillator, a USB association, a power jack, an ICSP header, and a reset catch. It contains everything expected to help the microcontroller; essentially associate it to a PC with a USB link or power it with an AC-to-DC connector or battery to begin.

![ARDUINO mega board architecture](image)

**HARDWARE AND COMPONENTS**

**Power:** The ARDUINO Mega can be controlled through the USB association or with an outside power supply. The power source is chosen consequentially. Outside (non-USB) power can come either from an AC-to-DC connector (divider wart) or battery. The connector can be associated by stopping a 2.1mm focus positive connect to the board’s energy jack. Leads from a battery can be embedded in the GND and VIN stick headers of the POWER connector. The board can work on an outer supply of 6 to 20 volts. On the off chance that provided with under 7V, notwithstanding, the 5V stick may supply fewer than five volts and the board might be precarious. On the off chance that utilizing more than 12V, the voltage controller may overheat and harm the board. The prescribed range is 7 to 12 volts.

**Motor Driver:** The L298 is an incorporated solid circuit in a 15-lead multi-watt and PowerSO20 bundles. It is a high voltage, high momentum double full-connect driver intended to acknowledge standard TTL rationale levels and drive inductive loads, for example, transfers, solenoids, DC and venturing engines. Two empower inputs are given to empower or cripple the gadget autonomously of the information signals. Fig. 4 display the chip design of L298 model to design seawater surveillance robot.

![L298 chip model to use in seawater surveillance robot](image)

**CONCLUSIONS**

The venture has been created for the observation reason. It can be utilized by the analysts to do submerged operations. It can be sent to the spots where human life
can’t go. The outrageous conditions, that make a danger human life, can be inquired about by utilizing this robot. Applications are recorded as: Fault examination in refined submerged frameworks

- Catching High Resolution pictures of submerged widely varied vegetation.
- Temperature Measurement.
- Recognizing spillages in ships.
- Utilized for SPYING purposes

Ethical Clearance: Taken from AMET University.

Source of Funding: Self

Conflict of Interest: NA

REFERENCES


A QOS Aware Dynamic Service Composition in Cloud Environment

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ABSTRACT

Service composition provides aggregation of services by composing various basic web services. The web service composition is difficult to get fit to dynamic business applications. Cloud computing, an efficient way to manage and integrate on demand computational resources is a new way to solve this problem. This paper describes the process of composition of dynamic services in a cloud environment, by considering the Flight Baggage Service as an example. To address this issue, an agent based service composition method is proposed for optimal solution. Cloud participants and service providers are implemented and instntiated by agent for flight baggage service application. However, a cloud service has various QOS (quality of service) information for providing the best service to the end user. In organizations worldwide, cross cloud has been one of the greatest challenges. By implementing cross cloud, common managing environment for public and private clouds enable customers to connect, run, manage and secure the applications. Applications that run on different cloud computing platforms are composed and the theoretical, experimental results are compared to evaluate the efficiency achieved.

Keywords: Cloud Computing; Web services; Service Composition; Agent based method; Quality of service

INTRODUCTION

The Flight Baggage Service (FBS) is a new innovation to this emerging world. With the development of various Internet technologies, available on the Internet, the number of web services available to the user is growing enormous. Service composition is a method of combining several services, and binding it together to satisfy the request of a end user. Indeed, when a task requested by a customer cannot be accomplished by existing available services, alternative possible method to compose and combine the component functions of various web services is implemented to fulfill the end user request or needs.

Service composition can be divided into two categories: static and dynamic service composition. In static service composition, the service selection process is performed in priori whereas in a dynamic service composition [3], the selection and composition process is completely based on the user request and needs.

Web services of a task can be constructed by service composition of different services characterizing complex aggregation of services. The web service model explains the process of three categories: Discovery, Request and Response. Discovery is the process of evaluating the service that provides the appropriate functions and components. Provided quality of service determines the web service. QoS facilitate selection [5] and filters the unrecognized providers.

In this paper, we considered web service composition method after selecting them. The main purpose of the web service composition is to choose optimal web service [4] solution for a given task to satisfy end user. When dynamic discovery is implemented, it is self evident that the development result contains many service providers. The Web Service Agent must select only one from all service providers to perform the invocation process. Web Service composition involves many Web Services and the selection process needs to be addressed when there are multiple providers available for atomic services. In order to make a drastic difference between the services possessing the same functionality, service selection condition [1] should be used. Service selection evaluates the Web Services within an association and chooses the
component that matches the preferences of the consumers, while considering the abilities of the providers.

Architecture: Figure 1 shows the architecture for dynamic services composition \cite{6} implementation using cloud. In order to satisfy the end user, requested services by an agent are selected by service selection process. Service composition is a process of choosing best service availed from service provider, in turn provided to the end user.

Related Background Knowledge

Web Service: Web service can be defined as a software system of combining and integrating web based applications using technologies like XML, WDSL and SOAP over an internet protocol with a standardized way of providing interoperability between disparate applications. The Web service architecture is classified into three roles. They are: service provider, service registry and service requester. Implementation of service by service provider makes it accessible over the internet.

Service requestor make effective use of existing service by initiating a network connection and sending XML request as per the user needs or request. Service Registry is a centralized directory of service. The developer plays a major role in publishing a new service or invokes existing ones.

Consumer: Consumer is an entity utilizing the web service.

Traveler: Entity means for communication, while consumer make use of the services.

Provider: The vendor provides the service.

Service Oriented Architecture: SOA is a software architectural design pattern to represent unit of functionalities called service. The web service model based on SOA is shown in figure 2.

Table 1: Comparison between FBS, Shipping and Cargo service

<table>
<thead>
<tr>
<th>Service</th>
<th>Cost</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>FBS (India to USA)</td>
<td>9000(INR)</td>
<td>2 days(approx)</td>
</tr>
<tr>
<td>Shipping (India to USA)</td>
<td>8500(INR)</td>
<td>2 months(approx)</td>
</tr>
<tr>
<td>Cargo (India to USA)</td>
<td>15395.15(INR)</td>
<td>2 days(approx)</td>
</tr>
</tbody>
</table>

Simple Object Access Protocol (SOAP): It is a XML protocol specification for accessing web services. It is used for broadcasting messages that enables client application to get connected to remote services to invoke available remote methods. SOAP is used in various messaging systems and delivered through transport protocols. Its main focus is on remote procedure calls that are transferred through the HTTP.

Representational state transfer (REST): They are basically restful Web Services that are REST Architecture based Web Service. Restful web service uses HTTP protocol as a source for interaction between client and server. A client transmit message in the form of HTTP request and receive the message in the form of HTTP Response. This process is called messaging.

Cloud Computing: Cloud computing is usage of remote servers network available on the Internet for storage, managing purpose, and processing the data, rather than using a local server or a personal computer. It is a “Pay as you go model”–cost effective approach. Cloud computing characterizes massive abstracted infrastructure, dynamic allocation, scaling and application movement with no long term commitments. It is application architecture independent with no hardware or software installation.
Analysis shown in Table 1 provides the estimation of FBS compared with shipping and cargo service available to send baggage to destination. FBS is found to be cheaper and less time consuming, when compared with other two available services.

**Proposed System:** Service composition is process of binding the service together to perform the desired functionality. In FBS system, appropriate service selection is performed to compose the complex services. Ticket Booking and Baggage booking are the service composed together to benefit the end user. Service providers are chosen by the agent based on Time and Cost estimation provided by the service providers. Utility factor plays an important role in identifying and selecting the service provider and QOS parameters like latency, efficiency and throughput are considered for service composition technique. The proposed system implements cross cloud for better performance. Utilization of Service Oriented Architecture (SOA) for FBS system can employ qualified cloud service. Comparing different vendor websites and providing the best service to the user makes the service very flexible to users and the providers. Developed web application is implemented and deployed on AWS EC2 by creating instance & Open Stack cloud platform and moving the data to cloud using Amazon RDS. Application provide services irrespective of any Operating system (Windows, Linux, Unix) or Database(Db2, My SQL, Oracle). Some advantage of FBS system are guaranteed baggage delivery in less time and cost effectiveness. It gives more features to customize and enhance user experience. Cloud service adjust its QOS level based on user real-time demands.

**Dynamic Service Composition Scenario Analysis:**
The process involves assembling individual services at runtime to compose a dynamically adaptive composite service to achieve some desired functionality. The process can be categorized as static or dynamic. In dynamic composition abstract task model and participating services are created at run time. Here is a typical example to better illustrate the dynamic service composition of web service.

The Dynamic Service Composition approach can be broadly classified into three steps:

1. The user’s requirements are decomposed and formalized into interdependent requests, which are sent to a intermediate agent who is responsible for the discovery of essential services.

2. After discovery, the necessary services are retrieved from a user registry using appropriate keywords mined from the requests specified by the user.

3. Selection and composition of the service functionalities through the communication between the intermediate agent and the agents providing the essential services are carried out until it satisfies user requirements.

The utility factor is used as service selection method which is defined as an extended set of system parameters to achieve some user specific objective. A graph algorithm is used for service selection process in which a directed acyclic graph is constructed with user defined utility values given for each QOS parameters considered. In FBS system, selection process finds the path with highest utility value from source to destination.

**Walk Through Example:** As an example a flight baggage service is considered. The services are generally divided into 2 categories: Ticket booking service and baggage service as shown in figure 3. An agent is responsible for combining the services offered by the flight vendor. Case i) Booking a ticket for the traveler. Case ii) Baggage service for the customer - to send the baggage via airlines to the destination without travelling through slots available in traveler baggage system. Customer needs to pay the amount for availing the service. A Cash back offer is given to the traveler if he carries less amount of baggage than the allowed weight and the flight vendor gets some profit by offering the service. Overseas baggage transport is quick, easy, safe and economical. To avail the baggage services, both traveler and end user need to register in the respective flight websites. If user wants to find the best rate, the user has to register in all ticket booking sites.

**Figure 3: Flight Baggage Service System**
idea for describing different modules for flight baggage system. The system is proposed to have the following modules: Data Collection, Data Analysis, Data Comparison, Data Transaction as shown in Figure 4.

**Figure 4: Overall Architecture of Service Composition**

**Data Collection:** User has to create an account for availing the FBS service by providing the necessary details as shown in Figure 5 by providing the personal details. The registered email is updated in the database. Whenever the user or traveler books a flight ticket or baggage, all the data related to booking are collected and a confirmation email is sent to the respective end user for further reference. This process involves the dynamic service composition where end user needs are satisfied by obtaining the details by the service agent.

**Figure 5: User account creation**

**Data Analysis:** It is used to analyze the data with an aim of identifying useful information which aids in decision making. Analysts apply a variety of techniques called as exploratory data analysis to initiate understanding of messages contained in the data. Analysis is made by the agent by using the utility factor for identifying the best service provider and displaying the appropriate flight information to the end user as shown in Figure 6.

**Figure 6: Flight Information**

**Data comparison:** Process is implemented and configured to compare certain attributes. Such identified attributes are extracted from the core data, standardized, and stored as comparison data in the derived data layer of the database. Comparison data is formatted and stored in a manner that allows for fast access and comparison. End user chooses the service provider as per the needs and gets benefitted. Traveler books the flight ticket by choosing the options as shown in figure 7.

**Figure 7: Book flight**

Similarly the end user wishing to avail the baggage service can book the baggage service as shown in figure 8. The baggage once booked by the end user will cause a reduction in the baggage count which is updated in the database for future transactions. Since the baggage count is decreased as per the booking, this service is considered to be dynamic as per user needs.
Data Transactions: Transaction data are defined as the data describing an event. Transaction data always has a time dimension value, a numerical value and refers to one or more objects (i.e. the reference data). A transaction symbolizes a unit of work performed within a database management system to retrieve data. By definition, the database transaction must possess ACID properties. User and traveler make payment, traveler gets cash back offer for sharing the baggage allowed to him for the end user as shown in Figure 9. Baggage to be sent can be electronic gadgets like Television, Home Theatre, etc.

Related work: In recent years, there has been a lot of work performed on web service composition, and it is basically an issue in the service computing domain. Literature approaches can usually be categorized into two types: Functional and Semantic service composition and the other is QoS aware service composition. The former usually aims at finding a composed service process based on a high level specification of the required functionality, while the latter usually aims at optimizing the service composition solution. These two categories of service composition are interrelated. Here, QoS aware service composition is discussed more in detail. To select an optimal composition solution, QoS is important when there are many available equivalent-functionality services. In this paper it is widely investigated. Some paper such as those in[5] and[8] use CSSM and Multiple agent method to get the optimal composition solution. Caol[1] proposed localized approach for service composition based on the Ubiquitous Interacting Object (UIO) model. S.Meng[4] proposed a paper to meet users’ personalized requirements using a Keyword-Aware Service Recommendation method. In addition to these, the computation methods are introduced into the composition of services. The internal changes will seriously increase the complexity of service selection and composition. With these observations, a cloud agent based method is proposed and implemented in FBS application. Utility factor is considered for service selection process by constructing DAG graph based on QOS parameters and this method aims at efficiently selecting multiple optimal composition solutions for a user.

CONCLUSION

In this paper, we intended an approach for dynamic service composition[1], that resulted in the following advantages compared to previous proposed approaches: (1) The complexity is not visible to the clients. (2) The service composition is transparent from the client. (3) Security level is high, because the end user cannot access the Web Services directly. Cloud service adjusts its QOS parameter[8] level based on user real-time demands and needs. It gives more features to customize and enhance user experiences.

Future Work: We need to consider improvements to achieve maximum scalability in both service composition and service selection process. For instance, the service selection process step should apply QoS[8] parameters like availability, reliability and security in addition to the user’s demands, in order to select the optimal services for service composition. Similarly, in the service selection process, if the mediator agent didn’t gather answers for all the user requests in the given time, it could either elaborate it or initiate the discovery of services for all the unanswered requests. Finally, we plan to study (both theoretically and empirically) the performance metrics of our system, in order to provide a quantitative demonstration of the benefit of our system by implementing Agent based method using utility factor.
REFERENCES


Computer-Aided Diagnosis of Systemic Lupus Erythematosus Using Immunological Profile

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ABSTRACT

Systemic Lupus Erythematosus (SLE) or Lupus is a prototype multisystem autoimmune connective tissue disorder with variable prognosis and remitting and relapsing course. As the cause of lupus is still unknown, diagnosing the lupus is very difficult for the physicians. Machine learning plays a very important role for assisting the doctors in diagnosing the diseases very accurately. The dataset used for this work is collected from various hospitals in Tamilnadu. Immunological profiles of 400 patients (200 SLE and 200 Non-SLE) are taken into this experimental study. Various classification techniques are used for classification of data set into SLE or Non-SLE. Experimental results proved that the J48 classifier model gives higher accuracy than other models for the identification of SLE.

Keywords: Systemic Lupus Erythematosus (SLE), Multilayer Perceptron (MLP), Radial Basis Functions (RBF), Support Vector Machines (SVM), Naïve Bayes (NB), J48, Functional Trees (FT), Non-Nested Generalised Exemplars (NNGE), Ripple down Rule learner (RIDOR).

INTRODUCTION

It has been observed earlier that Systemic Lupus Erythematosus (SLE) is a systemic autoimmune disease in which the immune system of the body attacks its own tissues. The symptoms of lupus are similar to other diseases such as fibromyalgia (fatigue and joint pain), rheumatoid arthritis (swelling and joint pain), psoriasis (red patches of skin) etc.[1]. As the years go, lupus affects the other organs of the body such as kidney, heart, skin or lungs. There is no single test to diagnose this disease. Women register a far greater incidence of this disease, than men[2]. Still the cause of lupus is unpredictable over the periods of illness. As Lupus has no significant single diagnostic tool, it can only be identified through clinical and immunological (laboratory) findings. The revised 1982 American College of Rheumatology (ACR) framed the criteria[3] for classifying patients with SLE.

The classification is based on these 11 criteria, which are given in Table 1. The patients can be diagnosed as lupus only if a patient satisfies any 4 or more of the 11 criteria. Lupus in patients varies from mild joint disease to severe life threatening diseases. Serological findings such as ANA, Anti dsDNA are highly associated with SLE. Clinical examinations are carefully done based on the symptoms and signs of the patients.

Table 1: Criteria framed by ACR for classification of patients with SLE

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Name of the criterion</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Malar Rash</td>
</tr>
<tr>
<td>2.</td>
<td>Discoid Rash</td>
</tr>
<tr>
<td>3.</td>
<td>Photosensitivity</td>
</tr>
<tr>
<td>4.</td>
<td>Oral ulcers</td>
</tr>
<tr>
<td>5.</td>
<td>Arthritis</td>
</tr>
<tr>
<td>6.</td>
<td>Serositis (Pleuritisor pericarditis)</td>
</tr>
<tr>
<td>7.</td>
<td>Renal disorder</td>
</tr>
<tr>
<td>8.</td>
<td>Neurological disorder</td>
</tr>
<tr>
<td>9.</td>
<td>Haematological disorder</td>
</tr>
<tr>
<td>10.</td>
<td>Immunological disorder</td>
</tr>
<tr>
<td>11.</td>
<td>Anti-nuclear antibody</td>
</tr>
</tbody>
</table>
Generally, symptoms vary from person to person, with swelling, fatigue, fever, joint pain, sunlight sensitivity, hair loss, skin rash. The routine visit to the rheumatologist can reduce the severity. Anti-malarial drugs and corticosteroids can be given to sustain the lupus. Diagnosis of Systemic Lupus Erythematosus should be accurate so that the rheumatologists can provide treatment to reduce the mortality and morbidity. In this study, with the assistance of the rheumatologists, the immunological profile (laboratory findings) features are extracted. After the features are extracted, a classifier model can be trained to classify the patients as SLE or Non-SLE.

MATERIALS AND METHODS

The Dataset used for this work is collected from various hospitals containing immunological profile (laboratory findings) of 400 patients of age group 15 to 45 (200 SLE and 200 Non-SLE). Patients who fulfilled the revised 1982 ACR characterization criteria for SLE are selected. These laboratory findings of 400 patients are used to classify into SLE or Non-SLE patients. Fig. 1 gives the overview of the proposed approach. The proposed framework consists of three phases:

(i) Pre-processing is the first step in the analysis of the data. In this step, the missing values in the given data set are replaced by the attribute mean.

(ii) Feature extraction to extract the features which are determinant to diagnose the lupus.

(iii) Classifiers, Multilayer perceptron, Radial basis Function, Support vector machine, Naïve Bayes, J48, Functional Trees, Non-Nested Generalized Exemplars and Ripple down Rule learner are used for the classification of the patients into SLE or Non-SLE groups based on the immunological profile. The performances given by various classifiers in classification of patients are analyzed by computing the accuracy, precision, recall and F-score.

Feature extraction: As diagnosing lupus is very difficult, lab tests are very useful to confirm the lupus in patients. Features play an important role in the analysis of data. 12 determinant features are extracted from the records of hospitals on consultation with a rheumatologist. Table 2 shows the immunological profile features used for classification.

Table 2: Features used for classification of patients

<table>
<thead>
<tr>
<th>Features</th>
<th>Description</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>Patient’s age</td>
<td>Numeric</td>
</tr>
<tr>
<td>Hb</td>
<td>Haemoglobin</td>
<td>Numeric</td>
</tr>
<tr>
<td>Urine pcr</td>
<td>Urine–Protein creatine</td>
<td>Numeric</td>
</tr>
<tr>
<td>ESR</td>
<td>Erthrocyte Sedimentation rate</td>
<td>Numeric</td>
</tr>
<tr>
<td>C3</td>
<td>Complement component 3</td>
<td>Numeric</td>
</tr>
<tr>
<td>C4</td>
<td>Complement component 4</td>
<td>Numeric</td>
</tr>
<tr>
<td>RBC Cast</td>
<td>Checking the kidney function</td>
<td>Numeric</td>
</tr>
<tr>
<td>platelet</td>
<td>Component of Blood</td>
<td>Numeric</td>
</tr>
<tr>
<td>ANA</td>
<td>Antinuclear antibody</td>
<td>String</td>
</tr>
<tr>
<td>Anti dsDNA</td>
<td>Anti double stranded antibody</td>
<td>String</td>
</tr>
<tr>
<td>Anti smith</td>
<td>Anti smith antibody</td>
<td>Numeric</td>
</tr>
<tr>
<td>WBC Cast</td>
<td>White Blood Cell count</td>
<td>String</td>
</tr>
</tbody>
</table>

Machine learning classification techniques: In machine learning, a dataset is itself divided into a training set and a testing set. The training set is applied as input into the ML algorithm where the models are formed and then the test dataset are applied to these models to determine the classification accuracy using performance measures such as precision, recall, F-score and ROC curves.

Multilayer Perceptron Neural Network: A Multi Layer Perceptron (MLP) is an artificial neural network and it maps the given input data (information) into a set of outputs. An MLP has one or more layers of nodes such that each and every layer in the network is fully connected to the next layer. MLP comprises of three layers: input layer, hidden layer and output layer. The training and testing data are fed into the input layer and it is processed by the nodes in the hidden and output layers. Back propagation feed forward training algorithm is used by the MLP for network training.

Radial Basis Function Neural Network: A Radial Basis Function (RBF) network is a supervised learning model. The structure of RBF and the structure of MLP
are similar. It differs from MLP only that it contains only one hidden layer which has RBF units. RBF uses Gaussian transfer function. The locations of the centre of the guassian function and its deviation are the two important parameters of each RBF. The purpose of the hidden unit is to find the distance between the input data and centre of its RBF[5].

**Support Vector Machine:** Support Vector Machine (SVM) is a supervised machine learning model and it is used for classification, regression and outlier’s detection[6]. SVM uses support vectors to construct a linear model to estimate the function using non-linear class boundaries. SVM constructs a set of hyper planes in a high dimensional space for classification.

**Naive Bayes classifier:** Naive Bayes (NB) classifier is a powerful and straightforward classification algorithm. This is a probabilistic classifier uses Bayes theorem and it holds strong independent assumptions among the attributes [7]. It calculates probabilities for each class, for example, the likelihood that given record or data has a place with a particular class. The most likely class contains the highest probability.

**J48 classifier:** A J48 is a machine learning model that finds the target value, a dependent variable of a new instance based on the different attributes of the data set. The internal nodes of a J48 tree represents the attributes and the leaf nodes denotes the final value i.e. classification. The class which is to be predicted is a dependent variable and depends on other attributes of the data set. Hence the other attributes are independent variables. Information gain is a measure to find the amount of information in the attributes of a given data set. Thus the algorithm constructs a decision tree by calculating the information gain at each tree node which in turn predicts the target variable[8][9].

**Functional Trees:** Functional trees (FT) are models that follow decision tree algorithm. It is easy to construct and a reliable algorithm. There are two phases in constructing this univariate tree. The first phase is constructing a large tree and pruning the tree is the second phase [10]. The important aspects of Functional trees are

(i) Splitting rule
(ii) Termination criterion
(iii) Leaf assignment criterion

The leaf nodes denotes the target variables i.e. classification.

**Non-Nested Generalised Exemplars:** Non-Nested Generalised Exemplars (NNGE) is a rule based classifier where generalisation is performed and form hyper rectangles in attribute space by merging exemplars. These hyper rectangles represent conjunctive rules. Whenever a new example is added, NNGE algorithm frames a generalisation and joining along with it to its nearest neighbour of a similar class. It first classifies and then generalise each new example. When an instance gets classified, at least one hyperrectangle states that the new instance belongs to the wrong class. The algorithm prunes in such a way that the instance is not a member of correct class. After classification, the new instance is generalised to form a single hyperrectangle by combining it with nearest neighbour of the similar class[11].

**Ripple-Down Rule Learner:** This is a rule based classifier which generates first a default rule [12]. Then for this default rule, the exceptions are generated with the least weighted error rate. For each exception, it generates a best exception and it continuously iterated until pure. A tree is generated based on these exceptions. The exceptions are generated using IREP. These exceptions are a set of rules which is used to predict the classes.

**RESULTS AND DISCUSSION**

**Accuracy Measures:** In this experimental study, different classifiers having different approaches namely functions based classifiers (Multilayer Perceptron, Radial Basis Function and SVM with polynomial kernel), Bayes based classifier (Naive Bayes), Rules based classifiers (NNGE, RIDOR), and Tree based classifiers (J48, FT) are used for classification. 10-fold cross validation is performed for the classification. The performances of the classifiers are assessed using precision, recall, specificity, accuracy (correct classification) and F-score, given in equations from (1) to (6) respectively.

\[
\text{Precision} = \frac{TP}{TP + FP} \quad \ldots (1)
\]
\[
\text{Recall} = \frac{TP}{TP + FN} \quad \ldots (2)
\]
\[
\text{Specificity} = \frac{TN}{TN + FP} \quad \ldots (3)
\]
\[
\text{Accuracy} = \frac{(TP + TN)}{(TP + TN + FP + FN)} \quad \ldots (4)
\]
\[
F\text{-score} = 2\frac{\text{Precision} \times \text{Recall}}{\text{Precision} + \text{Recall}} \quad \ldots (5)
\]
Here, TP (True Positive) provides the correctly classified SLE patients, FP (False Positive) provides the misclassified SLE patients, FN (False Negative) provides the misclassified Non-SLE patients, and TN (True Negative) provides the correctly classified Non-SLE patients.

**Patients Classification performances by various Classifiers:** The various performance measures are calculated for classifying patients by the various classifiers as discussed earlier. Table 3 and Table 4 represent precision, recall and F-score values given by various classifiers in classifying patients into SLE or Non-SLE respectively. J48 shows higher performance measures than all other classifiers having precision of 100%, recall of 99.7% and F-score of 99.7% and it is followed by SVM with the precision of 99.3%, recall of 100% and same F-score as of J48. It is inferred that precision of 99.3% are same for MLP, NNGE and RIDOR. MLP shows 99.7% as recall value and 99.5% as F-score value. RBF, NNGE and RIDOR show the same recall values of 99%. FT has same precision, recall and F-score values of 99.3%. Compared to all other classifiers, RBF performs less.

**Table 3: Classifiers vs. Precision, Recall and F-score values for SLE**

<table>
<thead>
<tr>
<th>Classifiers</th>
<th>Precision (%)</th>
<th>Recall (%)</th>
<th>F-score (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MLP</td>
<td>99.3</td>
<td>99.7</td>
<td>99.5</td>
</tr>
<tr>
<td>RBF</td>
<td>99.0</td>
<td>99.0</td>
<td>98.8</td>
</tr>
<tr>
<td>SVM</td>
<td>99.3</td>
<td>100.0</td>
<td>99.7</td>
</tr>
<tr>
<td>Naïve bayes</td>
<td>98.7</td>
<td>99.3</td>
<td>99.0</td>
</tr>
<tr>
<td>J48</td>
<td>100.0</td>
<td>99.7</td>
<td>99.7</td>
</tr>
<tr>
<td>FT</td>
<td>99.3</td>
<td>99.3</td>
<td>99.3</td>
</tr>
<tr>
<td>NNGE</td>
<td>99.3</td>
<td>99.0</td>
<td>99.2</td>
</tr>
<tr>
<td>RIDOR</td>
<td>99.3</td>
<td>99.0</td>
<td>99.2</td>
</tr>
</tbody>
</table>

**Table 4: Precision, Recall and F-measure values vs. classifiers for Non-SLE**

<table>
<thead>
<tr>
<th>Classifiers</th>
<th>Precision (%)</th>
<th>Recall (%)</th>
<th>F-score (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MLP</td>
<td>99.7</td>
<td>99.3</td>
<td>99.5</td>
</tr>
<tr>
<td>RBF</td>
<td>99.0</td>
<td>99.0</td>
<td>98.8</td>
</tr>
<tr>
<td>SVM</td>
<td>100.0</td>
<td>99.3</td>
<td>99.7</td>
</tr>
<tr>
<td>Naïve bayes</td>
<td>99.3</td>
<td>98.7</td>
<td>99.0</td>
</tr>
</tbody>
</table>

**Table 5: Error Rate and Accuracy Values**

<table>
<thead>
<tr>
<th>Classifier</th>
<th>Error Rate (%)</th>
<th>Accuracy (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MLP</td>
<td>0.0066</td>
<td>99.50</td>
</tr>
<tr>
<td>RBF</td>
<td>0.0157</td>
<td>99.00</td>
</tr>
<tr>
<td>SVM</td>
<td>0.0033</td>
<td>99.70</td>
</tr>
<tr>
<td>Naïve bayes</td>
<td>0.0105</td>
<td>99.00</td>
</tr>
<tr>
<td>J48</td>
<td>0.0033</td>
<td>99.83</td>
</tr>
<tr>
<td>FT</td>
<td>0.0087</td>
<td>99.33</td>
</tr>
<tr>
<td>NNGE</td>
<td>0.0083</td>
<td>99.17</td>
</tr>
<tr>
<td>RIDOR</td>
<td>0.0083</td>
<td>99.17</td>
</tr>
</tbody>
</table>

From the table 5, one can infer that the J48 and SVM gives lower error rate of 0.0033 compared to other classification algorithms. The error rate is higher for RBF with 0.0157. The Accuracy of all classifier models are shown in table 5. From table 5, it is shown that J48 classifier has shown a better performance with 99.83 percent of accuracy compared to other classifiers. SVM shows the accuracy rate of 99.7% followed by MLP with 99.5%. FT shows 0.0087 as error rate and 99.33% as accuracy. RBF and Naïve bayes performed similar accuracy rate of 99%. It is observed from the table 5 that, NNGE and RIDOR show the same error and accuracy rate of 0.0083 and 99.17% respectively.

A Receiver Operating Characteristic curve (popularly called as ROC curve) is a tool to evaluate the discrimination between the SLE and Non-SLE patients. A ROC curve is plotted by taking True Positive Rate - TPR (Sensitivity) in Y-axis and False Positive Rate - FPR (100-specificity) in X-axis [13]. Sensitivity-specificity pair is represented as a point in the graph for a given threshold value. The area under the curve is a measure to provide the accuracy of the test. When the curve is closer to the left and right border of the graph, then the test is most accurate. When the curve is closer to 45° diagonal in the graph, then the performance is less accurate. Each point on the curve represents a decision threshold for
that particular TPR/FPR pair. The ROC curves shows that the classifiers are classifying the dataset with little error rate. Fig. 2 shows the receiver operating characteristic curves of various classifying models for the classification of SLE or Non-SLE. Among all the classifiers, J48 performs better with 99.8% accuracy.

(a) MLP (AUC = 0.999)

(b) RBF (AUC = 0.988)

(c) SVM (AUC = 0.997)

(d) NB (AUC = 0.983)

(e) J48 (AUC = 0.997)

(f) FT (AUC = 0.997)

(g) NNGE (AUC = 0.992)

(h) RIDOR (AUC = 0.992)

Fig. 2: ROC Curves for classification of patients by various classifiers ((a) – (h))

In this literature study, studies [14][15] showed that the accuracy rate of J48, BPNN and CHAID were 97.1%, 96.1% and 95% respectively. In this study, J48 achieved the accuracy rate of 99.8% and MLP showed the accuracy rate of 99.5%.

In order to increase the efficiency of the classification, decision level fusion can be employed. The block diagram of decision level fusion is shown in Fig. 3. Using the table 5, three classifiers are selected based upon the accuracy. The output of multilayer perceptron, support vector machine and J48 classifiers are fused using the weighted sum rule. The fused output Y is given in equation (6),

\[ Y = w_1s_1 + w_2s_2 + w_3s_3 \] …(6)

Where X represents the input to the classifiers, w1, w2 and w3 are the weights assigned and s1, s2, s3 are the outputs of multilayer perceptron, support vector machine and J48 classifiers respectively. Weights
are assigned based on the accuracy of the classifier models. If \( w_1=0.1, w_2=0.2, w_3=0.7 \), the accuracy of the multimodal system is 99.9%. When fusing the output of the different classifiers, the performance gets enhanced from 99.8 to 99.9%

**CONCLUSION**

Different classifiers adopting different approaches have been used to classify the patients into SLE or Non-SLE. Collecting the various attributes of SLE with the help of a rheumatologist, 12 determinant features were extracted. To identify the best modelling technique to classify the lupus, the study has used the classifiers namely MLP, RBF, SVM, Naïve Bayes, J48, Functional Trees, NNGE and RIDOR. The study showed that J48 performed well with 99.8% accuracy. The decision level fusion made by multilayer perceptron, support vector machine and J48 enhanced the performance to 99.9%. The rheumatologists who perused the new model felt that the efficacy of the diagnostic process would greatly improve through this model.

**Ethical Clearance:** Taken from Sri Sairam Engineering college

**Source of Funding:** Self

**Conflicts of Interests:** Nil

**REFERENCES**


Face Recognition Based on Dwt and PCA Feature Extraction Using Artificial Neural Network Classifier

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ABSTRACT

Face Recognition is a prototype with stirring functions in the direction of facial features for consent and validation. In this approach, a particular type of face recognition systems is bond different feature extraction approaches to conquer the image entity configuration. To solve face recognition under unreliable pose is rigorous pose invariant features with effective approach. In this work, an algorithm is implemented in MATLAB and performance evaluation of achievement rate with existing techniques is proposed. Also, the performance of the face recognition system is based on feature extractions using wavelet transform and demonstrates the improved quality image. This work provides Artificial Neural Network (ANN) for face recognition and using a combination of Discrete Wavelet Transform (DWT) and Principal Component Analysis (PCA) algorithm for feature extraction and acquires a transformed face image to raise the features. The results demonstrated that the proposed system has higher accuracy, precision and sensitivity than face recognition using different feature extractors.

Keywords: Face recognition, Feature extraction, DWT, PCA, ANN.

INTRODUCTION

Face recognition has fields such as pattern recognition, ANN and computer vision. Hence, the system is trained with a definite number of images from each class. The pre-processing phase is to improve the quality of the face image for efficient feature extraction that have an imperative function in the recognition process and a superior extraction methodology selects the optimal distinguish features which are not sensitive to variations in pose, scale and facial expressions. It eliminates the unfortunate features and decrease complications accuracy.

Problem Issues with Feature Extraction: Feature extraction removes the significant and characteristic features from the set to convince an objective with the slightest possible features selected. The problems issues with system based face recognition are,

(i) It handles the variations in pose, appearance and occlusion, and failure to extract the imperative features needed for face recognition.

Methodology of the work: The managerial process for face recognition algorithm, reduce the dimension and extract the features for face recognition are shown in Figure 1. The face recognition feature classifier have a convolutional neural network which can be utilized for invariant facial recognition which comprised of a training set involving different faces of a human.

Fig. 1: Face recognition algorithm implementation procedure
DWT with Face Recognition: Wavelet is an image processing apparatus and computer vision which has numerous features of space-frequency localization and multi-resolutions. The steps used in FR to observe the process are shown in Figure 2. The feature extraction is a dimensionality reduction process to transform the input data into the set of features.

![Feature Extraction Flowchart](image)

**Fig. 2: Face Recognition to observe the process with DWT**

**LITERATURE SURVEY**

Feature extraction and classification method using wavelet is discussed in [1]. Comparative study of feature extraction using PCA and LDA for face recognition is described in [2]. Problem which is using complex wavelets and PCA to remove multi-scale features for protected FR classification is explained in [3]. In [4] the analysis of facial image classification using DWT is presented. Feature extraction method using DWT image classification is introduced in [5]. Image-based methods for different sets of facial images to classify new face detection are explained in [6]. In [7] a new face recognition system based on Haar WT and PCA using Levenberg-Marquardt Back-Propagation Neural Network (BPNN) is presented.

Reduced feature vectors which are used for further classification using Euclidean distance classifier to enhance the accuracy are introduced in [8]. The Gabor filter which is used to filter the anterior face images along with PCA technique is discussed in [9]. The simplicity, suitability and regularity for face recognition using multi-resolution approaches are presented in [10]. Eigen face approach which is conservative and considers frontal for implementing the system and apparatus intrinsic capture properties in the process of detection is introduced in [11]. The FR method that is based on edge, skin fusion and template matching method to recognize as a test image by comparing with the training images is described in [12].

An enhanced in the FE among various techniques and extracted recognition rates in different techniques is explained in [13]. A stout FR approach for image decomposition using WT with PCA and classification using BPNN is discussed in [14]. Various techniques to improve the efficiency of FR under various enlightenments are presented in [15]. DWT is widely used in brain cancer classification is explained in [16]. To acquire the subsequently crude altitude of wavelet coefficients that leads two-level wavelet decomposition is introduced in [17]. Facial based emotion recognition system which is used for face region extraction by face components is described in [18].

Presented the survey of FE, divided into different categories are based on knowledge, mathematical transform and NN. The restricted classifiers for FR in a disorderly prospect with diminutive endeavor that achieves a confront purpose is explained in [20]. The wavelet based FE to recognize the realistic and optimized technique for superior results is discussed in [21].

**Vital Roles of Face Recognition System:** Face recognition system takes input as an image where the corresponding output is an identification and show in the image or video. However, some face recognition systems define it as a process is shown in the Figure 3.
Fig. 3: A generic face recognition system process

The face detection is feature extraction where the appropriate facial features are extracted and recognize the face. A comparison method is adopted with facilitate of a classification algorithm and an accuracy measure. Figure 4 shows the block diagram of face recognition for face verification, gender and age.

PCA: PCA method extracts as to be the eigenvectors of all the covariance matrix of the overall data. The first principal component is a linear combination of all the original dimensions that have been over the highest variability. Finally, all the recognition threshold is a computed by using all the maximum distance between the any two face projections.

ANN STRUCTURE

ANN is the interconnection between the basic unit’s called artificial neurons which takes two inputs, multiplies them by a weight and adds them together. Each input link has an independent as,

\[
\text{Weight combines with the sum of the weighted where,}
\]

\[
\text{if} \quad \text{input value} = \text{threshold value} \quad \text{then} \quad \text{output} = 1
\]

\[
\text{else} \quad \text{sum} < \text{threshold value} \quad \text{then} \quad \text{output} = 0
\]

The artificial neurons to compute the logic functions (AND, OR and NOT) unite to relies on its ability to regulate its weights to correlate all pieces of input to the corresponding desired output. ANN is generated by join artificial neurons into a structure containing the layers are,

(i) Liable to input a face image sample into the ANN.
(ii) A hidden layer that allows an ANN to execute the error reduction to attain the desired output.
(iii) The neurons are determined by the size of the desired outputs along with the achievable output presented by a detach neuron.

Back Propagation Networks (BPN) based Method:
The BPN technique determines the error rates of neurons to impact the output. The neurons of the input layer are attached to the hidden layer and the outputs of the hidden layer are attached to the output layer. This procedure is vital to the minimization error process that leads to recognize of the desired value.

Training Method: The training of ANN is carried out indifferent measurements which are,

(i) The nosh forward path is trained by standard BP algorithm where the feedback on path provides to
amend a meticulous fragment of input creates to the results.

(ii) The training of the feedback path is to be execute by a set of pairs consist of face images and ease the regulation of the influences in the feedback path.

**Feature Extraction and Classifier with PCA Algorithm:** The face image is signifying as dimensional vector by concatenate into a lean vector. E.g., $P$ vectors of size $Q=\text{rows of image } 'Z'$ columns of image shows a position of replica images and $m_i$ shows the pixel values as,

$$Z = \{m_1, m_2 \ldots m_p\}^T; \ r = 1, \ldots, P$$

The mean axis images by subtract from each image vector represent mean ‘$t’$ by mean image as in eqn. [1],

$$t = \frac{1}{P} \sum_{r=1}^{P} Z_r \ 
\text{and, let be described as mean axis image as,}$$

$$y_r = Z_r - t$$

The feasible projection onto each of theand find a set of $P$ orthonormal vectors for which the measure is maximum with the orthonormality constraint as given in eqn. [2],

$$\delta_i = \frac{1}{P} \sum_{u=1}^{P} (g_i^u y_u)^2 \ 
\text{where, the } g \text{ and } y \text{ are given by the eigenvectors and eigenvalues of the covariance matrix as given in eqn. [3],}$$

$$F = Y^v \ 
\text{where, } Y \text{ is a matrix composed of the column vectors placedside by side.}$$

**PCA Recognition Patterns for Image Data Compression:** PCA recognized the patterns and emphasizes in dimensional data to compresses the data by reducing the dimensions without lose any information of an image. The set of images $\{z_r\}$ is presented a matrix $Z$ images of size $Q*P$, where $Q$ is the number of pixels in an image is given in eqn. [4],

$$Z = \{Z_1, Z_2, Z_3, \ldots, Z_P\} \ 
\text{Eqn. [5] is given the average or mean face which is obtained as,}$$

$$Z = \frac{1}{P} \sum_{r=1}^{P} Z_r \ 
\text{The average face is calculated and deducted from each image face in } Z, \text{ gives rise to } Z’ \text{as given in eqn. [6],}$$

$$Z_1 = \{(Z_1 - Z’)(Z_2 - Z’ \ldots(Z_p - Z’))\} \ 
\text{The Eigen values of the data set are calculated by enchanting the eigenvectors of the covariance matrix } F \text{ and is given in eqn. [7],}$$

$$F = \sum_{r=1}^{P} Z_r^v \ 
\text{where, } F \text{ is a symmetric matrix and } g_1, \ldots, \text{ form a basis (i.e., any vector } Z \text{ or is a linear combination of the eigenvectors) and } a_1, \ldots, \text{ is the coefficients given in eqn. [8],}$$

$$Z = a_1 g_1 + a_2 g_2 + a_p g_p = \sum_{r=1}^{P} a_r g_r \ 
\text{The dimensionality reduction takes the ‘$h’$ eigenvectors analogous to maximum eigenvalues. The eigenvectors have the track of the principal variance of the data. The face has } k \text{ dimensions are given in eqn. [9],}$$

$$Z = \sum_{r=1}^{h} a_r g_r \ 
\text{where, } h<<P, \text{ and the facial image is projected into } h \text{ less than } P \text{ dimensions.}$$

**RESULTS AND DISCUSSION**

**Performance of DWT with NN using Essex database:** For training purpose, only one single face is chosen, where the test is performed using the similar training set procedure. The test is evaluated on the basis of following,

(i) Accuracy = \frac{truepositive + truenegative}{truepositive + truenegative + falsepositive + falsenegative}

(ii) Precision = \frac{truepositive}{truepositive + falsepositive}

(iii) Sensitivity = \frac{truepositive}{truepositive + falsenegative}

The performance of the system using each algorithm is evaluated individually on the basis of sensitivity, precision and accuracy and then the three algorithms are fused to enhance the performance of the system.
In this work, this experimental results claim the accuracy, and sensitivity according to class, where average accuracy is clamed with this method is 75.5% recognition rate demonstrated.

**Performance of DWT with NN based face recognition using ORL database:** For this training purpose also only one single face is chosen, where the test is performed using the similar training set procedure with different ORL database and presented test evaluation. The system is evaluated under ORL database with 10 images in each class, there are total 10 class has been taken 5 image from each class has been taken for reduction in training overhead. In Figure 8 ‘x’ axis represents the number of class and ‘y’ axis represents the accuracy in each class in terms of ratio.
Comparison with Essex and ORL Databases as Test Evaluation Ratio: The comparison view of ORL and Essex databases are graphically presented the accuracy, precision, and sensitivity which have different angles, facial brightness and expressions of a personage shows test evaluation ratio with different approach is shown in Figure 11 and Figure 12 respectively.

Fig. 10: DWT NN based face recognition (in sensitivity ratio)

Fig. 11: Comparison image data analysis as test evaluation ration (Essex database)

Fig. 12: Comparison image data analysis as test evaluation ration (ORL database)
CONCLUSION

In this work, the face recognition techniques that can be used for recognizing the person by using different techniques like DWT and PCA feature extraction. This work is identified the performance for face recognition to distinguish the face image. As the graphical presentation shows the DWT with NN technique recognize the face image as 75.5% (Essex database) and 81% (ORL database) can recognize the face image. After the experiment in MATLAB, the mentioned face recognition methods are examined that PCA with ANN works better than the individual PCA. It provides a prominent accuracy, precision and sensitivity ratio. The performance of face recognition is enhanced by using soft computing techniques to combine with ANN to achieve elevated precise results as demonstrated.

Conflict of Interest: Nil

Source of Funding: Self

Ethical Clearance: Taken from St. Peter’s University

REFERENCES


Modeling and Dynamic Performance of Photovoltaic and Fuel Cell Power Generation for Hybrid Converter System

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ABSTRACT

In recent days increasing the utilization of renewable energy generation such as solar and fuel has pollution free power generation. The domestic and urban revitalize is being swiftly deployed for small commuter vehicles there is limited availability of sites and lack of operating flexibility for urban transport operation. The hybrid renewable energy based multilevel inverter can reduce the harmonics and utilize the Cuk-SEPIC converter. The nine level inverter utilized for reducing the harmonics and increase the performance. The controller of the multilevel inverter has compared the triangular carrier and sine wave. The Cuk converter has used the PI based PWM control method. The SEpic converter has used the maximum power point tracking control methodology. The simulation results are carried out and presented for analysis the performance of these topologies using MATLAB/SIMULINK. In order to achieve maximum output voltage, while using proposed scheme compared to conventional topologies of Cuk-SEPIC converter.

Keywords: Photovoltaic (PV), Proton Exchange Membrane (PEM) fuel cell, Maximum Power Point Tracking (MPPT), Single Ended Primary Inductor Converter (SEPIC), Cuk Converter.

INTRODUCTION

In Recent years the renewable energy sources have been tremendous potential power generation compared to conventional power systems. The main uses of renewable energy sources and power electronics systems for capitalizing such energy sources have acknowledged renewed interest in the past decade [1-2]. General forms of renewable energy sources consist of photovoltaic (PV) energy, hydro energy, and wind energy, and several sources are commonly balancing in the sense that they can be utilized concurrently and regulate constant deliverance of power to the load. In future power systems will require interfacing of various energy sources. The multi-source technology and multi-input power converter can be used for practical development. With multiple inputs, the energy source is expanding the reliability and utilization of sustainable sources[3-4].

The Cuk and SEpic combination of converter is modelled for increase the power factor correction, high gain voltage and improve the efficiency of the drive system. The buck and boost converter has used to increase the system performance. In boost converter the switching stress is high across the energy transferred to the load. The Cuk converter has used in the hybrid renewable energy sources for meet out the load demand and improves the system efficiency. The phase disposition control methodology is used in the modular multilevel inverter for enhance the system performance [5-8]. The modular multilevel converter has used in high power drives and operate at medium and high voltage levels. The multilevel converter has high operating voltage using series connection of sub modules [9]. The harmonic is reduced in the phase disposition based pulse width modulation for multi modular converter. The multilevel is determined by the number of switched-capacitor cells and one dc voltage source is needed for avoid the capacitor voltage balancing problem [10]. The multilevel inverter is not simple level inverter and the respective gate circuit is simplified because of decreased utilization of active switches. The inverter modulation method is analyzed and the power loss is reduced[11-12].

SOLAR POWER GENERATION

Solar cells can be converting the radiance into electrical energy by exciting the semiconductor electron.
The most common types of solar cells are based on the photovoltaic effect, while occurs when light falling on a two-layer semiconductor material generates a potential difference or voltage between the two layers. The voltage produced in the cell is capable of current through an external electrical circuit that could be utilized to power electrical devices [13-14].

Modeling of Solar Array: In this section provided all mandatory information of photovoltaic array models and can be used in power generation of converters for PV array applications [15].

\[ I = I_{PV, Cell} - I_0, \text{Cell} \left[ \exp \left( \frac{qV}{aKT} \right) - 1 \right] I_d \]  

(1)

Where \( I_{PV, cell} \) = current generated by incident light, Shockley diode equation \( I_0, \text{cell} \) \( \text{[A]} \) is reverse saturation and leakage current of diode \( \text{[A]} \), \( q \) is electron charge \( \text{[\textbf{ Coul }]} \), \( k \) is Boltzmann constant \( \text{[1.3806503.10^{-23} J/K]} \), \( T \) \( \text{[K]} \) is the temperature p-n junction. PV array Single-diode model of the theoretical photovoltaic cell and equivalent circuit of a practical photovoltaic device including the series and parallel resistances. The equivalent circuit of PV array is shown in Figure 1.

\[ I = I_{PV} - I_0 \left[ \exp \left( \frac{V + R_S I}{V_t} \right) - 1 \right] - \frac{V + R_S I}{R_p} \]  

(2)

Where \( I_{PV} \) and \( I_0 \) is the photovoltaic and saturation current of array respectively, \( V_t = N_qKT/q \), array is composed by \( N_p \) parallel connection of cell the photovoltaic and saturation current can be expressed as of \( I_{PV} = I_{PV, cell} N_p \), \( I_0 = I_{0, cell} N_p \). Figure 2 shows the voltage current characteristics of solar photovoltaic cell.

**Figure 1: Equivalent Circuit for a Practical Photovoltaic Device with Single Diode, Series and Parallel Resistance**

**Figure 2: Voltage and Current Characteristic of Solar Photovoltaic**
**FUEL CELL POWER GENERATION**

In modern years, hydrogen would generate electricity for energy carrier element. An energy carrier of electricity moves and delivers energy in a usable form to consumers. Renewable energy sources like as the sun and wind can’t produce energy all the time. For example, it could produce electric energy and hydrogen which can be stored until needed. Hydrogen can also be transported (electricity) to locations where it should be needed. A fuel cell combines hydrogen and oxygen to produce electricity, heat and water. Fuel cells are often compared to storage of batteries. Both converted of the energy produced by a chemical reaction from usable electric power.

Among the several types of fuel cell, Proton Exchange Membrane Fuel Cell (PEMFC) is a suitable best choice for distributed energy sources. It have advantages such as low temperature, high power density, fast response and zero emission. If it is run with pure hydrogen means suitable for use in portable power supply, vehicles and residential power plants. In this paper, a dynamic model is proposed to simulate a PEMFC which accounts for the effects of different conditions.[16-17].

**PROPOSED HYBRID SOURCE CUK – SEPIC CONVERTER**

The hybrid fuel cell-solar energy system is shown in Figure 3, where the Cuk converter has operate under the input of fuel cell and SEPIC converter is associated to the output of the PV array. The combination of the two converters is achieved by restructured by the presented diode from each converter and inductor is common for both Cuk and SEPIC converter[18].

The proposed hybrid converter is used to generate the power from the combined feature of Cuk and SEPIC converter. If fuel cell source available means D1 turns off and D2 turns on. In second mode, if only the PV source is available means D2 turns off and D1 will always be on and the circuit becomes a Cuk converter. The proposed circuit becomes a SEPIC converter and the input to output voltage. In both the diode are alternate on and off for both converters and similar function as buck boost converter, which offer more design flexibility in the system if duty ratio control is utilized to improve reliability.

**PROPOSED MULTILEVEL INVERTER**

The proposed nine level based multilevel inverter has one source and two capacitor for producing
harmonic less output. The voltage level is increased with less components and minimized THD of output voltage. The one supply, two capacitor, two diode and nine power switches are used to generate the multilevel output voltage. The switching pattern is mentioned in Table 1. The power devices are ideal, on state resistance and forward voltage drops are zero. Figure 4 shows the multilevel inverter circuit.

In state 1 the two capacitor are charged and discharged in series at $\pm V_d$ and $\pm 2V_d$. These state share same charging and discharging current. In state 2 the two capacitor are connected in parallel and the voltage are get balanced during $\pm \frac{V_d}{2}$ and $\pm \frac{3V_d}{2}$. In state 3 the two capacitor voltage are remain unchanged during 0V.

Table 1: Switching Pattern of Proposed Multilevel Inverter

<table>
<thead>
<tr>
<th>Voltage Level</th>
<th>S1</th>
<th>S2</th>
<th>S3</th>
<th>S4</th>
<th>S5</th>
<th>S6</th>
<th>S7</th>
<th>S8</th>
<th>S9</th>
<th>D1</th>
<th>D2</th>
<th>C1</th>
<th>C2</th>
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<tr>
<td>$2V_{dc}$</td>
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<td>0</td>
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<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>D</td>
<td>D</td>
</tr>
<tr>
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<td>0</td>
<td>1</td>
<td>0</td>
<td>C</td>
<td>C</td>
</tr>
<tr>
<td>$-\frac{3V_d}{2}$</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>D</td>
<td>D</td>
</tr>
<tr>
<td>$-2V_d$</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>D</td>
<td>D</td>
</tr>
</tbody>
</table>

Figure 4: Proposed Multilevel Inverter Circuit
RESULTS AND DISCUSSION

The proposed hybrid renewable energy based Cuk-SEPIC converter fed multilevel inverter is implemented in MATLAB/SIMULINK. The performance of the hybrid cascaded converter has improved compared to the conventional Cuk-KY converter. The enhanced version of dual converter based on solar and fuel cell reduces the conduction losses, lower power rating of devices required. So that in order to attain the maximum voltage from the proposed hybrid converter. The simulation results have given the performance analysis such as high efficiency, small size energy storage elements and less power rating devices. The Simulink model of proposed hybrid system is shown below in Figure 5.

![Figure 5: Overall Simulation of Proposed Circuit](image)

The dynamic performance of proton exchange membrane based fuel cell has implemented during starting and load change condition. The simulink model of PEM fuel cell is shown in Figure 6. The modeling of fuel cell contains a hydrogen, oxygen, water flow and fuel cell.

![Figure 6: Simulink Block for PEM fuel cell](image)

The single diode model PV module has been implemented using MATLAB simulink model is shown in Figure 7. It can be produced the PV output current fluctuates dynamically with lagging conditions and there is a finest operating point such that the solar supply its greatest power to the load. The optimal operating points alter with the solar insulation, temperature and load conditions. The solar photovoltaic system of output voltage and current is shown in Figure 8-9.
Figure 7: Simulink Block for solar photovoltaic system

Figure 8: PV Output Voltage Waveform

Figure 9: PV Output Current Waveform
The output power of the PV module and fuel cell is given to the maximum power point tracking (MPPT) for generation of converter gate pulse signal. The MPPT used in the Cuk converter has been implemented using matlab simulation. The simulink modeling of MPPT is shown in Figure 10.

![Simulink Block of Incremental Conductance MPPT Model](image)

Figure 10: Simulink Block of Incremental Conductance MPPT Model

The simulation parameters should be mentioned in Table 2. The converter across the DC link voltage is shown in Figure 11. This proposed configuration with R load of the output boosted voltage 165V can be obtained. The input of the Cuk is 30V from the fuel cell system and the input of Boost is 30V from the solar PV system. The output voltage waveform for proposed scheme using without filter is shown below in Figure 12. The total harmonic distortion of multilevel inverter based hybrid converter is shown in Figure 13.

![DC Link Voltage of Hybrid Renewable Energy Based Converter](image)

Figure 11: DC link Voltage of Hybrid Renewable Energy Based Converter
Table 2: Specification of Proposed Method

<table>
<thead>
<tr>
<th>S. NO.</th>
<th>PARAMETERS</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Solar Voltage</td>
<td>30V</td>
</tr>
<tr>
<td>2.</td>
<td>Fuel Cell Voltage</td>
<td>30V</td>
</tr>
<tr>
<td>3.</td>
<td>Switching Frequency</td>
<td>50Hz</td>
</tr>
<tr>
<td>4.</td>
<td>Battery Capacity</td>
<td>55Ah</td>
</tr>
<tr>
<td>5.</td>
<td>Output Voltage</td>
<td>165V</td>
</tr>
</tbody>
</table>

CONCLUSION

The dynamic performance of the distributed energy sources has been investigated with converters for electric vehicle applications. In order to find out the detailed model of hybrid system performance has analyzed and verified in MATLAB/SIMULINK. The proposed topology can be obtained the high output voltage from the hybrid supply system. The improved description of double-input Cuk-SEPIC converter is used to reduce the voltage and current stresses. Also, in order to attain the higher efficiency by using similar power transfer method. Moreover, the additional features of this proposed topology using for reduced component count and less harmonic distortion. The control of hybrid system based converter is simple and capable of power sharing method can be identified. In MPPT based control scheme is used for generating converter gate pulse signal. It can be realized for each supply such as PV and fuel cell has work in simultaneous operation is possible. The high voltage gain is generated by using the Cuk EPIC converter fed multilevel inverter compared to Cuk KY converter methodology. Thus, the simulation results show the dynamic performance of converter such as less energy storage elements and lower rating of switching devices.

Ethical Clearance: Taken from St Peters University

Source of Funding: Self

Conflict of Interest: Nil

REFERENCE


Implementing an Iot Vehicular Diagnostics System Under an Rtos Environment Over Ethernet IP

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ABSTRACT

Due to ever more complex electronic systems and the frequently growing volume of data in vehicles, vehicle access for diagnostics and Electronic Control Unit (ECU) programming has to be correspondingly efficient. For this purpose, communication-based on Ethernet technology has been precise with Diagnostics over Internet Protocol (DoIP). In recent times, Ethernet-based DoIP is useful to automotive systems, and in-vehicle gateways have been initiated to assimilate Ethernet with usual in-vehicle networks, such as the Local Interconnect Network (LIN), Controller Area Network (CAN) and FlexRay. The preface of in-vehicle gateways and Ethernet based diagnostic protocols not only decreases the difficulty of the networks but also reduces the renew time for ECU software reprogramming while permitting the use of a range of services, together with remote diagnostics. In this work, a remote diagnostic vehicular gateway is implemented under a Real Time Operating System (RTOS) environment for an automotive system is presented.

Keywords: ECU, DoIP, Ethernet, TCP/IP, Remote Automotive Diagnostics.

INTRODUCTION

The Internet is becoming more widespread; there was the prospect of communication with automation systems for configuration, reprogramming or control in real time. For this, the automation system requests a physical communication port with the network. This work presents the design and execution of such Ethernet interface for automation system with the microcontroller. Recently, the number of high-performance ECU installed in vehicles has increased significantly. ECUs provide convenient features to drivers, such as Advanced Driver Assistance Systems (ADAS) [1, 2]. Both the number of ECUs for high-performance and the size of the software for reprogramming are increased. This result in the requirement for the network to have a higher bandwidth and provide real-time functionality, but the current CAN-based systems cannot meet these criteria because of a small data size of 8 bytes and low bandwidth of maximum 1 Mbps. To solve these difficulties, DoIP, which is an Ethernet-based diagnostic protocol, was introduced for use in automotive systems. Ethernet [3-9] can support a maximum data size of 1,500 bytes and with a bandwidth 100 Mbps. Therefore, Ethernet-based DoIP can meet the requirements for high-performance functions. Moreover, automotive systems can provide services, such as diagnosis, calibration and software updates for ECUs, and new applications that support DoIP through the in-vehicle gateway give convenience to drivers [10]. The external diagnostic devices based on DoIP cannot interface directly with in-vehicle networks, so an in-vehicle gateway [11-14] is essential to integrate different in-vehicle networks with Ethernet. As a result, the external diagnostic devices can be connected to the automotive system. The gateway provides an interface to the external diagnostic tools to access the in-vehicle ECUs through an On-Board Diagnostics (OBD) terminal. If the external diagnostic device is connected to the Internet, the vehicle can provide a range of telematics services from the external diagnostic devices through the gateway.

The Proposed system will help in reducing the time and effort to find a defect by continuously monitoring and controlling the automobile subsystems. Among all the microcontrollers, STMicroelectronics is selected because of the features it has like simplicity, compiler, easy start-up and peripheral libraries. Since STM32F429
The microcontroller has 10/100MBit Ethernet compatibility, it can be interfaced to Ethernet modem to implement IoT. The observed values from sensors can be continuously updated in a web page. Controlling of the devices is the other task that could be done for diagnosis from the remote location. Motors can be used as actuators to move automobile in different directions as per the needs. Automation system online makes technician operate the system even when a technician is not in the locality of the automation system. In this environment, IoT perception has been initiated. IoT represents an integration of devices through internet which implies that the devices utilize Internet Protocol (IP) address as the unique identifier. When interfaced to Ethernet, STM32F429 microcontroller generates unique IP address.

**RELATED WORK**

Many studies related to automotive gateways that integrate different networks have been conducted. One study [9] presented that the future generation of the networks and automotive gateways will concentrate on methods for data conversion between different protocols, such as CAN, FlexRay and Ethernet.

Another study [11-12] presented a conversion method of CAN-Ethernet frame transmission in a range of circumstances through a Field Programmable Gate Array (FPGA)-based gateway. Moreover, the study presented the methods of protocol conversion and the experiments were carried out by a real network configuration. As a result, the average end-to-end latency (from 500 Kbps CAN network to 100 Mbps an Ethernet network) was 500μs. In [15] a prototype of an automatic system that continuously monitors the gas leakage status feed over the internet with the help of the sensors. An attempt has been made to make a practical model of ‘IoT Based Smart Energy Meter’. The propagated model is used in [16] to calculate the energy consumption of the household and even make the power unit reading to be handy.

A previous study [13] on DoIP context clarified how remote online vehicle diagnostics could be realized based on the DoIP. Moreover, in studies [4] and [7], the authors proclaimed the application of Ethernet for vehicle diagnostic in 2008 at BMW. In these studies, the reprogramming time (based on CAN network) of the 4th generation vehicle was compared with the reprogramming time (based on) of a 5th generation vehicle. Ten hours were needed to upload 81 MB in the 4th generation vehicle (based on the CAN), whereas only 20 minutes was required to upload 1 GB of software data in the 5th generation vehicle (based on Ethernet).

**SYSTEM ARCHITECTURE**

The proposed work develops a DoIP gateway device that provides its diagnostics services over Ethernet and TCP/IP allowing the vehicle to be connected directly to a test tool that is available on the local network or the Internet as shown in figure 1. The vehicle is now directly accessible to any PC with an Ethernet Local Area Network (LAN) interface. When connected to the internet it offers the benefit of accessing the advanced services provided by the vehicle manufacturer in real-time. There is no necessitating for additional external devices to examine the diagnostic data.

![Figure 1: System Architecture of IoT Automotive Network](image-url)
Additionally, the device is capable of transmitting real-time video to provide a visual feedback of the vehicle behaviour when the diagnostic operations are carried out. This eliminates the need for the technician to be physically present near the vehicle. A four-wheel robotic car model will be used to show the prototype in action.

In DoIP networked connection, the device acts as a web server and provides diagnostic data live on the browser web page along with a live video stream that captures the inside of the vehicle. This enables the service person to carry out actions on the vehicle remotely from an internet connected device. Dynamic Host Configuration Protocol (DHCP) server is required. An internet infrastructure is needed in this type of connection.

DoIP direct connection uses no network infrastructure and uses a “cross-over” Ethernet cable to connect to the test PC. No DHCP server required. Dropped packets are low. It is the most secure connection.

**SYSTEM IMPLEMENTATION**

**Hardware Components:** The hardware of the system includes (STM32F429) cortex-M4F microcontroller, OV2640 2 MP camera, DP83848 Ethernet transceiver, BMP180 Pressure sensor, MEMS accelerometer sensor, MQ2 gas sensor, INA219 power monitor sensor, LED array, Linear potentiometer, L293D high current driver, 4-Wheel robotic vehicle, 6V Battery, User LEDs and Ethernet cable.

**ARM Cortex-M4F Microcontroller:** The Advanced RISC Machines (ARM) Cortex-M4F STM32F429 microcontroller is preferred for this function since it provides peripheral support for Ethernet which helps in implementing IoT part of the system. The microcontroller has library files to build which helps to monitor the values of sensors through the Internet. It consumes low power, it is also of low cost, and it can operate up to 180MHz. It makes possible the Ethernet and USB to run at the same time without affecting the performance as shown in figure 2.

![Figure 2: Hardware Setup of IoT Vehicular Diagnostic System](image)

**Flow Chart:** ARM Cortex-M4 with Floating Point Unit (FPU) processor has in-built Digital Camera Interface (DCMI) for the camera connection and the GPIO pins which are used to connect the sensors. To communicate with the system we use Ethernet cable which is connected to DP83848 Ethernet transceiver port, and it is directly connected to the PC. The client computer sends/receives data to/from the ARM board using Transmission Control Protocol (TCP) packets. The microcontroller is programmed with dedicated IP address which is used, to transmit and receive data by the controller. The client has to enter IP address to access this server as shown in figure 3, if the IP address matches to that of the server, a TCP/IP connection is establishes and the server starts sending/receiving the data, simultaneously it will be displayed on the web page through which user can remotely monitor and control the sensor and device status respectively.
The execution flow in figure 4 starts with checking the Ethernet connection. If Ethernet connection is accurate, then IP address gets displayed in the serial terminal. If there is a problem with Ethernet, it shows error. After checking Ethernet connection, server port configuration is verified.

If there is some trouble error message appears in serial terminal. If server port configuration is proper then the server runs, TCP socket gets connected, and Hypertext Transfer Protocol (HTTP) is established. The user can give options in web server to control automotive subsystem. HTTP commands internally invoke the microcontroller actions. When the TCP connection gets established, the HTTP server starts running. Then the Hypertext Markup Language (HTML) code also gets initiated. When the IP is given in the Uniform Resource Locator (URL) the background HTML code runs, and the webpage is displayed.

**Web Server for IoT Vehicular Diagnostic System:**
The device acts as a tiny web server responding to the user requests through HTTP application layer protocol. Here the web browser on the mobile device acts the client. Upon receiving the request from the client, the web server running on the device serves the HTML web page and returns the response messages to the client over a dedicated TCP/IP connection. The web pages are stored in the non-volatile section of the microcontroller memory area. The device uses the LwIP open source TCP/IP protocol stack for its internet connectivity.

**Client-Server Communication:** HTML pages are used for data communication between the client and the server. In the embedded web server, web pages are selected as the media of interaction. HTML is used in designing these web pages. HTML is a very basic markup language and requires a memorization of a few dozen HTML commands that structure the look and layout of each of the web pages. HTML page is designed with the user Authentication so cannot be directed without particular login id and password. Figure 5 shows live video streaming by OV2640 camera to provide a visual feedback of the vehicle behaviour when the diagnostic operations are carried out.
M-JPEG Video Streaming Technique: Motion JPEG (MJPEG) files consist of JPEG images saved “back to back” and are the preferred method for recording security camera footage because the files are “open-ended.” Most video file formats need to be “closed” when the recording finishes so that information about the file’s properties (particularly its length) can be saved in the data along with the actual images.

Because MJPEG files are open-ended, it doesn’t matter if the recording software is temporarily closed or even if power to the computer is interrupted. When power is restored, new images will simply be added to the end of the file as though nothing had happened (except, apparently, for the missing images while the power was down). It goes without saying that an in-tact file with some missing frames is infinitely better than the entire recording being lost because the unexpected power cut didn’t close the file properly.

SOFTWARE FLOW

RTOS based Firmware Development: ARM processors have widely used an embedded system which has the support of RTOS like FreeRTOS. In this application, a RTOS is used to handle the task scheduling as shown in figure 6. A RTOS allows multiple processes to be executed concurrently, by dividing the processor’s time into time slots and allocating the time slots to the processes that require services. A timer needs to handle the timekeeping for the RTOS, and at the end of each time slot, the timer generates a timer interrupt, which triggers the task scheduler and decides if context switching should be carried out. If yes, the currently executing process is suspended, and the processor executes another process. Besides task scheduling, RTOSs also have many other features such as semaphores, message passing etc. RTOS is necessary to handle multitasking requirements of internet task, Sensor reading task and control task. Figure 7 and 8 shows that image transfer rate Vs a number of the task without and with RTOS configuration.

RESULT

The proposed system is designed to transfer these real-time vehicle parameter readings to the internet and hence can be accessed from the web browser. Apart from the vehicle parameters, it shows the Diagnostic Trouble Code (DTC) of the automobiles, if any. The DTCs can be cleared from the device. This stage uses the data obtained and using the formatting devices (Ethernet shield), the data is converted to TCP/IP format and transferred the data based on TCP send buffer size as shown in figure 8. The web page created and hosted on the ARM board has functions for indicating the vehicle parameters, displaying DTC and for clearing the DTC as shown in figure 9 and 10. The power consumption of Hardware Module in an automotive network is tabulated in Table 1.
Table 1: Power Consumption of Automotive Network using Ethernet

<table>
<thead>
<tr>
<th>Power Consumption of Hardware Module</th>
<th>Running State with RTOS</th>
<th>Running State without RTOS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.5 Watts</td>
<td>2 Watts</td>
</tr>
</tbody>
</table>

Figure 8: Data Transfer rate in TCP stack for Ethernet Protocol

The user can send commands to do any of the following.

1. Monitor current data
2. Monitor stored error codes
3. Clear stored error codes
4. Control vehicle operation

Figure 9: Real-Time Vehicle Status Monitoring

CONCLUSION

CAN-based in-vehicle networks have limitations when high-performance systems are implemented (i.e., multimedia, infotainment, ADAS). Moreover, diagnostic services using CAN-based diagnostic protocols take too long because of the low bandwidth, and it is difficult to apply new services that provide ease to drivers. In contrast, Ethernet-based DoIP provides high bandwidth and large data sizes for large-scale communication, and it can diagnose the vehicle in near real-time. With an external connection to the Internet, an external diagnostic device can request a multiplicity of services, such as the remote diagnosis of ECUs and real-time monitoring of traffic congestion, through the in-vehicle gateway. An IoT vehicular diagnostic system integrates a traditional in-vehicle network with Ethernet, thereby providing an interface for the external diagnostics device is implemented to optimize communication with RTOS environment and as well as provide comfort and safety to the drivers.

Ethical Clearance: Taken from Dr. MGR Educational and Research Institute University

Source of Funding: Self

Conflict of Interest: NA

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Texture Statistical Approach for Optical Coherence Tomography Image Classification

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ABSTRACT

Glaucoma is a condition that damages optic nerve head which is irreversible if it is not treated at the earliest. In this paper, Optical Coherence Tomography (OCT) image classification for glaucoma diagnosis is presented which uses texture statistical approach for classification. A set of common statistical features from the OCT image and another set of statistical features from the Gray Level Difference Matrix (GLDM) of OCT image are used. They are analyzed independently by a supervised classifier named Support Vector Machine (SVM). To obtain higher accuracy, two sets of features are combined linearly and tested. Experimental results show that the OCT image classification system provides an accuracy of 95.5% with sensitivity of 94% and specificity of 97% by the combination of features.

Keywords: Glaucoma classification, GLDM, Statistical features, SVM classifier.

INTRODUCTION

Glaucoma is an ocular disorder. The Intra Ocular Pressure (IOP) in the eye is the main cause of raising glaucoma. The congestion of fluid in the eye results in raise of IOP which leads to optic nerve damage. It is a chronic disease and if the glaucoma progression is not detected early, it can damage the ganglion cells which may lead to permanent loss of sight. Automated diagnosis of glaucoma using texture and Higher Order Spectra (HOS) features is presented in [1]. SVM, sequential minimal optimization, naïve Bayesian, and Random-Forest (RF) classifiers are used to execute supervised classification. The z-score normalization is applied on the extracted features and also feature selection is demonstrated and combined with a RF classifier.

Automatic extraction of anterior chamber contour in OCT images is explained in [2]. A series of methods are employed with unique features and anterior structure to execute automatic extraction of the anterior chamber contour in OCT images. The extraction of Optic Disc (OD) endpoints in OCT data is discussed in [3]. At first, the retina and optic nerve head are separated from the vitreous humor using hybrid edge supported boundary detector. Then this boundary is partitioned using a model based technique to recognize the Optic Cup (OC). The endpoints of lower retinal boundaries obtained by markov model represent the limits of the OD. The optimal estimation of the nerve head level is found by minimizing the trace of the within class scatter matrices for optic nerve and retina.

A quantitative assessment using Cup to Disk Ratio (CDR) in spectral domain OCT images for glaucoma diagnosis is described in [4]. The breakpoints of the retinal pigment epithelium layer are detected by combining binary and flattening images. The segmentation of inner limiting membrane is achieved by the intensity difference between retinal layers and background. SVM based texture classification in OCT is introduced in [5]. To detect glaucoma, the inner retinal layer thickness and speckle patterns are exploited. It relies on SVM, while principal component analysis is also employed to progress classification performance.

Two new parameters; mean of continuous measurement of angle opening distance centered on Schwalbe’s line and area of the anterior chamber are used to diagnose glaucoma using Swept Source Optical
Coherence Tomography (SS-OCT) images is presented in [6]. Open and closed angle measurements in SS-OCT images are compared with Schwalbe’s line based single angle assessment.

3D OCT super pixel with machine classifier analysis for glaucoma detection is discussed in [7]. Machine classifier is used to analyze Spectral Domain (SD-OCT) images after combining adjacent pixels into super pixel. A 3D SD-OCT image is first converted into a 2D feature map and partitioned into over a hundred super pixels. Glaucoma image classification using Discrete Orthogonal Stockwell Transform (DOST) is discussed in [8]. DOST distribute its coefficients based on sample spacing paradigm where low frequencies have a lower sampling rate, and high frequencies have higher sampling rate. All DOST coefficients are considered for the diagnosis of glaucoma using RF classifier.

A comparative study on macular OCT image alignment is explained in [9]. An exhaustive experimental study on macular OCT image alignment using intensity based image registration technique is presented. More than 10 combinations of registration metric and transformations have been explored. An early glaucoma detection using structural features from clinical and machine learning perspectives is explained in [10]. The functional and structural features are highlighted and their importance with respect to digital fundus and OCT images for glaucoma detection are discussed.

Automatic glaucoma detection using adaptive threshold in fundus image is implemented in [11]. An efficient method to study the fundus image which can act as a diagnostic tool for detection of glaucoma is described. The histogram based image is used to study some statistical features of the image such as mean and standard deviation. OD and OC are segmented by using adaptive threshold.

Angle closure glaucoma detection using fractal dimension index on SS-OCT images is introduced in [12]. A strategy for automatic and landmark invariant quantification of the anterior chamber angle of the eye using SS-OCT images is presented. Fractal Dimension (FD) analysis is used to measure the anterior chamber angle structure. FD index is evaluated with biometric parameters for the classification of open angle and angle closure glaucoma.

Computer aided diagnosis of glaucoma detection using digital fundus image is presented in [13]. K-means clustering and hill climbing algorithm are used to achieve OD segmentation and OC region is extracted by exploiting fuzzy C-mean clustering. CDR is computed to diagnose glaucoma after segmentation of OC and OD.

In this paper, an approach for fundus image classification to diagnose glaucoma is presented based on statistical features. The rest of the paper is as follows: Section 2 gives the overview of GLDM, computation of statistical features and SVM classifier. Section 3 illustrates the fundus image classification system for glaucoma diagnosis and the outcomes of the system are discussed in Section 4. The conclusion is given in the last section.

**METHODS AND MATERIALS**

The proposed OCT image classification to diagnose glaucoma is utilized GLDM features and SVM classifier. The procedure for computing GLDM and SVM classifier are discussed in this section.

**GLDM:** GLDM is a traditional statistical method to extract texture feature of an image. It is based on the occurrence of two pixels having absolute difference in their intensity value and both are separated by a specific displacement [14-15]. To describe the GLDM, let $g(n, m)$ be the digital picture function. For any given displacement $\delta = (\Delta n, \Delta m)$, where $\Delta n$ and $\Delta m$ are integers, let $g_\delta(n, m) = |g(n, m) - g(n + \Delta n, m + \Delta m)|$. Finally, let $f(\cdot | \delta)$ be the estimated probability density function associated with the possible values of $g_\delta$, i.e.,

$$f(i | \delta) = P(g_\delta(n, m) = i) \quad \ldots (3)$$

The four possible forms of displacement vector $\delta$ with inter-sample spacing of $d$ are $(0, d), (d, 0), (-d, d), (-d, -d)$. Hence, texture features are extracted from the four different probability density functions.

**SVM Classification:** SVMs are based on the design to look for the hyper-plane that maximizes the border between two classes. Actually, SVM classifier in its source is a binary classifier. But, it can be used for multiclass classification also. One-against-all scheme is the one of the strategies for adapting binary SVM
classifiers for solving multiclass issues. It includes decomposition of the M-class problem into series of two-class issues. The fundamental theory is to build M class SVMs where the \(i\)th classifier is trained to divide the class \(i\) from all other \(M-1\) classes. It is a very popular machine learning method used for classification, regression and other learning task.

The optimal separating hyper plane discriminating the classes is defined by

\[
x^T \hat{w}^j + \hat{b}_j, \quad j = 1, \ldots, k
\]

where the superscript in \(\hat{w}^j\) stands for the class which should be separated from the other observations. The decision rule \(t^j\) that assigns the vector \(x\) to the class \(j\) or to the combined class is

\[
t^j(x) = \text{sgn}(g^j(x))
\]

where, \(g^j(x) = x^T \hat{w}^j + \hat{b}_j\). After all \(k\) optimal separating hyper planes defined by \((\hat{w}^j, \hat{b}_j)\) = 1, \ldots, \(k\) the final classifier \(t_k\) is defined by

\[
t_k(x) = \arg\max_j (t^j(x))
\]

In Eqn.3 the argmax-rule is not well-defined since there is not always a unique solution. Figure 1 illustrates such a situation where the class-2 cannot be reasonably separated. As the OCT image classification system is a binary classification approach, it is employed for glaucomatous image classification\(^{[16-18]}\).

![Figure 1: Hyperplane along a line to separate 3 classes](image1)

**OCT IMAGE CLASSIFICATION SYSTEM**

The OCT image classification system using texture statistical approach consists of two modules; extraction of texture statistical features and classification. Figure 2 shows the OCT image classification system.

![Figure 2: OCT image classification system for glaucoma diagnosis](image2)

The acquired OCT image contains the very important retinal area along with background region. Thus, before extracting features, preprocessing is applied to get the Region Of Interest (ROI) in which only the retinal area is available. Also, the acquired colour OCT image is converted into gray intensity image at first. Figure 3 shows a sample OCT and its corresponding ROI region.

![Figure 3: (a) OCT colour image (b) OCT gray image (c) OCT-ROI image](image3)
The accuracy of any classification system mainly depends on the extracted features. Hence, the features are extracted from the OCT-ROI obtained in the preprocessing step. A set of common statistical features which includes mean, standard deviation, skewness, and kurtosis from the OCT-ROI image is extracted. Table 1 shows the formula for extracting common statistical features (SF) from the OCT-ROI image.

Another set of statistical features from the GLDM of OCT image is extracted. It includes contrast, angular second moment, entropy, and mean. Table 2 shows the formula for extracting GLDM features from the GLDM of OCT-ROI image. As the GLDM has four possible forms, GLDM features are extracted from all the four forms with inert-sample spacing of single pixel. Figure 4 shows the four forms of GLDM of OCT-ROI image. To extract GLDM features, histogram of all these forms are generated at first. Figure 5 shows the histogram of GLDM with inter-sample spacing of single pixel for OCT-ROI image in Figure 3 (c).

Table 1: Common statistical features used in OCT image classification system

<table>
<thead>
<tr>
<th>Features</th>
<th>Information Captured</th>
<th>Equation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>Brightness</td>
<td>Mean = ( \frac{1}{L} \sum_{i=1}^{L} r_{i} P(r_{i}) )</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>Contrast</td>
<td>Stddev = ( \frac{1}{L} \sqrt{\sum_{i=1}^{L} (r_{i} - \text{mean})^2 P(r_{i})} )</td>
</tr>
<tr>
<td>Skewness</td>
<td>Asymmetry about the mean</td>
<td>Skew = ( \frac{1}{(\text{Stddev})^3} \sum_{i=1}^{L} (r_{i} - \text{mean})^3 P(r_{i}) )</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>Measure of peakedness</td>
<td>Kurtosis = ( \frac{1}{(\text{Stddev})^4} \sum_{i=1}^{L} (r_{i} - \text{mean})^4 P(r_{i}) )</td>
</tr>
</tbody>
</table>

Table 2: Computation of GLDM features

<table>
<thead>
<tr>
<th>GLDM Features</th>
<th>Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contrast</td>
<td>( \Sigma i^2 \text{pdf}(i) )</td>
</tr>
<tr>
<td>Angular Second Moment</td>
<td>( \Sigma \text{pdf}(i)^2 )</td>
</tr>
<tr>
<td>Entropy</td>
<td>( \Sigma - \text{pdf}(i) \times \log(\text{pdf}(i)) )</td>
</tr>
<tr>
<td>Mean</td>
<td>( \frac{1}{m} \Sigma i \text{pdf}(i) )</td>
</tr>
</tbody>
</table>

where \( \text{pdf} \) is the probability density function and \( m \) is the number of gray levels.

Figure 3: Four forms of GLDM of OCT-ROI image
Once the features are extracted from OCT-ROI images, SVM classifier is used to classify the given OCT image into normal/glaucomatous.

**Experimental Results and Discussions:** In this section, the outcomes of the proposed OCT image classification system described in section 3 for glaucoma diagnosis are discussed. The system is applied on internal database with 200 OCT images. It consists of normal (100 images) and glaucomatous images (100 images). Features are extracted from the OCT-ROI and trained by SVM with Radial Basis Function (RBF) Kernel. K-fold cross validation is used to separate the whole database into 10 folds \((K=10)\). For training SVM-RBF classifier, images in one fold are used and then images in the remaining folds are tested. Based on the number of OCT images correctly classified into either normal or glaucoma, the performance metrics in Table 3 such as sensitivity, specificity, and accuracy are computed. Figure 3 shows the confusion matrix constructed based on TP, FP, TN, and FN and corresponding Receiver Operating Characteristics (ROC) curve.

**Table 3: Performance Evaluation of the Proposed System**

<table>
<thead>
<tr>
<th>Performance Metrics</th>
<th>Accuracy (\frac{TP + TN}{TP + FP + FN + TN} \times 100%)</th>
<th>Sensitivity (\frac{TP}{TP + FN} \times 100%)</th>
<th>Specificity (\frac{TN}{FP + TN} \times 100%)</th>
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Where TP- True Positive, FP- False Positive, TN- True Negative and FN- False Negative
It is observed from the confusion matrices in Figure 3 (a)-(c) that the 95.5% accuracy is obtained while using the combination of GLDM and statistical features whereas 88.5% and 91.5% accuracy is obtained for statistical features and GLDM features respectively. Also, the system provides 94% sensitivity and 97% specificity. From Figure 3(d), it is clearly observed that the maximum area under the curve is 0.955 which is obtained by the system for glaucoma diagnosis while using the combination of GLDM and statistical features.

**CONCLUSION**

In this paper, OCT image classification system using texture statistical features is presented. To reduce the time and space complexity, the given OCT colour image is transformed into gray intensity image. Then, ROI is cropped automatically from the gray OCT image. Statistical features are extracted from the gray intensity image (mean, standard deviation, skewness, and kurtosis) as well as GLDM of OCT images (mean, entropy, contrast, and angular second moment). SVM-RBF classifier is trained with these features and tested. Results show that the OCT image classification system provides 95.5% accuracy using texture statistical features with the combination of GLDM and common statistical features of OCT images.

**Ethical Clearance:** None

**Source of Funding:** None

**Conflict of Interest:** None

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