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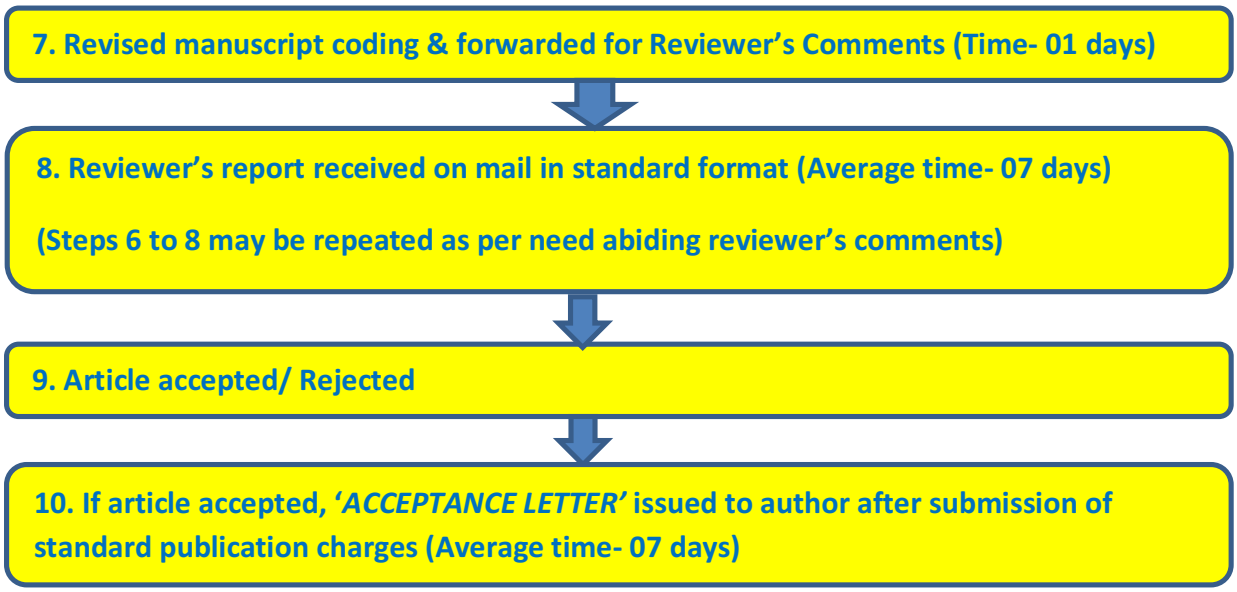


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*Editorial*

# Workplace-based Issues & Challenges in Formulating the Medical Boards Under the MTP Act 2021.

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## 1. Introduction

**Abortion** was being made legal in India under various circumstances with passing the Medical Termination of Pregnancy (MTP) Act, 1971.[1] To facilitate the implementation the rules were also issued under the concerned Act with time to time amendments which enable women for accessing safe and legal abortion services at authorised healthcare centres.

## 2. Abortion law in India (Fig. 1):

Before 1971, the Indian Penal Code, 1860, section 312 provided for criminal liability related to abortion. Abortion except which was carried out for saving the life of mother i.e. intentionally 'causing miscarriage' was punishable offence. Around 1960, abortion was legal in certain countries which initiated a thought on need of legal framework on abortion in India due to the alarmingly increased number of unsafe abortions. In 1964, the government of India formed a committee under chairmanship of Shantilal Shah for giving suggestions to draft law on abortion in India whose recommendations were accepted in 1970 and the bill passed in 1971.[1,2]

In early 1990, ultrasound techniques were rampantly used to detect sex of fetus leading to increased female feticide (Sex selective abortion) in India.[3] The Pre-Natal Diagnostic Techniques (Regulation and Prevention of Misuse) Act, 1994 (PNDT) was enacted to ban the sex selective techniques after conception and to prevent the misuse of prenatal diagnostic technique for sex selective abortion. This was further amended in 2003 to The Pre-Conception and Pre-Natal Diagnostic Techniques (Prohibition Of Sex Selection) Act (PCPNDT Act) to facilitate and improve the regulation of the technology used in sex selection.

Later, to facilitate the better implementation of the MTP Act 1971 and to increase access for women especially in the private health sector, the act was amended in 2002. MTP Rules 2003 were provided to facilitate the same. But, there were multiple challenges faced by women to access the safe abortion facilities. Further, after Government's cognizance, experts group was formed to review the exiting provision to suggest further amendments. Later, MoHFW shared the Medical Termination of Pregnancy bill 2014 in public domain for suggestions. MTP Amendment bill 2020 was introduced by Government on 29th January 2020 which was passed by LOK Sabha on 17th March 2020 and passed in Rajya Sabha on 16th March 2021 as MTP Amendment Act 2021.[4] The MTP Rules 2021 were announced by the Government of India on 12th October 2021 which provided for the which provided for the formation of state

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level medical boards to evaluate the request for termination of a pregnancy longer than 24 weeks only in the cases of foetal anomalies.

**3. Constitution of State-level Medical Boards**

The amendments provides for constitution of Medical Boards in all the states and union territories for determining substantial foetal anomalies.[5] The Board will decide on the necessity of termination of pregnancy after 24 weeks. It is provide in the act under Section 3 (2B) that the length of the pregnancy shall not apply to the termination of pregnancy by the registered medical practitioner if such termination is necessitated as a result of diagnosed substantial foetal abnormalities by a Medical Board constituted under this act for the abovementioned purposes. The Act under Section 3(2C) mandates that every State Government or Union territory shall constitute a Board to be called a Medical Board to facilitate the purposes of this Act. They will have powers to exercise the necessary duties and functions as may be prescribed by rules made under this Act. Such notification should be declared in the Official Gazette.

The constitution of the board will be inclusive of a gynaecologist, radiologist/sonologist, paediatrician and other members as notified by the concerned government. Boards have power to co-opt specialists in the board and even ask for additional investigations, as required on case to case basis. Abiding the MTP Rules 2021, the medical board has authority to determine the request for medical termination of pregnancy after 24 weeks only if there is substantial foetal anomaly.[6]

**4. Functions of Medical Board**

The board need to examine the woman and her reports, if such request made for termination of pregnancy under section 3 (2B) of the MTP Amendment Act 2021. Within 3 days of such requests, board need to provide an opinion in Form D (as prescribed under the MTP Rules 2021) with regard to the termination of pregnancy or rejection of such request. Board need to ensure that the recommended termination procedure, as advised by the Medical Board, should be carried out within five days of the receipt of the request for termination of pregnancy under section 3 (B) with necessary safety precautions and appropriate counselling.[5,6]

**5. Workplace based issues and challenges**

- After the amendment act and the rules still the notification of official formation of such boards is awaiting.
- Aggrieved need to file writ petition in high court.
- Number of persons to be included as a board members are not defined.
- Shortage of specialist expert in certain states.
- Inadequacy of Healthcare availability, Infrastructure as well as specialists for reproductive services.
- Multiple invasive examinations violates fundamental rights of pregnant woman.
- Termination need to be done in higher centres only.
- Consideration of Special circumstances only i.e. those including substantial foetal anomaly only.
- For other cases, writ petition in high court is only option. Need of high level of legal awareness.
- Safe and affordable services and facilities at local level not available.
- Delay in abortions due to bureaucratic process and cost incurred to travel to the board leads to financial burden on the pregnant woman.

**6. Recommendations**

There is need of official notification on formulation of medical board as prescribed in the act. The government needs to ensure that all norms and standardised protocols in clinical practice to facilitate abortions are followed in health care institutions across the country. Along with that, the question of abortion needs to be decided on the basis of human rights, the principles of solid science, and in step with advancements in technology. There is need of appropriate flexibility in norms.

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*Original Research Article*

# Evaluation of Perceptions of Postgraduate Medical Residents About Effectiveness of Workshop on Medical Certificate of Cause of Death.

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**Key words**
Medical Certification of Cause of Death (MCCD), Error, Post-graduate medical residents, Workshop.

Abstract

A Medical Certificate of cause of death (MCCD) is an official document furnished by the medical practitioner where sequence of events, the time interval between the onset of the cause of death and death, and personal details of the deceased are primarily recorded. The format of medical certificate of the cause of death recommended by the World Health Organization (WHO) is being used worldwide to document the sequence of events leading to death. Medical Certificate of Cause of Death [MCCD] is a vital document to be filled by attending physician following International Classification of Disease [ICD]. There are several studies those have reported major and minor errors by physician while completing the MCCD and recommended need for proper training program. In this study, a workshop was conducted by Forensic Faculty to train postgraduate residents from the stream of medicine. After the workshops, postgraduate resident doctors' perceptions about different aspects of MCCD were evaluated. The study was also aimed to assess their knowledge and awareness about rules, regulations and format of MCCD. Subsequently, their anonymous responses were collected in a structured proforma and analysed.

## 1. Introduction

A cause of death certificate is an official document furnished by the medical practitioner where sequence of events, the time interval between the onset of the cause of death and death, and personal details of the deceased are primarily recorded. The importance of quality cause-of-death information has been emphasized extensively in the past.[1-4] The format of medical certificate of the cause of death recommended by the World Health Organization (WHO) is being used worldwide to document the sequence of events leading to death.[5] This form consists of the direct cause of death (immediate and antecedent causes of death) and other significant conditions contributing to death but not related to the direct cause of death. Medical Certificate of Cause of Death [MCCD] is a vital document to be filled by attending physician following International Classification of Disease [ICD].[6]

MCCD is used for several purposes like mortality statistics, disposal of the dead body, settlement of the deceased's estate, compensation, insurance and also useful for public health epidemiology.[7]

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These statistics are used for surveillance of infectious diseases, undertaking control measures and to understand the trend and changing mortality pattern. This aids in monitoring the effectiveness of immunization and other prevention programme.[8,9] Cause specific mortality rates are key indicators of the health trends in the population. They help in assessing the effectiveness of public health programme and provide feedback for future policy and implementation. They are essential for better health planning and management and deciding priorities of health and medical research programme.[10] Thus it is vital in the interests of the international health scenario that the data in the MCCD is complete and reliable.

In India, the registration of each birth and death is an important moral obligation on physicians. Medical Certificate of Cause of Death (Form number 4 for Institutional deaths and form number 4A for non-institutional deaths - Registration of Births and Death Act) is to be completed in the format as per ICD.[11] Health care providers, specially registered medical practitioner must be aware of guidelines, prevailing rules and format for MCCD as it is a legal proof of occurrence of death.

Any errors in the information reported in cause of death certificates may even result in the failure of prospective health policies. The major errors include missing underlying cause of death, competing potential underlying causes of death, and improper sequencing of the events. Minor errors include improper use of abbreviations, mentioning mode or mechanism of death, and ignoring time interval between onset of the cause of death and death. Such errors relate to the poor quality of death certificates.[12-15]

Despite the development of guidelines on medical certification of the cause of death by the WHO, errors in death certificate documentation are not uncommon and are reported across the globe. This study highlights the importance of MCCD by imparting training to the post-graduate residents in the field of medicine so that they can be able to minimize errors while furnishing MCCD.

**2. Material and method**

The study was conducted at Pramukhswami Medical College and S.K. Hospital, Karamsad – a Rural based tertiary Health Care Centre in central part of Gujarat (India). Department of Forensic Medicine has conducted two workshops about various aspects of MCCD; one for third year postgraduate medical residents and another for second year postgraduate medical residents. These workshops were planned to upgrade the existing knowledge of the residents who are routinely involved in completion of MCCD. They were sensitized in this workshop on MCCD by explaining important aspects of issuing Death Certificates such as:

- A Death Certificate with cause of death must be issued only when the medical practitioner is completely satisfied with the cause of death.
- In case the Medical Practitioner is not satisfied with the cause of death, s/he must only certify the fact of death and inform the Police/ Magistrate.
- Death Certificate must be issued free of cost.
- Death Certificate must not be withheld for unbilled amount of hospitalization.
- Refusal to issue a legitimate Death Certificate is a punishable offence.
- Only single copy of a Death Certificate must be issued to the relatives of the deceased. If a second copy is issued, then the copy must be marked as DUPLICATE.
- A signed blank Death Certificate must never be issued.
- Death Certificate must be handed over to the nearest relative of the deceased after recording the thumb impression of the person receiving, his/her relationship with the deceased and signatures on the Doctor's Copy.
- A duplicate copy of every Death Certificate issued, must be with the doctor in his/her records.
- Death Certificate is essential even in case of a stillborn or premature newborn or normal newborn.
- The other requisites for issuance of Death Certificate are the same as for a Medical Certificate.

At the end of this workshop, their voluntary and anonymous responses were collected in a partially validated written feedback form. Maintenance of privacy and confidentiality was ensured.

**3. Results**

Total 61 medical residents submitted the responses as tabulated (Table 1).

**Table 1: Students' responses on attributes regarding MCCD workshop [n = 61].**

| Attributes | Number of responses on Likert Scale | | | | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | Total |
| The program met my expectations. | 0 | 0 | 9 | 31 | 21 | 61 |
| The information was presented at an appropriate learning level for this stage in my career. | 0 | 0 | 6 | 34 | 21 | 61 |
| I gained knowledge about how to fill Medical Certificate of Cause of Death. | 0 | 0 | 5 | 26 | 30 | 61 |
| The workshop help me in better understanding about what not to write in MCCD. | 0 | 0 | 3 | 35 | 23 | 61 |
| I learned concepts that will help me to differentiate mode of death with cause of death. | 0 | 3 | 4 | 30 | 24 | 61 |
| I gained knowledge regarding the approach for cause of death in Medico-legal cases. | 0 | 1 | 4 | 32 | 24 | 61 |
| I now understand the importance of timely filling of Medical Certificate of Cause of Death. | 0 | 2 | 3 | 28 | 28 | 61 |
| Hand-on activities help me in better understanding and clarifying the concepts of MCCD. | 1 | 0 | 10 | 32 | 18 | 61 |
| The workshop build my confidence to fill Medical Certificate of Cause of Death as per ICD. | 0 | 1 | 10 | 29 | 21 | 61 |
| I get adequate time for discussion. | 0 | 2 | 12 | 27 | 19 | 60 |
| I would recommend this program to colleagues. | 0 | 1 | 4 | 28 | 28 | 61 |

## 4. Discussion

Since 2003, medical certification of death was made compulsory for public and private hospitals in Delhi (India).[16] It was remarkable that over 62% of the death records in Delhi (between 2004 and 2013) included cause of death.[17]

In a study from Iran the researchers analyzed a total of 236 death certificates and identified specific types of major error in 110 (47%) cases.[18] The minor errors were identified in 168 (71%) which included repetitive phrases in different lines, entry of modes of death etc. Similarly in Palestine, Qaddumi et al. noted that two-third of the death certificates (out of 547) had at least one major error.[19] Common major errors among those were absence of the underlying cause of death and incorrect sequence of causes of death, followed by no acceptable cause of death, and mention of competing causes of death.[19] Whereas, they noted common minor errors such as absence of the time interval between the onset of the cause of death and death; use of abbreviations and symbols, followed by mention of irrelevant information, and illegible writing.[19]

A study from Beirut reported that 58% of the death certificates did not mention a cause of death and the certificates were not signed by medical practitioners in 51% cases.[20] These studies from the middle-eat countries spotted improper use of abbreviations and symbols and non-conveyance of a cause of death.[19,20,21] These studies suggested the need of structured training program and workshop to address common lacunas and also a training for physician about procedure for furnishing details in MCCD.

Another study from India evaluated that 93% of the death certificates were having some kind of errors.[22] It also showed a statistically significant association between work experience and completeness of the certificate.[11] Major errors such as inappropriately conveyed underlying cause of death and inaccurate cause of death such as no or multiple irrelevant causes, irregular sequence, etc. were reported in Australia.[22]

In our study, almost 50% of the medical residents perceived that they gained knowledge about proper filling of the certificate. There was a significant clarity in their perception regarding their understanding about the common errors, approach and its importance while filling the death certificate. They considerably felt adequate time for discussion in the workshop. Here, the students perceived that a single workshop can bring significant improvement in filling of Medical Certification of Cause of Death. It has already been established that a multifaceted

educational intervention training of junior medical residents on appropriate completion of a death certificate was effective in a residency-based pediatric program.[23] To achieve maximum understanding and clarity among medical postgraduates, many such workshops should be conducted on quarterly or yearly basis.

**5. Study limitations**

Our study has several important limitations; the sample size was small and limited to a unit in a tertiary care center; henceforth, a study with a large sample size testing this intervention in other settings might affect the obtained results; although, this might also introduce variability in the nature of the delivered intervention. The study design limits our capability of testing individual participant's performance and the factor(s) that influence performance. Future evaluation of this intervention is recommended to examine whether any factor(s) influence positive change.

**6. Conclusion**

Inappropriateness in the medical certification of the cause of death compromises the formulation of effective public health policies and proper identification of the disease trends, continuous education would be imparted to the medical practitioners in this regard. Medical practitioners even at the end of their undergraduate medical course are possessing a considerable scope of improvement in filling death certificates. The cause of death certification is already included in undergraduate medical curriculum; however, its teaching and learning has not been appropriately weighed. Efforts are recommended to arrange workshops on various issues on the cause of death certificate. Such trainings are perceived timely and valuable for medical residents.

**Ethical approval**

The study was conducted after obtaining approval from the Institutional Ethics Committee at H M Patel Centre for Medical Care and Education.

**Conflict of interest**

We wish to confirm that there are no known conflicts of interest associated with this publication and there has been no significant financial support for this work that could have influenced its outcome. This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors. We confirm that the manuscript has been read and approved by all named authors and that there are no other persons who satisfied the criteria for authorship but are not listed. We further confirm that the order of authors listed in the manuscript has been approved by all of us.

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*Original Research Article*

# A Cross Sectional Study on Perception of Medical Students on Online Medical Teaching in Present Scenario of COVID 19 in a Tertiary Care Medical Institute.

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**Key words**
Medical Undergraduates, Online teaching, COVID-19.

Abstract

**Introduction:** The present pandemic caused by COVID 19 has affected the world as a whole and social distancing became a part of our lives. Medical education like any other form of education was affected and online classes came to the rescue. **Methods:** This study was conducted with the rationale to find out how effective are online classes and what measures can be taken to further to simulate online classes as near as possible to physical classes. Google forms were given to undergraduate medical students. 183 students participated in this study. Likert's scale was used to grade the scores from strongly agree to strongly disagree. **Results:** The observations revealed that only 2.73% students strongly agreed being comfortable with online classes and 6.55% participants strongly agreed that their internet connectivity was good. 1.64% strongly agreed and that they were able to follow the class and 14.98% strongly disagreed that there were no distracting agent. 16.94% strongly agreed that they are accustomed with the smart devices being used. About 25.13% disagreed that voice quality was good. Majority strongly agreed that recorded videos and hard copies of the class material would be helpful. On being asked if online classes are as good as the physical classes for theoretical knowledge and practical knowledge, most of them disagreed. **Conclusion:** Online classes is the important resource in hand for continuing medical teaching during pandemics, there is need to take more efforts for making it student-friendly by incorporating audio, video and texts which are interesting for the students. Technological support should be provided by institution and appropriate Faculty training is needed.

## 1. Introduction

Since the inception of COVID 19, education system of the world has been affected. Social distancing has restricted upon students and teachers attending educational institutions.

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Hence, studies are affected and courses are delayed. Exams in many places are postponed and even e-mark sheets were provided based on previous scores. Medical education has also seen upheavals in this respect. To cope up with this hurdle online training and assessment has become the need of the hour. Through video conferencing classes are being conducted. But digitalization has its own pros and cons. Due to poor internet connections and unavailability of smart devices online teaching may also be hindered. Different video conferencing applications have their own time limits and are not user friendly, hence online classes have become challenging. Practical classes and Clinical postings, which are the integral parts of medical education, cannot be properly taught through online teaching mode. People have to be technology savvy to understand the functioning of such devices. Online training has been started at every medical college since a couple of months. It has been received well by the students as well as teachers but different lacuna is persisting and the trainers and the trainees are facing them every day.

Many researchers have studied about online teaching methodology and its evident boon in the current scenario. An article published in International Journal of Applied and Basic Medical Research states about the history of online teaching "Actual online learning began as intranet in 1960, wherever coupled computer terminals were accustomed to give educational material to students. With the appearance of web in 1994, digital acquirement unfolded its wings in teachers, paving means for formal, commissioned on-line courses and modules. Easy availability of mobiles, internet services, web, and social media provided opportunities to learners for personalized learning experience.[1] Online learning has advantages of transcending Online teaching has the potential to transcend geographical boundaries, is flexible, learner centered and can help students develop self-directed learning skills. One article published in JAMA focuses on how COVID-19 is changing medical education. The authors quoted "The requirement to prepare medical professionals of the future has never been as essential and determined as it is now, in the current context of this COVID-19 Pandemic, which has become an emergency worldwide. The profound effects of COVID-19 may forever change how future physicians are educated."[2] The authors also felt the need of standardized examination protocol when exam centers are closed. Association of American Medical colleges has released important guidelines for clinical postings during COVID-19.[3] One study conducted at Ghana has found out that eight groups of issues during online classes that emerged were social issues, lecturer issues, accessibility issues, learner motivation, academic issues, generic issues, learner intentions, and demographics.[4]

Another study conducted at Bangladesh has focused more on internet accessibility in rural parts. Similarly, in India too after the closures of educational institutes, majority of the students have gone back to their home, which might be in the peripheries, where accessing internet may be difficult at times.[5] With the advent of online classes, medical students in India also coped up with the trend. However, several issues were faced by them during the classes. This study was conducted amongst medical undergraduates in a tertiary medical institute in Northeastern part of India with the motive of finding out if online classes are at par with physical classes and to suggest remedial measures if required.

## 2. Methods

This was a cross sectional study done at a tertiary care medical institute. Undergraduate medical students, who gave consent for this study, were taken as study subjects. The study period was for a period of two months during the first wave of COVID in 2020. Google forms were provided to the undergraduate medical students through their email ids. Age, Gender, Year of MBBS, whether they stayed at home or in the In the Google form, the questionnaire was preceded by the consent form and once the participant agree to participate, then only he or she could proceed to the questionnaire part consisting 13 questions. Likert's scale for rating the answers were used for rating from one to five [for example – Strongly agree, Agree, Neutral, Disagree, Strongly disagree]. The responses were entered in Microsoft Excel 2007 and analyzed accordingly. The data were expressed in frequencies and percentages. Chi-square test was used to compare between different categorical variables.

## 3. Results

183 medical undergraduate students participated in this study. Out of them 95 (51.92%) of the participants were males and 88 (48.08%) of the participants were females. The Mean age of the

participants was 21.19 years ranging from 18 years to 26 years, as shown in **Table no. 1**.

According to their year of M.B.B.S, the distribution of participants is as follows- 23.49% were in 1st year, 22.96% were in 2nd year, 28.96% were in 3rd professional part-I and 24.59% were in 3rd professional part-II. During the study period, 31.15% of the participants attended their online classes from their home and 68.85% of the students attended their classes from their respective hostels in the Institute campus. The responses to the questions were noted and it was found out that only 5 students (2.73%) strongly agreed that they were comfortable with online classes, followed by 48 students (26.23%) agreeing to it. 12 participants (6.55 %) strongly agreed

**Table no. 1: Age wise frequency distribution**

| Age in years | Frequency | Percentage (%) |
|---|---|---|
| **18** | 1 | 0.55 |
| **19** | 10 | 5.46 |
| **20** | 27 | 14.75 |
| **21** | 32 | 17.48 |
| **22** | 50 | 27.32 |
| **23** | 34 | 18.57 |
| **24** | 19 | 10.38 |
| **25** | 8 | 4.37 |
| **26** | 2 | 1.09 |

**Table no 2: Frequency and percentages of the participants according to their age.**

| Sr. No. | QUESTIONS | STRONGLY AGREE | AGREE | NEUTRAL | DISAGREE | STRONGLY DISAGREE |
|---|---|---|---|---|---|---|
| **1** | I am comfortable with online classes | 5 (2.73%) | 48 (26.23%) | 27 (14.75%) | 54 (29.50%) | 49 (26.77%) |
| **2** | My internet connectivity is good | 12 (6.55%) | 48 (26.23%) | 17 (9.29%) | 62 (33.88%) | 44 (24.04%) |
| **3** | I can follow the class from start to end | 3 (1.64%) | 34 (18.58%) | 28 (15.30%) | 72 (39.34%) | 46 (25.13%) |
| **4** | There is no distracting agent during the class | 6 (3.28%) | 33 (18.03%) | 21 (11.47%) | 75 (14.98%) | 48 (26.23%) |
| **5** | I am accustomed with the smart devices I am using for the class | 31 (16.94%) | 106 (57.92%) | 28 (15.30%) | 14 (7.65%) | 4 (2.18%) |
| **6** | I am aware of all the features of software used | 30 (16.39%) | 96 (52.46%) | 29 (15.84%) | 26 (14.20%) | 2 (1.09%) |
| **7** | The speed of the presentation is comprehensible | 9 (4.91%) | 81 (44.26%) | 55 (30.05%) | 32 (17.48%) | 6 (3.27%) |
| **8** | The voice quality of the presentation is good | 3 (1.64%) | 37 (20.22%) | 83 (45.35%) | 46 (25.13%) | 14 (7.65%) |
| **9** | The content of the presentation is adequate | 5 (2.73%) | 61 (33.33%) | 54 (29.50%) | 46 (25.13%) | 17 (9.29%) |
| **10** | Recorded videos of classes will be helpful | 59 (32.24%) | 80 (43.71%) | 20 (10.93%) | 13 (7.10%) | 11 (6.01%) |
| **11** | Hardcopy of class materials should be provided | 64 (34.97%) | 95 (51.91%) | 17 (9.29%) | 6 (3.28%) | 1 (0.54%) |
| **12** | Online classes are as good as the Physical classes for theoretical knowledge | 10 (5.46%) | 26 (14.20%) | 25 (13.66%) | 57 (31.14%) | 65 (35.52%) |
| **13** | Online classes are as good as the Physical classes for practical knowledge | 1 (0.54%) | 6 (3.28%) | 16 (8.74%) | 59 (32.24%) | 101 (55.19%) |

that their internet connectivity was good, followed by 48 (26.23%) agreeing to it. Only 3 (1.64%) strongly agreed and 34 (18.58%) agreed that they can follow the class from start to end. About distracting agent, 75 (14.98%) strongly disagreed, 48 (26.23%) disagreed that there were no distracting agent. The rest felt distracted by homely affairs or sounds from outside. Most of them (n=31, 16.94%) and (n=106, 57.92%) strongly agreed and agreed respectively that they are accustomed with the smart devices they are using for the class. About awareness of all the features of software used, majority (n=30, 16.39%) and (n=96, 52.46%) strongly agreed and agreed respectively. Responses to comprehensibility to speed of the presentation stated the majority (n=9, 4.91%) and (n=81, 44.26%) strongly agreed and agreed that it was

comprehensible. Out of the participants, many disagreed (n=46, 25.13%) and strongly disagreed (n=14, 7.65%) that the voice quality of the presentation was good. There were nearly equal responses strongly agreed (n=5, 2.73%), agreed (n=61, 33.33%), disagreed (n=46, 25.13%) and strongly disagreed (n=17, 9.29%) when being asked if the content of the presentation was adequate. Majority strongly agreed (n=59, 32.24%) and agreed (n=80, 43.71%) that recorded videos of classes would be helpful. Most of them strongly agreed (n=64, 34.97%) and agreed (n= 95, 51.91%) that hardcopy of class materials should be provided. On being asked if online classes are as good as the physical classes for theoretical knowledge, most of them disagreed (n=57, 31.14%) and strongly disagreed (n=65, 35.52%). Similarly, when asked if online classes are as good as the physical classes for practical knowledge, most of them disagreed (n=59, 32.24%) and strongly disagreed (n=101, 55.19%). (**Table no 2**)

**4. Discussion and Conclusions**

Before the vaccines for this disease become full-fledged, social distancing is the only way to keep the spread of this contagion at bay. Because of this social distancing, national policy makers of various countries have initiated implementation of nation-wide partial to complete lock-down. This has inadvertently affected the education system since educational institutes were closed. Medical education alike other streams of education too suffered at the hands of the present pandemic. However, this pandemic has shown us a surge in the need of front line workers and doctors as foremost. However, medical education must go on despite the threat of diseases since health professionals are to be made to combat the present pandemic and any future pandemics to come. Perseverance of the medical students have been showcased in the current pandemic when this extraordinary time called for less physical classes and more online classes. Some researchers focus more on the teachers' challenges faced since, teaching staff of all backgrounds and ages have had to prepare and deliver their classes from home, with all the practical and technical challenges this entails, and often without proper technical support.[6] Also, it has been seen that attention at the computer screens are poorer compared to the old modality.

The Covid-19 crisis has brought forth an excessiveness of recommendation geared toward academicians. A lot of this recommendation focuses on tools and materials that academicians will use to switch from their Physical classes.[7] This requires the knowledge principally associated with coming up with and organizing for higher learning experiences and making distinctive learning environments, with the assistance of digital technologies. Some authors pointed out about cheating threats which might be a hindrance to online examinations and how to minimize them.[8] Also, the privacy issues related to different video conferencing apps have created hesitation amongst the minds of the users.[9]

In our study we have found out that online learning, though, is the only modality in times of crisis like the present pandemic, yet it has many shortcomings which must be addressed if we are to be prepared for natural calamities. Participants disagreeing that they were comfortable with online classes were more in number to those agreeing to the matter. This highlights our inertia as a learner of newer modalities and technologies and since for ages we have been taught the physical way of classes and as direct human to human interactions are being reduced through e-learning, it would take a certain period of time for the learners to find e-learning modality pleasant and congenial. Majority agreed to the fact that they were accustomed with the devices, software and applications. Students mostly used their mobile phones as compared to their laptops as they found it to be easily portable and could carry on with their learning hours from anywhere. Majority were not satisfied with the speed, voice quality and content of the presentation. For these issues, training of the educators is essential as how to modulate their voices, which part to emphasis on, etc. Speed of their delivery should be maintained so that each word is comprehensible by the students. Institutes can buy business packs of video-conferencing apps which can go beyond stipulated time of free packages so that the educators do not have to rush to complete their topics of presentation. Majority agreed that class materials and pre-recorded videos would be helpful. This can also resolve issues like poor quality of voice during presentation or network issues. Through pre-recorded video lectures, testing the content of the presentation previously and by handing over the class materials, many technical issues can be resolved. These courses should be made interactive and interesting so as to grasp the attention of the learners as many students felt they were being distracted.

Through different groups or forums on the social media or texting, communication can be made and students can reach out to the teachers with queries if time limit of online classes has been exceeded.[10]

Creative forms of the classes should be made so that the interest of the students is not lost. Group based tasks may be given so that the pupils communicate with each other like projects and case studies.[11] Though it is evident from this study and many other studies done earlier that online learning is not satisfactory in terms of theoretical and practical knowledge, however use of simulators and procedural videos can be incorporated in the curriculum, which may prove to be useful. Although vaccines have been on the run and frontline COVID warriors have received it and will go the masses soon, still we must be prepared for any drift from the scenario and must develop our e-learning for future pandemics and or disasters.

Online classes are becoming part of the modern teaching system, so it is to be decided how to make it more attractive and student as well as teacher friendly. Moreover, in all such type of teaching and learning tools, there remains one issue of the technology, one have to be careful while choosing the appropriate tool for the same. During the study, it has been observed that the slow internet connection was one of the major snags in the online teaching method, and the students have rightly pointed out the same. In India, we are yet to have the proper internet connections up to the remote areas, and so for the persons in the remote areas, it is still not easy to access the online classes. Therefore, better connectivity is utmost essential for any such exercise.

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*Original Research Article*

# Virginity Test- Do We Really Need It? A Cross Sectional Study.

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**Key words**
Virginity,
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Sexual Intercourse.

Abstract

**Introduction** Virginity testing or per vaginal examination, is the inspection or the examination of the female genitalia to assess whether a woman or girl has experienced sexual intercourse. **Methods:** This was descriptive cross-sectional study conducted on registered medical practitioners (RMP) of Ahmednagar district of Maharashtra. A pilot study was carried out for validation, practicality, and applicability of questionnaire. In present study 74 registered medical practitioners (RMP) of Ahmednagar city of Maharashtra participated. Out of all RMP's 62.2% (46) and 37.8% (28) were post graduates (MD/MS/Diploma/ DNB) and undergraduates (MBBS) respectively. **Results:** Out of 74 respondent 54.1% (40) were aware and 45.9% (34) not aware of the name of scientific medical test use to confirm virginity. Out of those who were aware, 80% (32) of them reported that it called 'two finger test' while remaining reported test only as finger test or per vaginal (PV) examination. **Conclusion:** The present study concluded that even though it is now scientifically proven that virginity testing has inconclusive nature and its harmful effects on women, many physicians were still unaware of this fact.

## 1. Introduction

Virginity; there is no universal definition, its meaning transmogrifies as era, region, culture and religion. Virginity testing or per vaginal examination, is the inspection or the examination of the female genitalia to assess whether a woman or girl has experienced sexual intercourse.[1]

It is generally believed that the hymen is the membrane that covers the opening of the vagina. The existence of a membrane founds many cultural understandings of the hymen, as it is often believed that a hymen breaks or tears upon virginity loss.[2] It is clear that the hymen plays a stronger symbolic role than a factual role in virginity examination. Virginity testing is mainly performed on unmarried women without getting their consent or in settings where they are unable to give consent.[3] Virginity testing being performed to ascertain the character of girl, her eligibility for wedding and also as a part of the sexual assault examination or prostitution charge by the authorities.[4,5] It is unfortunate that the virginity testing not always done by doctor, even by the police personnel or a community or religious leader.[1,4]

Virginity testing bring additional suffering to rape victim by revisiting the experience and trauma. Many women experience unpleasant short-term and long-term physical, psychological and social consequences of this practice, some taking extreme steps to commit suicide and some unfortunate; in the

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name of honor killing, are killed by their own family members.[4,6]

Virginity testing exists on the basis of belief rather than facts therefore, it is unethical for virginity tests, which are entrenched in religious values and cultural ideology rather than standards of evidence, to be performed as a medical practice.[2] Due to lack of any scientific logic and interference in the fundamental rights of women, In India an appeal has been made to remove 'virginity test' from medical textbooks.[4] To put an end to this practice, there is an urgent need to raise awareness among the doctors and the society as high prejudices present even among medical professionals. With this background present study was conducted among registered medical practitioners (RMP) to ascertain their understanding and opinions on virginity test.

**2. Material and Methods**

The present study was commenced after obtaining institutional ethical committees' (IEC) permission. This was descriptive cross-sectional study conducted on registered medical practitioners (RMP) of Ahmednagar district of Maharashtra. The allopathic practitioners who were practicing for three years or more and having minimum 01 year of experience in public health hospitals were eligible to participate in this study. Help from local Indian Medical Association (IMA) and other professional bodies was sought to reach all participants for maximize participation. AYUSH practitioners, visiting consultants and those who were not willing for participation were excluded from study. Purposive sampling method was used to select participants.

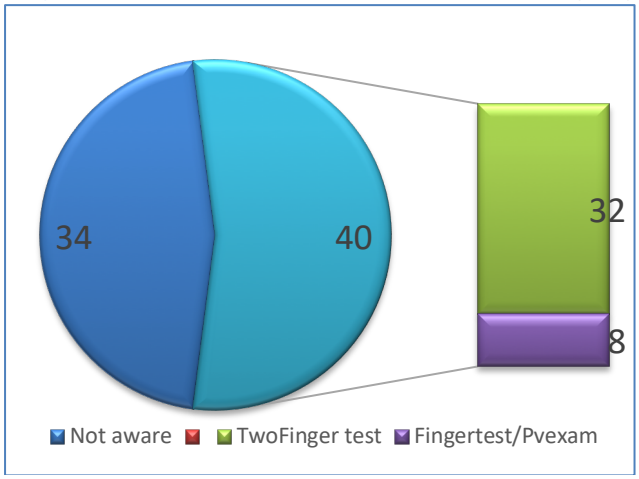
A pilot study was carried out for validation, practicality, and applicability of questionnaire. Through what's App group of different professional bodies appeal was made to RMP to participate in present study. These messages were content brief on problem statement, rational behind conducting study, objectives and consent of study. All participants were assured that the collected information will remain completely anonymous and no name or email id would require to fill the questioners. Those who consented are requested to join temporary what's app group which was created specifically for the study purpose. They can ask any questions/doubts regarding study on group and instructions pertaining to study were also shared on same group. Pilot tested questioner was created in google form and link was circulated on predetermined day and time for the participants. All participants informed the time limit after which link will be automatically deactivated. After dead line time spent and effort of participants were acknowledged and assured that the results of the study will be shared with them through their professional bodies. All participants were requested to exit and group was dissolved permanently. Descriptive statistics like frequency, percentages and pie chart and bar diagram was used to present data.

**3. Observation and Results**

In present study 74 registered medical practitioners (RMP) of Ahmednagar city of Maharashtra participated. Out of all RMP's 62.2% (46) and 37.8% (28) were post graduates (MD/MS/Diploma/DNB) and undergraduates (MBBS) respectively.

Out of 74 respondent 54.1% (40) were aware and 45.9% (34) not aware of the name of scientific medical test use to confirm virginity. Out of those who were aware, 80% (32) of them reported that it called 'two finger test' while remaining reported test only as finger test or per vaginal (PV) examination (**Graph 01**).

**Graph 01: Awareness of medical test to confirm virginity**



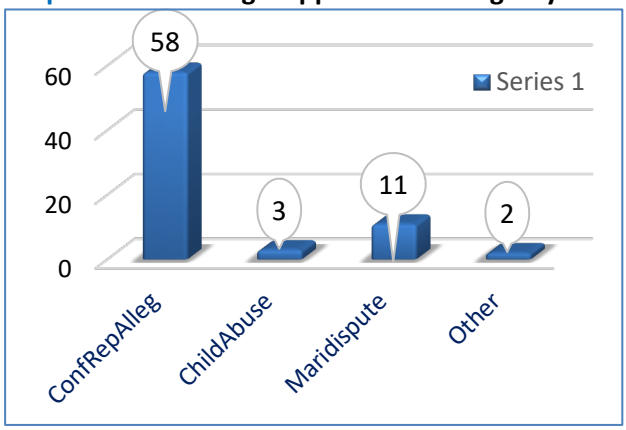

Out of all participants 74.3% does not considered intact hymen as a sign of virginity while 25.7% (19) considered otherwise. Bleeding (82%) per vagina was reported as the most common sign of broken hymen by practitioners followed by pain, and discomfort.

Majority practitioners (77%) were not aware of the various alternate ways that could be used to confirm the virginity. Only some (23%) of them reported breast examination, vaginal laxity by PV examination, DNA testing, and laboratory (mucosal, fructose) examination as alternatives to confirm

virginity. Out of all 75% of practitioners believed that laboratory tests and clinical would not be that helpful to confirm virginity.

Conventional medicolegal application of virginity test as per participants shown in **graph 02**. Majority of them opine that currently aforementioned test is being used to confirm rape allegation, child abuse, marital/parental dispute etc.

**Graph 02: Medicolegal application of virginity test**




About 81% responded that it is usual to bleed after losing virginity. Significant proportion (80%) of RMP were in favor of banning of test to confirm virginity. The commonest reasons given by practitioners to ban virginity test were discrimination women's social status (30%), could be other reasons (30%) to break hymen except loosing virginity like playing sports, use to tampons etc.

**4. Discussion**

The present study was conducted with the aim of documenting views on important but less discussed and research topic. Practitioners of modern medicine were participants of this study. In present study as compared to undergraduate many post-graduates participated. Even though nearly half of the participants who had been practicing for many years were unaware of the name of the test commonly used to determine virginity and the practitioners who knew about it named this test as two finger tests. Many articles have now documented that there are many other causes of ruptured hymen, although about a quarter of physicians believed that an intact hymen was a sign of virginity. Bleeding per vagina reported as most common sign of broken hymen by the participants. Most physicians were unaware of the various other options that can be used for virginity testing. Many practitioners reported that currently virginity test usual used in rape allegation. Less than a quarter of physicians believe in continuing to use the test to confirm virginity. Even after extensive research we have not found similar study to discuss the findings which confirm the lack of study on the said topic.

**5. Conclusion:**

The present study concluded that even though it is now scientifically proven that virginity testing has inconclusive nature and its harmful effects on women, many physicians were still unaware of this fact.

**6. Recommendation**

Health educators should update medical textbooks to reflect the obsolete nature of virginity testing. Similar detailed research is needed to dispel myths and misconceptions about intact hymen.

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**Ethical Clearance:** Yes.

**Conflict of interest:** None.

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*Original Research Article*

# Study of Feedback of Survivors of Sexual Offences Subjected For Medicolegal Examination in Tertiary Care Municipal Hospital.

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**Key words**
Feedback,
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Abstract

**Introduction:** Feedback of the survivors and accused of sexual offences can be in varying degrees of satisfaction. Satisfaction is a psychological notion and patient contentment relies upon many factors such as: Quality of clinical services available, medicine stock, sanitation, conduct of doctors and other health staff, expenditure of the services, hospital infrastructure, physical comfort, emotional support, and respect for patient preferences. **Methodology**: Observational study, cross-sectional in design has been performed on survivors of sexual offences brought for medico legal examination along with accused and police personnel in a tertiary care hospital in Mumbai, Maharashtra for the period of four months. Total number of the subjects included in the study were 40 survivors of the sexual assault, 30 accused of sexual assault and 70 police personnel accompanying the survivors and accused of sexual offences. Semi-structured questionnaire has been used for obtaining feedback of all subjects, consisting of three parts. **Results & discussion**: Mean satisfaction levels were maximum with time given by doctors and doctor's attitude. While least satisfaction levels were with the other staff behaviour, amenities, cleanliness in surroundings and accessory services. **Conclusion**: Survivors and accused of sexual assault were satisfied from majority of the services provided during the medicolegal examination.

## 1. Introduction

### 1.1. Background

Feedback of the survivors and accused of sexual offences can be in varying degrees of satisfaction. Patient satisfaction is accomplishment of expectations of a person from a service or product.[1] Satisfaction is a psychological notion and patient contentment relies upon many factors such as: Quality of clinical services available, medicine stock, sanitation, conduct of doctors and other health staff, expenditure of the services, hospital infrastructure, physical comfort, emotional support, and respect for patient preferences. [2]

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Rape is the fourth most common crime against women of India. India has been characterized as one of the "countries with the lowest per capita rates of rape". A large number of rapes go unreported in various countries including India. According to NCRB 2015 statistics, Madhya Pradesh has the highest raw number of rape reports among Indian states while Jodhpur in Rajasthan has the highest per capita rate of rape reports in cities followed by Delhi, the capital city.[3] Survivors and accused of sexual offences are brought along with police for medico legal examination in hospital of public setup.

**1.2: Statement of problem:**

- Being a public sector hospital managed by Municipal Corporation of greater Mumbai, there is huge overload of the patients as the treatment, investigations and medicines are being provided at very subsidized rates.
- Also, this hospital is tertiary care hospital where very advanced specialities and super specialities are available, this further increase the patient load not only from Mumbai but also from different parts of Maharashtra and even from different parts of India.
- This has resulted in increased crowding at all places starting from registration department to the doctor's consultation room as well as investigation's places and billing places.
- As the doctors have to examine the large number of patients, the time spent by the doctor with the patient is usually less.

**1.3: Rationale of the study**

Females who have experienced sexual offences has not only impact physically but also socially and psychologically. Survivors of sexual assault are usually in terror and highly apprehensive. They are always in dejected mood compared to others. Post-traumatic stress disorder was developed in survivors of rape at some point of their lives in 31 % of cases as per the report of the National Victim Centre and the Crime Victim's Research and Treatment Centre.[4] Subsequently survivors of sexual assault have to face various judicial procedures and medico legal examination in the hospital. Secrecy of the survivors can be vanished in the courtroom due to questions asked by the lawyers and ever character assassination can be done. Inappropriate behavior by the individuals of the various institutions in which the survivor is subjected can result in re-traumatization of the sexual assault. Types of secondary victimization consist of victim blaming and improper behavior or language by medical personnel or other staff with which the victim has to come across. It is more common in drug-induced, rape by known persons and statutory rape.[5]

Being public setup hospital, there is hefty patient load, most commonly from lower socio-economic status. Enormous crowd management in public hospitals is the biggest challenge for health care providers. There is ample amount of studies on patient satisfaction in various fields, but very few studies are found on satisfaction of survivor and accused of sexual offences along with police personnel accompanying them during medico-legal examination in public hospital. There is yet less literature about survivors' experiences of and satisfaction with comprehensive nursing-led hospital-based sexual assault. [6] There is very high connection between quality care, patient's satisfaction levels, patient's compliance, and success of treatment as per recent studies.[7] Therefore, studies on patient's contentment can play pivotal role in augmenting the quality of the health services. [8] Therefore, the present study will be conducted to ascertain satisfaction level of survivor and accused of sexual offences along with police personnel accompanying them during medico-legal examination in public hospital.

**1.4: Objectives of the study were:**

- To ascertain the feedback of survivors of sexual offences brought for medico legal examination in tertiary care municipal hospital for services provided.
- To evaluate the feedback of accused and police personnel accompanying survivors and accused of sexual offences brought for medico legal examination in tertiary care municipal hospital for services provided.

**2. Methodology**

The present study is observational study, cross-sectional in design has been performed on survivors of sexual offences brought for medico legal examination along with accused and police personnel in a tertiary care hospital based on questionnaire on pilot basis. The study was conducted for the duration of four months. Survivors of sexual offences comprise of all females and males below 18 years under POCSO act brought for medicolegal examination. The present study consists of the subjects accepting to participate in the study. Total number of the subjects included in the study were 40 survivors of the sexual assault, 30

accused of sexual assault and 70 police personnel accompanying the survivors and accused of sexual offences.

**Exclusion criteria:** Unwilling subjects, follow up subjects, deaf and dumb subjects, seriously ill subjects and subjects working in the same hospital.

Informed consent has been taken from all subjects. Semi-structured questionnaire has been used for obtaining feedback of all subjects**,** consisting of three parts.

The first part contains questions to collect the patient's demographic details and questions related to different domains of patient care. The second part have questions to measure the service quality on the basis of five dimensions: consistency, substantial, sensitivity, assurance and compassion. And the third part comprise of determining the various areas and reasons for subject discontent. Semi structured questionnaire has been validated from subject experts. Few questions have been customized after pre-testing and has been validated by subject experts.[9] In cases where the age of the subjects is below 10 years, the feedback has been taken from the parents or guardian of the subjects.

Variables for the study were:

**Dependent Variables:**

- Feedback of survivors and accused of sexual assault and accompanying police personnel.

**Independent** variables

- Doctors (Behaviour, Knowledge and time given)
- Nurses (Behaviour, Knowledge and time given)
- Other hospital staff (Behaviour)
- Facilities like drinking water, toilets
- Other department services Like radiology
- Time for registration
- Waiting time
- Cleanliness in surroundings
- Place for history taking and examination
- Location of OBGY ward/other place for examination

**Analysis and Interpretation of the Data**

Feedback data obtained was gathered in Microsoft Excel sheet followed by cross verification for any mistakes. Finally, Analysis of data has been done by determining descriptive analysis, mean, standard Deviation, percentages and bar charts using the Microsoft excel.

## 3. Results

The present study was carried in labour ward and department of forensic medicine and toxicology at tertiary care hospital, Mumbai. Total 140 subjects were included in the study out of which the survivors of sexual assault were 40, accused of sexual assault were 30 and the police personnel accompanying the survivors and accused of sexual offences were 70. Out of total 40 survivors, 38 were females while 02 were males. All the accused were males.

**Table no 01: Age and sex wise distribution of the Survivors of sexual assault.**

| Age in years | Females n= 38 | Males n=2 |
|---|---|---|
| Less than 12 | 5 | 1 |
| 12 – 18 | 22 | 1 |
| 19-30 | 7 | 0 |
| 31-40 | 3 | 0 |
| More than 40 | 1 | 0 |

Referring to **Table 1,** Maximum numbers of cases (i.e.22) were between ages 12-18 years in females, while lowest numbers of cases (i.e. 1) were in age groups more than 40 years**.** In Males both the cases are below 18 years.

**Table no 02: Age wise distribution of the Accused of sexual assault.**

| Age in years | Males n=30 |
|---|---|
| Less than 18 | 1 |
| 18 – 30 | 19 |
| 31-40 | 7 |
| 41-60 | 1 |
| More than 60 | 2 |

Referring to **Table 2**, Maximum numbers of cases i.e. 19 were between ages 18-30 years while lowest numbers of cases i.e. 1 were in age groups less than 18 years and in age group 41-60 years**.** Among the survivors 04 were Muslims while 36 were Hindus. Similarly, in the accused, 08 were Muslims, 01 was Parsi while remaining 21 were Hindus. Majority of the survivors and the accused were from the lower socio-economic status. Out of 40 survivors, only three were married while rest 37 were unmarried. Within the accused, out of 30, 15 of them were married, one of them was divorced and 14 were unmarried.

Majority of the survivors were the students studying in school below 10$^{th}$ standard while most of the accused were school dropout and educated below 10th standard. More than half the cases were attended within 15 minutes of arrival of survivors as well as accused of sexual offences. Next highest being within 30 minutes in both accused and survivors. Least cases in survivors were in between 1 hr to 2 hrs with one case and no cases after 2 hours. Similarly, least in the cases of accused was between 31 minutes

to 1 hr with no cases while in the period more than 2 hours there was one case.

**Table 3: Feedback of survivors of sexual assault and accompanying police personnel.**

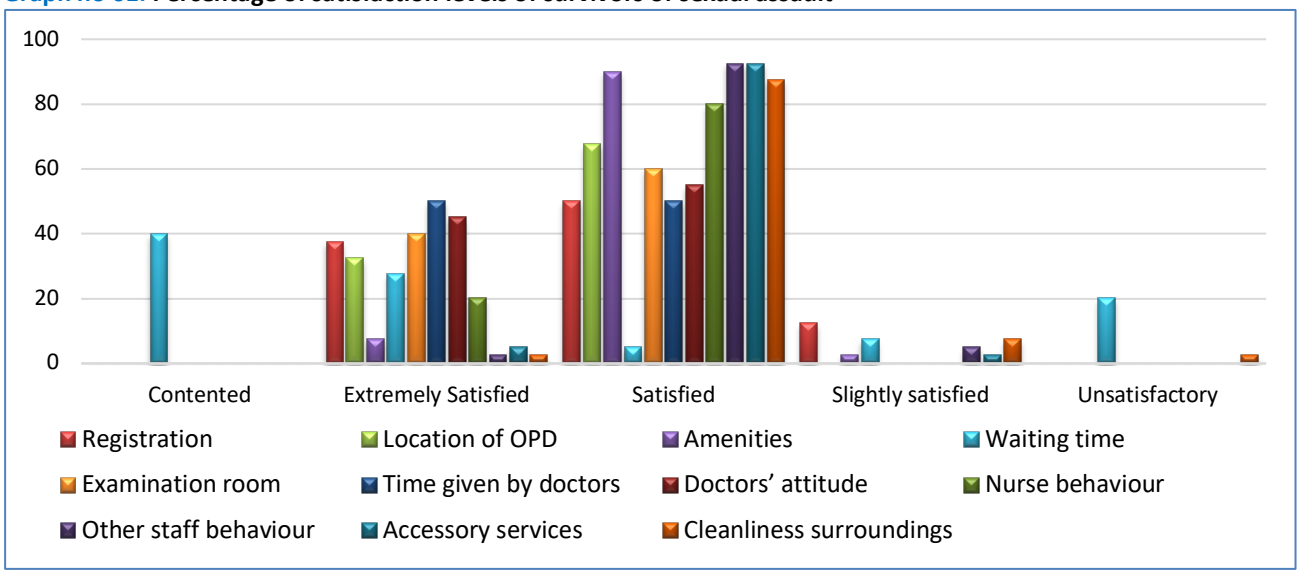
| Parameter | Survivors % Mean (SD) | Police % Mean (SD) |
|---|---|---|
| Registration | 77.87(10.61) | 76.75(10.35) |
| Location of OPD | 79.25(5.85) | 78.125(6.27) |
| Amenities | 75(5.5) | 73.875(6.04) |
| Waiting time | 80.125(19.43) | 77.375(18.67) |
| Examination room | 80.375(6.54) | 78(6.77) |
| Time given by doctors | 81.5(7) | 80.125(7.55) |
| Doctors' attitude | 81.5(5.57) | 79.25(6.46) |
| Nurse behaviour | 78.125(5.85) | 76(7.36) |
| Other staff behaviour | 73.125(5.74) | 71(6.91) |
| Accessory services like radiology, laboratory | 73.625(5.88) | 71.625(6.34) |
| Cleanliness surroundings | 73.875(7.38) | 71.75(7.21) |

Referring to Table 3, Mean satisfaction levels was maximum with time given by doctors and doctor's attitude while least was with the other staff behaviour and accessory services. Highest standard deviation was with waiting time and least with the amenities.

**Table 04: Percentage of satisfaction levels of survivors of sexual assault.**

| Parameter | >90% Contented | 81-90 % Extremely Satisfied | 61-80% Satisfied | 51-60% Slightly satisfied | 41-50% Unsatis-factory | 31-40% Poor | <31% Very Poor |
|---|---|---|---|---|---|---|---|
| Registration | 0 (00%) | 15(37.5%) | 20(50%) | 5(12.5%) | 0 (00%) | 0 (00%) | 0 (00%) |
| Location of OPD | 0 (00%) | 13(32.5%) | 27(67.5%) | 0 (00%) | 0 (00%) | 0 (00%) | 0 (00%) |
| Amenities | 0 (00%) | 3(7.5%) | 36(90%) | 1(2.5%) | 0 (00%) | 0 (00%) | 0 (00%) |
| Waiting time | 16(40%) | 11(27.5%) | 2(5%) | 3(7.5%) | 8(20%) | 0 (00%) | 0 (00%) |
| Examination room | 0 (00%) | 16(40%) | 24(60%) | 0 (00%) | 0 (00%) | 0 (00%) | 0 (00%) |
| Time given by doctors | 0 (00%) | 20(50%) | 20(50%) | 0 (00%) | 0 (00%) | 0 (00%) | 0 (00%) |
| Doctors' attitude | 0 (00%) | 18(45%) | 22(55%) | 0 (00%) | 0 (00%) | 0 (00%) | 0 (00%) |
| Nurse behaviour | 0 (00%) | 8(20%) | 32(80%) | 0 (00%) | 0 (00%) | 0 (00%) | 0 (00%) |
| Other staff behaviour | 0 (00%) | 1(2.5%) | 37(92.5%) | 2(5%) | 0 (00%) | 0 (00%) | 0 (00%) |
| Accessory services like radiology, laboratory | 0 (00%) | 2(5%) | 37(92.5%) | 1(2.5%) | 0 (00%) | 0 (00%) | 0 (00%) |
| Cleanliness surroundings | 0 (00%) | 1(2.5%) | 35(87.5%) | 3(7.5%) | 1(2.5%) | 0 (00%) | 0 (00%) |

**Graph no 01: Percentage of satisfaction levels of survivors of sexual assault**




Referring to Table 4, Majority of the Survivors were satisfied by all the parameters during medicolegal examination in the hospital. However, 40 % of the survivors were contented with prompt service while 20 % were unsatisfied with the service showing huge variation in the feedback. Also, the percentage of survivors with extremely satisfied feedback was low with amenities, other staff behaviour, accessory services and cleanliness in the surroundings (Graph 01).

**Table 5: Feedback of accused of sexual assault and accompanying police personnel.**

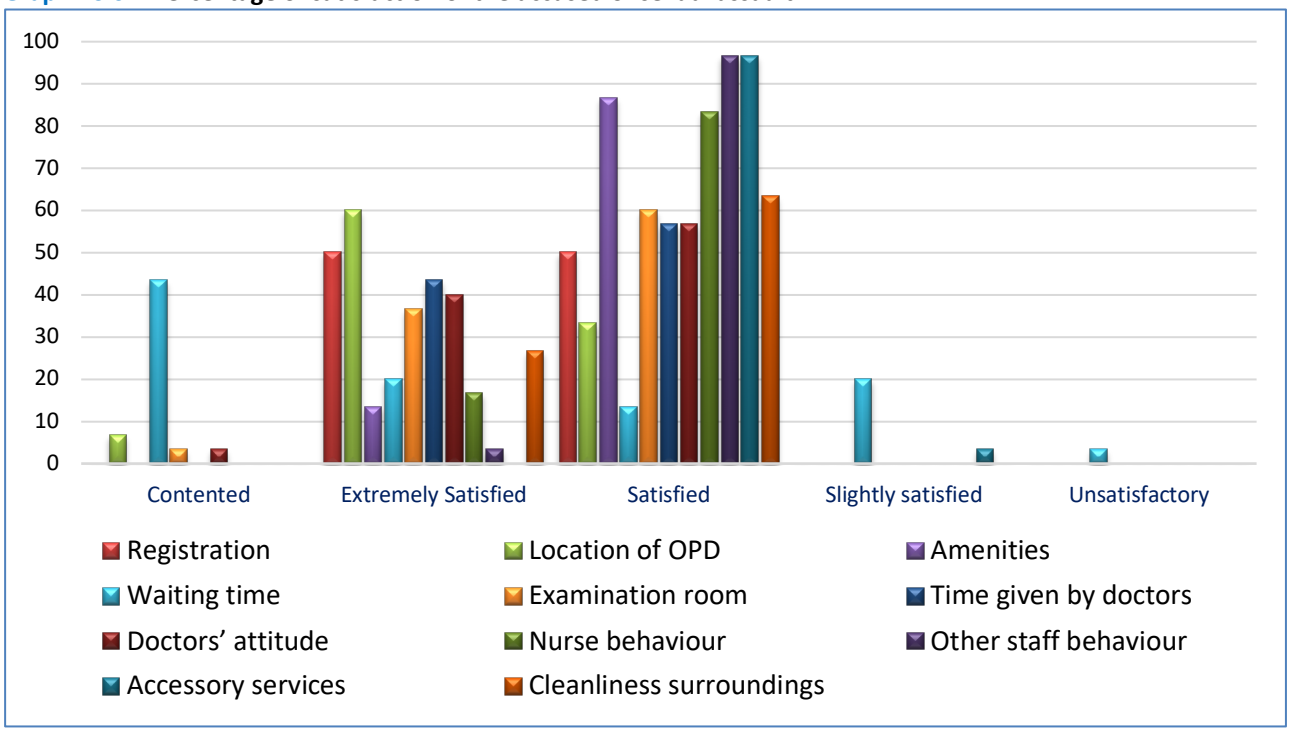
| Parameter | Accused % Mean (SD) | Police % Mean (SD) |
|---|---|---|
| Registration | 82.5(6.66) | 80.17(6.09) |
| Location of OPD | 84.67(6.56) | 82.33(6.79) |
| Amenities | 77.5(5.21) | 75.67(4.5) |
| Waiting time | 81(16.68) | 79.33(17.06) |
| Examination room | 81(5.78) | 79.17(6.03) |
| Time given by doctors | 81.83(4.82) | 79.33(4.87) |
| Doctors' attitude | 81.67(5.77) | 79.17(6.31) |
| Nurse behaviour | 77.83(4.86) | 74.17(6.17) |
| Other staff behaviour | 74.5(4.42) | 71.33(5.07) |
| Accessory services like radiology, laboratory | 71(4.24) | 68.83(4.49) |
| Cleanliness surroundings | 78.66(6.14) | 76.33(6.81) |

Referring to Table 5, Mean satisfaction levels was maximum with location of the department and registration while least was with the accessory services and other staff behaviour. Highest standard deviation was with waiting time and least with the accessory services and other staff behaviour.

**Table 06 Percentage of satisfaction levels of accused of sexual assault.**

| Parameter | >90% Contented | 81-90 % Extremely Satisfied | 61-80% Satisfied | 51-60% Slightly satisfied | 41-50% Unsatis-factory | 31-40% Poor | <31% Very Poor |
|---|---|---|---|---|---|---|---|
| Registration | 0 (00%) | 15(50 %) | 15(50 %) | 0 (00%) | 0 (00%) | 0 (00%) | 0 (00%) |
| Location of OPD | 2 (6.67%) | 18(60%) | 10(33.33%) | 0 (00%) | 0 (00%) | 0 (00%) | 0 (00%) |
| Amenities | 0 (00%) | 4(13.33%) | 26(86.67%) | 0 (00%) | 0 (00%) | 0 (00%) | 0 (00%) |
| Waiting time | 13(43.34%) | 6(20%) | 4(13.33%) | 6(20%) | 1(3.33%) | 0 (00%) | 0 (00%) |
| Examination room | 1(3.33%) | 11(36.67%) | 18(60%) | 0 (00%) | 0 (00%) | 0 (00%) | 0 (00%) |
| Time given by doctors | 0 (00%) | 13(43.34%) | 17(56.66%) | 0 (00%) | 0 (00%) | 0 (00%) | 0 (00%) |
| Doctors' attitude | 1(3.33%) | 12(40%) | 17(56.67%) | 0 (00%) | 0 (00%) | 0 (00%) | 0 (00%) |
| Nurse behaviour | 0 (00%) | 5(16.67%) | 25(83.33%) | 0 (00%) | 0 (00%) | 0 (00%) | 0 (00%) |
| Other staff behaviour | 0 (00%) | 1(3.33%) | 29(96.67%) | 0 (00%) | 0 (00%) | 0 (00%) | 0 (00%) |
| Accessory services like radiology, laboratory | 0 (00%) | 0 (00%) | 29(96.67%) | 1(3.33%) | 0 (00%) | 0 (00%) | 0 (00%) |
| Cleanliness surroundings | 0 (00%) | 8(26.67%) | 22(63.33%) | 0 (00%) | 0 (00%) | 0 (00%) | 0 (00%) |

**Graph no 02: Percentage of satisfaction of the accused of sexual assault**



Referring to **Table 6**, Majority of the accused were satisfied by all the parameters during medicolegal examination in the hospital. However, around 43 % of the accused were contented with prompt service while around 3 % were unsatisfied with the service showing huge variation in the feedback. Also, the percentage of survivors with extremely satisfied feedback was low with other staff behaviour, and accessory services (**Graph 2**).

## 4. Discussion

The present study was carried in labour ward and department of forensic medicine and toxicology at tertiary level care hospital, Mumbai. Total 140 subjects were included in the study out of which the survivors of sexual assault were 40, accused of sexual assault were 30 and the police personnel accompanying the survivors and accused of sexual offences were 70. Out of total 40 survivors, 38 were females while 02 were males. All the accused were males. Majority of the survivors were between 12 to 18 years and were of lower socio-economic status. Reason behind this can be both the parents were busy in the job and being lower socio-economic status, no support or backing to the girls making them easy targets.

More than half the cases were attended within 15 minutes of arrival of survivors as well as accused of sexual offences. except in few cases where there was delay in attending the patient. Reason for the delay might be doctors busy with other emergency cases or many sexual assault cases simultaneously. Mean satisfaction levels were maximum with time given by doctors and doctor's attitude. Reason behind this might be the doctors are taking in-depth history and detailed examination of the survivors of sexual assault as per prescribed format provided by the ministry of Health and family welfare, Government of India. While least satisfaction levels were with the other staff behaviour, amenities, cleanliness in surroundings and accessory services. Being a public sector hospital, there is patient load of around 10 thousand on daily basis which makes maintenance of cleanliness in the surroundings is challenging task. Also, the patients approaching to the hospital were from low socio-economic status, there were least aware about their responsibility of maintaining cleanliness. Similarly, the toilets may be dirty at times due to similar reasons. There is also evidence of rude and unfriendly behaviour of class four employees of the patients. Due to crowing in the hospital by the patients, there is possibility of delay at the radiology or other laboratory for carrying out the investigations.

Most of the findings are consistent with studies like Rajkumari B et al [1], Mishra PH et al [2], Ofili AN et al [10], Bekele A et al [11], Mankar et al [12], Qadri SS et al [13], Joshi K [14], Du Mont J et al [6], Du Mont J et al [15], Du Mont J et al [16] Boonma A et al [17] and Bhattacharya A [9] where most of the patients were satisfied with the services provided and least satisfied with amenities like dirty toilets and cleanliness in the surroundings. However present study findings were not in consistence with the study by Yusri CR et al [18] where majority of the patients were unsatisfied with services provided by the hospital. Reason for this discontent might be very huge expectation from the hospital or previous good experience of treatment at the hospital which might have raised the bar. Bahrampour A [19] displayed about inverse relation of education with level of satisfaction. More educated people, lesser the level of satisfactions of the patients which is consistent with current study.

Better services provided to the survivors can help in make them feel comfortable so that they can cooperate in providing history properly and assist in medicolegal examination. All this will ultimately strengthen the case against the accused and will ultimately enhance the conviction rate of the accused.

## 5. Conclusion

Survivors and accused of sexual assault along with the accompanying police personnel were satisfied from majority of the services provided during the medicolegal examination. Mean satisfaction levels for survivors of sexual assault was maximum with time given by doctors and doctor's attitude while least satisfaction levels were with the other staff behaviour, amenities, cleanliness in surroundings and accessory services. Highest standard deviation was with waiting time and least with the amenities. Mainly the reasons for dissatisfaction of the survivors of sexual assault were uncleanliness in the surroundings, poor toilet facilities, unfriendly behaviour of the supporting staff and incidence of delay in the accessory services like radiology which is usually very crowded.

Positive feedback of the survivor is very essential for the prosecution of the accused in the court of law. Better the experience for the survivor in the hospital, more comfortable will be the survivor and will assist

effectively to the doctors for medicolegal examination and ultimately increasing the conviction rate.

**6. Recommendations and plan of action**

Determining the lacunae in health services and causes of discontent of survivors was one of the vital aspects of performing this study. This can proceed further with taking necessary corrective measures for achieving the same.

Recommendations are as follows

1. Features which have got least satisfaction rating in most of the studies were dirty toilets and cleanliness in the surroundings. Proper efforts should be made to ensure proper and regular cleaning of the toilets and the wards along with surrounding areas.
2. Anti-rodent and pest control to be done on the regular basis.
3. The employees to be provided with appropriate safety equipment which can make them feel comfortable while work.
4. Employees should be made accountable for their work by regular follow up.
5. They should be given awards or incentives for good performance.
6. Similarly, there should be provision for penalty for bad performance.
7. There should be awareness campaign among the general public as well as the employees about cleanliness and hygiene.
8. Hospital administration should make provision of dustbin at designated places and need to ensure that the proper waste management is being done.
9. Safe drinking water facilities to be made available at specific places.
10. Lack of communication can be one reason for poor feedback by the survivors of sexual assault. This can be due to overstressed doctor having long working hours with heavy workload. Therefore, duty hours of the doctors to be restricted to 08 hours instead of 24 or 48 hours to prevent exhaustion of the doctors and enhancing the communication skill resulting in good doctor patient relationship.
11. Behaviour of other staff members like sweeper, ward boys and attendants has also been given less scoring. Hence it is very essential to have induction training as well as at regular intervals to all the employees about behaviour with the patients.
12. Communication skill workshops to be taken for all the employees from doctor to sweepers at regular intervals.
13. At times, there can be delay at the time of registration or in location of the wards. Therefore, proper guidance to be given to the patients or their relatives.
14. All the vacant posts to be filled at the earliest to avoid the shortage of the doctors or the staff which can adversely affect the functioning of the healthcare service.
15. Allocation of the staff should be done properly after taking into consideration the patient load.
16. There should be provision to the patient of making an appointment before coming to the hospital by using telephone or by using digital platforms like app. Well-organized appointment and proper distribution of the patient can reduce the causes of dissatisfaction of the patients to greater extent.
17. **Forensic Nursing**: In western countries, there is specialized branch called forensic nursing where the nurses are trained in handling the survivors of sexual assault. As the survivors are already in physical or mental trauma, there are reluctant to cooperate in medicolegal examination. Sexual assault nurse examiner (SANE) can augment extensively the quality of the examination and evidence collection.
18. **Establishment of one stop centre**: Government of India has come up with the initiative of one stop centre where all the facilities will be provided to the survivor under one roof. This is special provision for survivors of sexual assault to avoid discomfort to the survivor. It includes getting registration done, history taking and examination done by doctors of various department simultaneously like Forensic Medicine, Gynaecology, Surgery etc, statement of the police, facilities like drinking water and toilets along with portable Xray and video conferencing facility. There is also provision of temporary storage for five days. This step can act as big booster in fight against sex related crimes.
19. **Indian Medical services**: There is dire need for augmenting the quality of healthcare especially in public sector and this is not possible without civil service reform in form of initiation of Indian

Medical services at par with IAS, IPS, IRS, etc for better control and management of healthcare sector.

**Contributor ship of Author:** All authors equal contribution.
**Ethical Clearance:** Yes.
**Conflict of interest:** None.
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*Original Research Article*

# Palm Length as an Aid for Stature Estimation in South Indian Population.

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**Key words:**
Forensic Anthropology,
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Abstract

**Introduction:** Human remains identification is a paramount task for any investigator in a forensic investigation. The present paper focuses on relationship between the palm length and stature in the South Indian student population and regression formulae to estimate the stature from this measurement have been devised. These findings would be a valuable tool for the anthropologists in general and forensic experts in specific for estimation of stature. **Objectives:** To derive regression equations that can be applied for estimation of stature of South Indian population using the palm length. **Material and Methods:** Palm length and height were measured from 200 students (100 males & 100 females) aged between 18 to 25 years belonging to south Indian population. Measurements of palm length of males and females were taken by using a Vernier callipers and the height was recorded using Anthropometer rod. Pearson's correlation co-efficient was calculated and its significance was tested at a p-value of less than 0.05. **Results** The mean stature of males and females were 173.8 and 159.1 cm respectively. Mean palm length of right and left sides for males was same (11.3 cm) whereas in females was 10.1 cm and 10.3 cm respectively. Linear regression equations for estimation of stature in males and females and palm length showed a significant correlation with the stature in males and females. The right-palm length in both sexes appears to be the better predictor of stature. **Conclusions** It is better to use the combined regression equations than the specific gender-based equations.

## 1. Introduction

Forensic anthropology is a rapidly evolving discipline, with numerous applications in biological anthropology, archaeology and in medico-legal issues. In Forensic practice the science is helpful to determine whether the recovered article is bone or not, species, time since death estimation, age estimation, sex, stature, taphonomy etc.[1] In recent years forensic anthropology has reinforced its application firmly.

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In medicolegal point of view the contribution of forensic anthropometry in trauma analysis is considered as a huge endowment.[1] Estimation of stature guides in identification of individuals. Human remains identification is a paramount task for any investigator in a forensic investigation. Geographical, ethnic, genetic, dietary and other variations demand population specific regression models.[2] Studies have shown that length of long bones, fragmentary bones, spine, foot dimensions, metacarpal and metatarsal lengths, skull, and scapula can be used for stature estimation in identification of an individual. In natural calamities, bomb blasts or any other mass disasters extremities are easily found and can be used in stature estimation and hence establishing individual identity.[3]

The present paper focuses mainly on relationship between the palm length and stature in the south Indian student population, wherein an attempt has been made to develop regression formulae to estimate the stature from this measurement. These findings would be a valuable tool for the anthropologists in general and forensic experts in specific for estimation of stature.

**Aims and objectives**

To derive regression equations that can be applied for estimation of stature of south Indian population using the palm length.

**2. Material and Methods**

The study was conducted in the department of Forensic Medicine and Toxicology at JNMC, Belgaum, Karnataka state, India. In this study length of palm length and height were measured from 200 students (100 males & 100 females) aged between 18 to 25 years belonging to south Indian population. Non-resident Indians and subjects from northern, western and eastern India were excluded from the study. Subjects with Skeletal abnormalities and connective tissue diseases, which may be congenital or acquired, were also excluded. Informed written consent was obtained prior to recording the measurements.

Anthropometric measurements and Techniques: Measurements of palm length of males and females were taken by using a Vernier calipers and the height was recorded using Anthropometer rod. Stature was measured as vertical distance from the vertex to the floor. Measurement was recorded by making the subject to stand erect on a horizontal resisting plane, bare footed with shoulder blocks and buttocks touching the wall. Palms were turned inwards and fingers horizontally pointing downwards. Anthropometer was placed in straight vertical position in front of the subject with head oriented in eye-ear-eye plane (Frankfurt Plane). The movable rod of the Anthropometer is brought in contact with vertex in the mid sagittal plane. To measure palm length the subject was asked to place the hands on a flat table, and the distance between the midpoint of the proximal crease of middle finger and the distal transverse crease of wrist was recoded using a Vernier calipers.

**Statistical analysis:** The data was analysed using SPSS (Statistical Package for social science) version 18.0 to calculate descriptive statistics of stature and palm length for male and female subjects. For assessing the correlation between the stature and palm length, Pearson's correlation co-efficient was calculated and its significance was tested at a p-value of less than 0.05. The correlation coefficient was calculated separately for both male and female subjects. Linear regression models were derived for stature estimation from palm length in males and females keeping the stature as dependent variable and palm length as an independent variable.

**3. Results**

The mean stature of males and females were 173.8 and 159.1 cm respectively. Mean stature was significantly more in males than females. Mean palm length of right and left sides for males was same (11.3 cm) whereas in females was 10.1 cm and 10.3 cm respectively. Palm length was more in males than females in both the hands. Descriptive statistics of stature, palm length of both hands is depicted in **table No.1.**

**Table1. Descriptive statistics of stature, palm of both sexes.**

| Gender | Age (Years) | Stature (cm) | Right palm (cm) | Left palm(cm) |
|---|---|---|---|---|
| Female | 19.8+/- 0.83 | 159.1+/-5.77 | 10.1+/-0.55 | 10.3+/-1.39 |
| Male | 21.5+/-4.11 | 173.8+/-5.95 | 11.3+/-0.68 | 11.3+/-0.74 |
| combined | 20.6+/-3.07 | 166.5+/-9.41 | 10.7+/-0.86 | 10.8+/-1.21 |

Statistically significant correlation was observed between stature and palm length of both hands. Pearson correlation (r) for stature and palm lengths was higher in right palm than left palm as shown in **table No.2**. Linear regression equations for estimation of stature in males and females are shown in **table No.3.** The palm length showed a significant correlation with the stature in males and females.

**Table 2: Pearson's Correlation coefficient of palm length with height.**

| Variable | R | P |
|---|---|---|
| Right Palm | 0.747 | 0.00 |
| Left Palm | 0.519 | 0.00 |

The right-palm length in both sexes appears to be the better predictor of stature.

**Table 3: Regression equations for estimation of stature from length of palm.**

| Gender | Variable | Equation (St = a + bx) | r | $r^2$ | SE | t for b | p |
|---|---|---|---|---|---|---|---|
| **Combined** | Right (Rt.) Palm | St = 78.92+8.142 x Rt. Palm | 0.797 | 0.558 | 6.289 | 11.128 | 0.000 |
| | Left (Lt.) Palm | St = 122.943+4.013 x Lt. Palm | 0.519 | 0.269 | 8.089 | 6.009 | 0.000 |
| **Female** | Right Palm | St = 94.414+5.980 x Rt. Palm | 0.572 | 0.327 | 4.785 | 4.834 | 0.000 |
| | Left Palm | St = 145.618+1.307 x Lt. Palm | 0.315 | 0.009 | 5.537 | 2.299 | 0.026 |
| **Male** | Right Palm | St = 138.505+3113 x Rt. Palm | 0.359 | 0.129 | 5.612 | 2.663 | 0.001 |
| | Left Palm | St = 132.265+3.664 x Lt. Palm | 0.458 | 0.210 | 5.341 | 3.569 | 0.001 |

## 5. Discussion

Anatomical method of estimation of stature of an individual is considered best in skeletal remains and cadaver stature estimation. If mutilated or parts of the bodies are produced, like most common in forensic examination then the expert's choice has to be mathematical method for estimation of stature and mathematical method has the advantage to estimate stature when body parts are produced, disadvantages are due to a vast variation in population ethnicity the attainment of accuracy is in subpar level.[4] It is well known to the forensic experts that climate, genetic, racial and nutritional factors play a vital role in body built of an individual. Our main objective of the study was to develop regression equations for estimating stature in Indian student population based at Belagavi, India and consequently we have developed a set of usable equations. In the present study, a total of 100 subjects were studied for estimation of stature from hand length in both the sexes. Average stature seen in our study is 159.1 cm in females and 173.8 cm in males, males being taller than females. These findings correlate with that of observations made by other studies involving stature.[5,6,7,8]

In this study we found that right-palm length was longer than the left palm in females and it was same in males. Generally, this is due to the fact that dominant palm has larger dimension than the non-dominant hand.[3] Our findings in males are in par with findings of a study conducted by Krishan and Sharma where it was found that length of the right and left palm didn't show any marked difference.[9] In another study by, Bhatnagar et al. it was found that length and breadth of both right and left palm showed no significant difference.[10] Our study demonstrated that length of female palms are shorter than the males which is in accordance to observations made in a study on Nigerian population wherein it was found that the length of the female hands are shorter than male but the breadth of the palm is wider when compared to male.[11]

Generally, the puberty is delayed in male by two years when compared to females this is the reason why the skeletal growth of male is more when compared to females it gives extra two years for the growth in male.[12] In a comparative study between three different ethnic females it was found that palm length varied significantly among Indians, west Europeans and natives of West Indies suggesting population based studies are warranted for developing regression equations.[13] Consequently we have developed sets of separate formula in both sexes to estimate stature. In our study we have found a positive correlation palm length and stature which in accordance to other studies.[3,8,9]

In a study conducted in north and south Indian population, it was found that the length of a right palm in male points to a highest correlation with stature. The same study stated that comparatively female stature estimation is accurate and reliable than male with a single dimension of palm in unknown person.[14] Interestingly our study demonstrated that the combined regression equations are more reliable than the gender specific equations.

## 6. Conclusion

In present study, length of the palms was used to predict the stature of a person. It is better to use the combined regression equations than the specific gender-based equations. The formulae to estimate stature vary according to the genetic and environmental factors like climate, nutrition.

**Contributor ship of Author:** All authors equal contribution.

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*Original Research Article*

# Analysis of Primary Fingerprint Patterns in Medical Students of Banda District Uttar Pradesh.

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ABO blood group, Dactylography, Fingerprint pattern, Rh blood group.

Abstract

**Background:** A reliable personal identification is important in many situations like civil, criminal, commercial and financial transaction frauds. Dactylography is considered as the most effective and reliable method of personal identification. **Objective:** The objective of the present study was to find out the pattern of primary fingerprints in individuals with different ABO and Rh blood groups along with an evaluation of the relationship between primary fingerprint patterns and blood groups in both sexes. **Methods:** In the present cross-sectional study, fingerprints and ABO & Rh blood groups of 190 medical students belonging to the age group of 17-29 years were collected & data were analyzed by the chi-square test. **Results:** Maximum subjects (39.47%) belonged to the blood group 'O' followed by blood group 'B'. The majority (93.68%) belong to the Rh +ve blood group. Loop patterns were the most common primary fingerprint pattern followed by whorls and arches in both males & females in all blood groups. All fingers of both hands except ring finger showed the highest frequency of loop primary fingerprint pattern. **Conclusion:** The present study shows that the general distribution of the primary fingerprint pattern is related to gender and blood group 'B'. Primary fingerprint pattern distribution is also related to the individual digit in all blood groups except 'AB' blood group.

## 1. Introduction

Study of epidermal ridges on non-hairy part of palm, fingers, toes, and soles is known as dactylography. Configurations of ridge pattern are determined by both heredity and accidental or environmental influence.[1] Handwriting, lip prints, DNA fingerprinting, tattoo marks, scar marks, superimposition etc. are other methods of personal identification. The pattern of papillary ridges in hands is completely established between 11$^{th}$ to 24$^{th}$ weeks of gestation.[2] Arrangement and distribution of fingerprint patterns are unique and permanent to an individual and

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no two hands (even twins) resemble each other. Therefore, fingerprinting is widely accepted and adopted as most reliable method of personal identification. Galton described four types of primary fingerprint patterns i.e., loop, whorl, arch and composite.[3]

Fingerprints follow the Locard's Principle of Exchange. Fingerprint secretions contain various chemical residues and their metabolites which can be used for the forensic purposes.[4] They can be found in crime scene from which the presence of a suspect or a victim can be easily proved.

Clinically, "ABO" and "Rhesus" are considered most important blood groups. "Rhesus" system is classified into "Rh +ve" and "Rh –ve" on the basis of 'D' antigen.[5] Inheritance of both dermatoglyphics patterns and ABO blood group is polygenic.[6] Bloterogel also expressed a correlation between physical characters and blood groups.[7] A reliable personal identification is important in many situations like civil, criminal, commercial and financial transaction frauds. Therefore, the objective of present study was to find out the pattern of primary finger prints in individuals with different "ABO" and "Rh" blood groups along with evaluation of relationship between primary fingerprint patterns and blood groups in both sexes.

## 2. Materials and methods:

Present study was a cross sectional study, conducted in Department of Forensic Medicine & Toxicology and Department of Physiology, Government Allopathic Medical College (GAMC), Banda (Uttar Pradesh) during period of 3 months (August 2018 to September 2018). Total 190 medical students belonging to the age group 17-29 years were randomly selected for the study to avoid selection bias. Written informed consent was obtained from every participant prior to study. Ethical clearance was obtained from Institutional Ethics Committee. Subjects with hand deformity like permanent scars on fingers, suffering from chronic skin disease, having extra or bandaged fingers were excluded from study.

Students were asked to wash hands thoroughly with soap and water and dry them using a towel. Fingerprints were collected using the blue stamp pad of Camlin company size 15.7 cm X 9.6 cm. Fingertips were smeared with ink and fingerprints of all the ten digits were taken separately on respective blocks on the same paper sheet. Basic details such as name, age, sex was noted. "ABO" and "Rh" blood group types were known by slide agglutination method using antiserum A, B and D. The fingerprint patterns were examined with the help of a powerful magnifying lens and were classified as loops, whorls and arches based on the appearance of ridgelines. Variables were tabulated and analyzed using software "SPSS 20". The distribution of primary fingerprint patterns and its relationship with different blood groups in both sexes were evaluated by using chi square test.

## 3. Results:

In the present study, 190 subjects participated out of which 118 were males and 72 were females. Highest number of the subjects belonged to blood group 'O' 75 (39.47%), followed by blood group 'B', 'A' and 'AB' respectively. Blood groups 'A' and 'B' were found more frequent among females while blood groups 'O' and 'AB' were more common in males (**Table 1**).

Majority of subjects (93.68%) were of Rh-positive group while only 6.31% were Rh-negative. Maximum subjects belonged to blood group 'O' (75) followed by blood group 'B', 'A' and 'AB' (**Table 2**).

**Table 1: Distribution of subjects according to sex and blood groups**

| Sex | Blood groups | | | | Total |
|---|---|---|---|---|---|
| | A | B | AB | O | |
| | n (%) | n (%) | n (%) | n (%) | N (%) |
| Male | 18 (15.25) | 40 (33.89) | 12 (10.16) | 48 (40.67) | 118 (100.0) |
| Female | 12 (16.66) | 26 (36.11) | 7 (9.72) | 27 (37.5) | 72 (100.0) |
| Total | 30 (15.78) | 66 (34.73) | 19 (10.00) | 75 (39.47) | 190 (100.0) |

**Table 2: Distribution of subjects according to Rh blood groups**

| Blood group | Rh-positive | Rh-negative | Total |
|---|---|---|---|
| | n (%) | n (%) | N (%) |
| A | 28 (93.30) | 02 (6.70) | 30 (100.0) |
| B | 64 (96.96) | 02 (3.01) | 66 (100.0) |
| AB | 19 (100.0) | 00 (0.00) | 19 (100.0) |
| O | 67 (89.33) | 08 (10.66) | 75 (100.0) |
| Total | 178(93.68) | 12 (6.31) | 190 (100) |

Loop patterns were the most common primary fingerprint pattern followed by whorls and arches. The relation of primary fingerprint patterns and sex was found to be statistically significant ($P<0.05$) by Chi square test analysis. In comparison between both sexes, loop patterns were higher in incidence in

females (64.3%) than in males (49.74%), but whorl and arch patterns were more frequent in males (35.93% and 14.32%, respectively) compared to females (22.63% and 13.05%, respectively) (Table 3).

**Table 3: Distributions of primary finger print patterns in relation to sex**

| Primary fingerprint pattern | Male | Female |
|---|---|---|
| | n (%) | n (%) |
| Loop | 587 (49.74) | 463 (64.30) |
| Whorl | 424 (35.93) | 163 (22.63) |
| Arch | 169 (14.32) | 94 (13.05) |
| Total | 1180 (100) | 720 (100) |
| Statistics | $\chi^2$= 43.25<br>*P* value <0.0001 | |

Table 4 shows that loop patterns were predominant in all blood groups with highest percentage in blood group 'B'. Chi square test revealed that the relation between primary patterns of fingerprints and blood group 'B' was statistically significant (*P*<0.05) while relation between primary patterns of fingerprints and blood group 'A' and 'O' was not statistically significant. Frequency of loop patterns was higher in both Rh +ve and Rh −ve individuals, followed by whorls and arches. In the present study primary fingerprint patterns are not observed in Rh −ve blood group 'AB'. In this study, in 'B' blood group, the frequency of loop pattern (55.93%) and whorl pattern (30.15%) were higher in Rh +ve blood group than in Rh −ve blood group (50% loops and 15% whorls), but the incidence of arches was more (35%) in Rh −ve blood group than in Rh +ve blood group (*P*< 0.001) (Table 4). Table 5 & table 6 shows the frequency of loop pattern was high in all the fingers of both hands except ring finger while frequency of whorls was higher in the ring fingers of all the blood groups. In the present study, highest frequency of arches was observed in thumb as compared to other fingers in all blood groups. Chi square test showed the rejection of null hypothesis in all blood groups except 'AB' blood group.

**Table 4: Distribution of primary fingerprint pattern among different blood groups**

| Type of finger print | Blood group A | | Blood group B | | Blood group AB | | Blood group O | |
|---|---|---|---|---|---|---|---|---|
| | Rh +ve | Rh – ve | Rh +ve | Rh – ve | Rh +ve | Rh – ve | Rh +ve | Rh – ve |
| | n (%) | n (%) | n (%) | n (%) | n (%) | n (%) | n (%) | n (%) |
| Loop | 148 (52.85) | 15 (75.0) | 358 (55.93) | 10 (50.0) | 105 (55.26) | 00 (0.0) | 369 (55.07) | 45 (56.25) |
| Whorl | 100 (35.71) | 03 (15.0%) | 193 (30.15) | 03 (15.0) | 64 (33.68) | 00 (0.0) | 202 (30.14) | 22 (27.5) |
| Arch | 32 (11.4) | 02 (10.0) | 89 (13.90) | 07 (35.0) | 21 (11.05) | 00 (0.0) | 99 (14.77) | 13 (16.25) |
| Total | 280 (100) | 20 (100) | 640(100) | 20(100) | 190(100) | 00 | 670(100) | 80(100) |
| Statistics | $\chi^2 = 4.05$ p=0.13 | | $\chi^2 = 7.55$ p=0.02 | | NA | NA | $\chi^2 = 0.28$ P=0.865 | |
| | (Not Significance) | | (Significance) | | | | (Not Significance) | |

**Table 5: Distribution of primary fingerprint pattern in different fingers of right hand**

| Indivi-dual finger | Blood group | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A | | | B | | | AB | | | O | | |
| | Loop | Whorl | Arch | Loop | Whorl | Arch | Loop | Whorl | Arch | Loop | Whorl | Arch |
| Thumb (%) | 13 (43.3) | 10 (33.3) | 07 (23.3) | 30 (45.4) | 24 (36.3) | 12 (18.1) | 09 (47.3) | 06 (31.5) | 04 (21.0) | 30 (40.0) | 25 (33.3) | 20 (26.6) |
| Index (%) | 16 53.3 | 10 (33.3) | 04 (13.3) | 34 (51.5) | 21 (31.8) | 11 (16.6) | 11 (57.8) | 06 (31.5) | 02 (10.5) | 41 (54.6) | 21 (28.0) | 13 (17.3) |
| Middle (%) | 22 (73.3) | 05 (16.6) | 03 (10.0) | 45 (68.1) | 10 (15.1) | 11 (16.6) | 10 (52.6) | 05 (26.3) | 04 (21.0) | 51 (68.0) | 10 (13.3) | 14 (18.6) |
| Ring (%) | 09 30.0 | 20 (66.6) | 01 (3.3) | 25 (37.8) | 36 (54.5) | 05 (7.57) | 08 (42.1) | 10 (52.6) | 01 (5.26) | 35 (46.6) | 37 (49.3) | 03 (4.0) |
| Little (%) | 23 76.6 | 04 (13.3) | 03 (10.0) | 48 (72.7) | 11 (16.6) | 07 (10.6) | 12 (63.1) | 06 (31.5) | 01 (5.26) | 52 (69.3) | 16 (21.3) | 07 (9.33) |
| Statistics | $\chi^2 = 30.24$ p=0.0002 | | | $\chi^2 = 36.79$ p=0.0001 | | | $\chi^2 = 7.13$ p=0.521 | | | $\chi^2 = 43.18$ p=<0.0001 | | |
| | (Significance) | | | (Significance) | | | (Not Significance) | | | ( Significance) | | |

**Table No.6 Distribution of primary fingerprint pattern in different fingers of left hand**

| Individual finger | Blood group | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A | | | B | | | AB | | | O | | |
| | Loop | Whorl | Arch | Loop | Whorl | Arch | Loop | Whorl | Arch | Loop | Whorl | Arch |
| Thumb | 15 (50.0) | 09 (30.0) | 06 (20.0) | 34 (51.5) | 17 (25.7) | 15 (22.7) | 11 (57.8) | 04 (21.0) | 04 (21.0) | 41 (54.6) | 16 (21.3) | 18 (24.0) |
| Index | 19 (63.3) | 07 (23.3) | 04 (13.3) | 39 (59.0) | 18 (27.2) | 09 (13.6) | 11 (57.8) | 06 (31.5) | 02 (10.5) | 36 (48.0) | 22 (29.3) | 17 (22.6) |
| Middle | 19 (63.3) | 08 (26.6) | 03 (10.0) | 39 (59.0) | 16 (24.2) | 11 (16.6) | 11 (57.8) | 05 (26.3) | 03 (15.7) | 47 (62.6) | 17 (22.6) | 11 (14.6) |
| Ring | 07 (23.3) | 22 (73.3) | 01 (3.33) | 26 (39.3) | 31 (46.9) | 09 (13.6) | 09 (47.3) | 10 (52.6) | 00 (0.0) | 28 (37.3) | 43 (57.3) | 04 (5.33) |
| Little | 20 (66.6) | 08 (26.6) | 02 (6.66) | 48 (72.7) | 12 (18.1) | 06 (9.09) | 13 (43.3) | 06 (31.5) | 00 (0.0) | 53 (70.6) | 17 (22.6) | 05 (6.66) |
| Statistics | $\chi^2 = 26.57$ p=0.0008 | | | $\chi^2 = 22.35$ p=0.004 | | | $NA$ | | | $\chi^2 = 47.27$ p=<0.0001 | | |
| | ( Significance) | | | (Significance) | | | | | | (Significance) | | |

## 4. Discussion:

In the present study we found that blood groups 'A' and 'B' were more frequent among females while blood groups 'O' and 'AB' were more common in males which is in agreement to the previous reports by Bharadwaja A et al.[4] and Rastogi P et al.[8] However different results were observed by studies done by Garg P et al.[9] (most frequent blood group A) and Desai et al.[10] (most frequent blood group B). As expected, majority of subjects belonged to Rh-positive blood group in our report consistent with other studies done in various countries, i.e., India[4, 8], Nigeria[11] Iran[12] and Iraq.[13]

We observed that loop patterns were the most common primary fingerprint pattern followed by whorls and arches and similar have been reported in previous works done by various authors.[4,8,10] Our study also shows that distribution of primary fingerprint pattern is related to gender ($P< 0.05$). In comparison between both sexes, loop patterns were more frequent in females (64.3%) than in males (49.74%), but whorl and arch patterns were more frequent in males (35.93% and 14.32%, respectively) compared to females (22.63% and 13.05%, respectively). These results are in consistent with Sudikshya KC et al.[14] and Sangam et al.[15] except for the arches. In contrast to present study, Mehdipour M et al.[16] demonstrated higher frequency of loops in males compared to females.

We found that loop patterns were predominant in all blood groups with highest percentage in blood group 'B'. Similar findings were observed by Deopa D et al.[17] However different results were observed by Mehta AA et al.[18] where highest percentage of loop pattern was reported in blood group "O". Results of our study also suggest that general distribution of primary fingerprint pattern is related to blood group "B" but not related to blood group "A" and "O".

In our study, loop and whorl patterns are more frequent in B+ve blood group while arches in B-ve blood group, our observations are different from studies done by Bharadwaja A et al[4] where higher incidence of loops were observed in B−ve blood group. We observed high frequency of loop pattern in all fingers of both hands except ring finger which is in agreement with the previous reports.[4] Fayrouzet al.[19] observed high frequency of loop pattern ring finger in all blood groups.

In present study, frequency of whorls was higher in the ring fingers of all blood groups. Our results are different from Bharadwaja et al[4] which observed higher frequency of whorls in blood group 'A' and 'AB' while higher frequency of loops in blood group 'B' and 'O' in ring fingers. Result of our study shows that primary fingerprint pattern distribution is related to individual digit in all blood groups except "AB" blood group.

## 5. Conclusions:

The results of present study showed that general distribution of primary fingerprint pattern is related to gender and blood group 'B'. Primary fingerprint pattern distribution is also related to individual digit in all blood groups except 'AB' blood

group. It is widely accepted that fingerprints are unique, individualistic, permanent and never alike. Therefore, the association of primary fingerprint pattern with different blood groups and gender will enhance the authenticity of fingerprints in identification of an individual. This association could also be used for prediction of certain diseases.

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*Original Research Article*

# Estimation of age from hyoid bone – is it a viable option?

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**Key words:**
Age estimation,
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Abstract

**Introduction:** Identification of an individual is crucial from womb to tomb. It has always been a challenging task. Estimation of age after death from the adult skeleton is one of the most important objectives in medico-legal cases. Among the various parameters available, skeletal age determination is considered the best. This study attempts to assess the reliability of age estimation based on the ossification of hyoid bone as an indicator of chronological age. **Methodology:** This prospective observational study was conducted in the mortuary of the tertiary care Teaching Hospital in South India from October 2014 to September 2016. This study includes 100 hyoid bones from male and female cadavers of known age, brought for medico-legal autopsy. The hyoid bone was removed, cleaned and subjected to X-ray. For estimating the age of the person the categories such as non-fusion, initiation of fusion, partial fusion and complete fusion were used. **Results:** The mean age for bilateral complete fusion of greater cornua with the body of hyoid bone is 50.44 ± 10.28 years. The mean age for bilateral complete fusion of greater cornua with the body of hyoid bone in males is 52.77 ± 10.9 years. The mean age for bilateral complete fusion of greater cornua with the body of hyoid bone in females is 48.84 ± 9.82 years. **Conclusion:** The sample size was small for establishing a concrete conclusion. Future studies with a larger sample size need to be considered for more reliable results.

## 1. Introduction

Identification of an individual is crucial from womb to tomb. It has been defined as the "determination or establishment of the individuality of a person, whether living or dead, and it is exact fixation of the individuality".[1,2] Historically, identification of a person has always been a challenging task.[3] Investigating officers and forensic specialists are concerned with identifying a dead body. This is especially true in challenging cases like explosion, accidents, or other mishaps. The medico-legal importance of age is multi-faceted, for example, regarding criminal responsibility, judicial punishment, etc. Estimation of age after death from the adult skeleton is one of the primary objectives in medico-legal cases. Several techniques are used for estimating age in adult skeletons with varying accuracy. These include age estimation by cranial suture closure,

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radiological assessment of ossification centers, eruption pattern of teeth, studying the metamorphosis in the pubic symphysis and scapula, rib phase analysis, and osteon counting in a segment of long bone. Among the various parameters available, skeletal age determination is considered the best as it provides near total accuracy. Some bones are cartilaginous, and others are membranous in origin. However, changes in all bones continue after complete ossification and even until death. Ossification and degenerative changes in bones are taken into consideration when estimating the age of a person, since their occurrences maintain a reasonable sequence and chronology.

Based on previously conducted studies, we can recognize the importance of using hyoid bone for age estimation. The following observations would highlight the importance of using hyoid bone in the estimation of age:

1. Hyoid bone can be used for anthropological studies due to its robustness and location, even making it possible to be examined as a fragmented or burnt bone.
2. Previous studies gave significant results demonstrating the use of hyoid bone in estimating the age.
3. Scarcity of national (Indian) studies for estimating age from hyoid bone

Hence, this study was conducted to estimate the reliability of age estimation based on the ossification of hyoid bone as an indicator of chronological age.

**2. Aim & Objective:**

To estimate the age based on the fusion of greater cornua with the body of hyoid bone. This aim will be achieved by observing the time of fusion between the greater cornua and body of the hyoid bone

**3. Methodology:**

This prospective observational study was conducted in the mortuary of the tertiary care Teaching Hospital in South India from October 2014 to September 2016. This study includes 100 hyoid bones from male and female cadavers of known age, brought for medico-legal autopsy. The dissection was performed in the mortuary. A layer-by-layer flap dissection was performed, and subcutaneous dissection was carried up to the lower border of the mandible, laterally on the sides of the clavicle and neck. The deep cervical fascia is incised and reflected from the cervical muscles and the submandibular gland.[4] The sternocleidomastoid muscle was freed from its attachments, separated from its fascia, and reflected on each side. The omohyoid, sternothyroid and thyrohyoid muscles were exposed, inspected, and reflected on each side.

The thyroid gland and the carotid sheaths were freed from their investing connective tissue. The larynx, trachea, pharynx, and oesophagus were mobilised and pulled away from the prevertebral tissue. The hyoid bone was removed and was examined for any signs of fracture. Further dissection was done to clear the soft tissue and maceration was then performed to remove all soft tissue. The sample size was calculated based on comparison proportion formula and was estimated to be of 90 (45 males and 45 females). A control group of five bones were taken from hanging cases involving each sex (total 10 bones). Total of 100 hyoid bones were studied. They were numbered at the time of retrieval from body and tagged to reduce the objective errors which may cause undue confusion. After maceration, they were cleaned, dried, and packed in polythene zip lock bags. They were then labelled with their corresponding post-mortem numbers and X-rays of these hyoid bones were taken.

**Radiological examination:**

Superior view and antero-posterior views of the bone were X-rayed to study the fusion between the body of the hyoid and greater cornua.[5] Nine hyoid bones were subjected to digital X-ray film of size 17 x 14 cm. The first 11 batch with nine bones each and a single bone in the 12$^{th}$ batch were X-rayed by placing it in a thermocoal sheet. The bones were labelled with lead numbers (1 to 9), and on each X-ray the corresponding batch (lead) number was placed for identification. The corresponding batch of hyoid bones was noted down for correlation with postmortem number with respect to the lead number to avoid unnecessary confusion while assessing the fusion. The X-ray specifications were set to 60 Kilo volt potential energy, X-ray tube strength is 200 mA, and the exposure time was 0.05 seconds.

**Categories of fusion:** [5] The fusion of the hyoid bones was then classified into following categories:

**1 - Not fused**

**2 - Initiation of fusion:** When the fusion has started either in middle or on one side, but the total area of fusion was less than 1/4$^{th}$ of the contact area.

**3 - Partially fused**: When the area of fusion advanced to include more than half of the contact area but did not exceed 3/4$^{th}$ of the contact area.

**4 - Completely fused**: When the area of fusion involves more than 3/4$^{th}$ of the contact area.

**Inclusion criteria:** Hyoid bones of individuals between the age of 20 to 70 years were included in this study.

**Exclusion criteria:** Hyoid bones that were fractured by strangulation, hanging, trauma, etc or any artefacts; were excluded from the study.

**Statistical analysis:** For statistical analysis, the samples were classified in to five groups of 10 years' interval. This data was analysed using Statistical Package for the Social Sciences (SPSS) version 15.

**4. Results:**

In this study, a total of 100 subjects (50 males and 50 females) between the ages of 21 - 70 years were examined. It was observed that the maximum number of cases was belonging to the age group of 21 – 30 years (34%). Frequency of cases with respect to degree of fusion of greater cornua and the side of the cornua is as depicted in **Table 1.** Frequency of male cases with respect to degree of fusion of greater cornua and the side of the cornua is as depicted in **Table 2**. Frequency of female cases with respect to degree of fusion of greater cornua and the side of the cornua is as depicted in **Table 3**. The association between the right and left greater cornua fusion with respect to degree of fusion is depicted in **Table 4**. According to Pearson Chi-square test, there is a strong association between the fusion of right and left greater cornua with the body of the hyoid bone ('p' value < 0.05). The mean age of degree of fusion with respect to gender is depicted in **Table 5**.

**Table 1: Frequency and degree of fusion with respect to the side of greater cornua in age group**

| Age group | Degree of fusion - Greater cornua | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Not fused | | Initiation of fusion | | Partially fused | | Completely fused | |
| | Right | Left | Right | Left | Right | Left | Right | Left |
| 21 - 30 | 34 | 34 | 0 | 0 | 0 | 0 | 0 | 0 |
| 31 - 40 | 12 | 11 | 0 | 0 | 0 | 0 | 10 | 11 |
| 41 - 50 | 2 | 3 | 0 | 2 | 2 | 2 | 17 | 14 |
| 51 - 60 | 4 | 3 | 1 | 4 | 1 | 0 | 7 | 6 |
| 61 - 70 | 1 | 0 | 1 | 1 | 1 | 0 | 7 | 9 |
| Total No. of cases | 53 | 51 | 2 | 7 | 4 | 2 | 41 | 40 |

**Table 2: Frequency of male cases and degree of fusion with respect to age group**

| Age group In years | Degree of fusion - Greater cornua in males | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Not fused | | Initiation of fusion | | Partially fused | | Completely fused | |
| | Right | Left | Right | Left | Right | Left | Right | Left |
| 21 - 30 | 17 | 17 | 0 | 0 | 0 | 0 | 0 | 0 |
| 31 - 40 | 7 | 8 | 0 | 0 | 0 | 0 | 4 | 3 |
| 41 - 50 | 2 | 3 | 0 | 2 | 1 | 0 | 8 | 6 |
| 51 - 60 | 2 | 2 | 0 | 2 | 1 | 0 | 3 | 2 |
| 61 - 70 | 0 | 0 | 1 | 1 | 0 | 0 | 4 | 4 |
| Total No. of cases | 28 | 30 | 1 | 5 | 2 | 0 | 19 | 15 |

**Table 3: Frequency of female cases and degree of fusion with respect to age group**

| Age group In years | Degree of fusion - Greater cornua in females | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Not fused | | Initiation of fusion | | Partially fused | | Completely fused | |
| | Right | Left | Right | Left | Right | Left | Right | Left |
| 21 - 30 | 17 | 17 | 0 | 0 | 0 | 0 | 0 | 0 |
| 31 - 40 | 5 | 3 | 0 | 0 | 0 | 0 | 6 | 8 |
| 41 - 50 | 0 | 0 | 0 | 0 | 1 | 2 | 9 | 8 |
| 51 - 60 | 2 | 1 | 1 | 2 | 0 | 0 | 4 | 4 |
| 61 - 70 | 1 | 0 | 0 | 0 | 1 | 0 | 3 | 5 |
| Total No. of cases | 25 | 21 | 1 | 2 | 2 | 2 | 22 | 25 |

**Table 4: Right and left greater cornua association with respect to degree of fusion**

| | | Right side | | | | Total no. of cases |
|---|---|---|---|---|---|---|
| | | Not fused | Initiation of fusion | Partially fused | Completely fused | |
| Left side | Not fused | 45 | 0 | 1 | 5 | 51 |
| | Initiation of fusion | 3 | 1 | 0 | 3 | 7 |
| | Partially fused | 0 | 0 | 1 | 1 | 2 |
| | Completely fused | 5 | 1 | 2 | 32 | 40 |
| Total no. of cases | | 53 | 2 | 4 | 41 | 100 |

**Table 5:** Mean age of degree of fusion in relation to gender

| Degree of fusion | Male | | | | Female | | | |
|---|---|---|---|---|---|---|---|---|
| | Right | | Left | | Right | | Left | |
| | Mean | SD | Mean | SD | Mean | SD | Mean | SD |
| Not fused | 31.61 | 8.9 | 32.7 | 9.48 | 32.04 | 11.3 | 28.86 | 7.63 |
| Initiation of fusion | 65 | 0 | 53.6 | 7.73 | 58 | 0 | 55 | 0 |
| Partially fused | 53 | 4.24 | 0 | 0 | 55 | 14.14 | 43 | 2.83 |
| Completely fused | 50.74 | 9.88 | 51.4 | 11.08 | 48 | 10.01 | 48.92 | 10.98 |

## 5. Discussion:

Identification of the dead is an arduous task. But this task is mandatory according to the prevailing laws of the land. Availability of antemortem and postmortem information play an important role in easing this quandary. However, these identification features are ineffectual in cases involving advanced stages of decomposition.[6]

Aging is a continuous physiological and biological process which is inevitable and irreversible. Among parameters used to assess the age, skeletal remains are fairly accurate. Skeletal remains can even be used decades after death as it resists putrefaction. They are useful even if only fragments are recovered. This estimation of age from bones is most accurate in the first two decades of life, but variations increase as the age advances. To reduce this variation, numerous studies have been done on various skeletal indicators.

To estimate the age, X-ray of the hyoid bone was taken to look for the degree of fusion of the greater cornua with the body. It was observed that in the age group of 21-30 years (3rd decade of life), none of the hyoid bones were fused (0/34). In a similar study, Harjeet et al observed no fusion till the age of 25 years.[5] But from 26 to 30 years, bilateral non-fusion was noted in 58.54% cases, bilateral initiation of fusion in 9.76% cases, unilateral partial fusion in 7.32% cases, and bilateral complete fusion in 9.76% cases. However, Aysun Balseven-Odabasi et al[7] observed unilateral fusion in 20% of cases and bilateral fusion in 50% of cases. Deepak H D'Souza et al[8] found unilateral fusion in 24% cases and bilateral fusion in 6% cases. A. Gupta et al[9] discerned that only 10% of cases showed unilateral fusion.

Between the age of 31-40 years, 54.55% of cases (12/22) had not fused, whereas 45.45% of cases (10/22) exhibited complete fusion on the right side. On the left side, 50% of cases (11/22) showed non-fusion, and 50% of cases (11/22) showed complete fusion. For the same age group, Harjeet et al[5] noted bilateral non-fusion in 49.25% cases, bilateral initiation of fusion in 5.97% cases, bilateral partial fusion in 1.49% cases, and bilateral complete fusion was seen in 20.9% cases. Aysun Balseven-Odabasi et al[7] observed unilateral fusion, bilateral fusion and no fusion was seen in 45%, 40% and 15% of cases respectively. Deepak H D'Souza et al[8] noted unilateral fusion, bilateral fusion and no fusion was seen in 43%, 37% and 20% of cases respectively. A. Gupta et al[9] observed unilateral fusion, bilateral fusion and no fusion in 21.43%, 14.29% and 64.29% of cases respectively.

In the 5th decade of life, 9.52% of cases (2/21) showed no fusion, 9.52% of cases (2/21) showed partial fusion, and 80.95% of cases (17/21) showed complete fusion on the right side. However, 14.29% of cases (3/21), 9.52% of cases (2/21), 9.52% of cases (2/21), and 66.67% of cases (14/21) showed no fusion, initiation of fusion, partial fusion, and complete fusion on the left side respectively. Harjeet et al[5] noted bilateral non-fusion seen in 35.71% cases, unilateral initiation of fusion in 3.57% cases, bilateral partial fusion in 10.71% cases, and bilateral complete fusion in 35.71% cases. Aysun Balseven-Odabasi et al[7] discerned unilateral fusion, bilateral

fusion and no fusion in 38.89%, 50% and 11.11% of cases respectively. Deepak H D'Souza et al[8] detected unilateral fusion, bilateral fusion and no fusion in 37.5%, 31.25% and 31.25% of cases respectively. For A. Gupta et al[9] unilateral fusion, bilateral fusion and no fusion was seen in 17.65%, 27.45% and 54.9% of cases respectively.

In the age group of 51-60 years, no fusion was seen in 30.77% of cases (4/13), 7.69% of cases (1/13) showed initiation of fusion, 7.69% of cases (1/13) showed partial fusion, and 53.85% of cases (7/13) showed complete fusion on the right side. Regarding the left side, 23.08% of cases (3/13), 30.77% of cases (4/13), and 46.15% of cases (6/13) showed no fusion, initiation of fusion and complete fusion respectively. For the same age group, Harjeet et al[5] noted bilateral non-fusion in 22.22% cases, unilateral partial fusion in 22.22% cases, and bilateral complete fusion in 44.44% cases. Aysun Balseven-Odabasi et al[7] observed that bilateral fusion and no fusion was seen in 88.89% and 11.11% of cases respectively. In the study by Gupta et al,[9] unilateral fusion, bilateral fusion and no fusion was seen in 15.15%, 69.7% and 15.15% of cases respectively. Between the age of 61-70 years, it was observed that 10% of cases (1/10) had no fusion, 10% of cases (1/10) had initiation of fusion, 10% of cases (1/10) had partial fusion, and 70% of cases (7/10) had complete fusion on the right side. However, 10% (1/10) of cases showed initiation of fusion and 90% (9/10) of cases showed complete fusion on the left side. Harjeet et al[5] noticed bilateral non-fusion in 42.11% cases, unilateral initiation of fusion in 10.53% cases, bilateral partial fusion in 5.26% cases, and bilateral complete fusion in 21.05% cases. Aysun Balseven-Odabasi et al[7] noted bilateral fusion in 100% of cases. In the age group of 51-70 years, Deepak H D'Souza et al[8] observed that unilateral fusion, bilateral fusion and no fusion was seen in 60%, 30% and 10% of cases respectively. Between the age of 61-65 years, A. Gupta et al[9] observed bilateral fusion in 100% of cases. Only Harjeet et al. classified the degree of fusion of the greater cornua with the body of the hyoid.

In this study, 10 cases showed unilateral complete fusion (either right or left side completely fused, while the other side showed no fusion). Of cases which showed unilateral fusion, right-sided and left-sided unilateral complete fusion was seen in 50% of the cases each. The proportion of unilateral complete fusion of greater cornua with the body in each age group contributes to 70%, 20% and 10% of cases in 31-40 years, 41-50 years, and 61-70 years respectively. However, Harjeet et al observed that 3$^{rd}$, 4$^{th}$, 5$^{th}$, 6$^{th}$ and 7$^{th}$ decade and above showed 26.92%, 34.62%, 7.69%, 11.54% and 19.23% of cases with unilateral complete fusion respectively.

The incidence of bilateral complete fusion among all the (100) cases studied was 32% and out of which the maximum number of cases were observed between the age group of 41 to 50 years that accounts for 40.63% cases. Bilateral complete fusion of greater cornua with the body of the hyoid bone was seen in 21.88%, 15.63% and 21.88% of cases in the age group of 31 to 40 years, 51 to 60 years and 61 to 70 years respectively. However, in a study by Harjeet et al, it is observed that 3$^{rd}$, 4$^{th}$, 5$^{th}$, 6$^{th}$ and 7$^{th}$ decade showed 10%, 35%, 25%, 20% and 10% of cases with bilateral complete fusion respectively.

The earliest bilateral complete fusion of the greater cornua with the body was seen at the age of 32 years. On the contrary, even at 65 years the hyoid bone was found unfused bilaterally (initiation of fusion was seen on both the sides). There is no significant statistical difference between the fusion of right and left greater cornua with the body of the hyoid bone. This observation is supported by studies by Deepak H D'Souza et al, Achintya Biswas et al[10], Harjeet et al, Miller et al[11] where the authors found no statistically significant difference among the two sex groups. However, Gupta et al found the bilateral fusion occurs 5 years earlier in females when compared to males.

The mean age of complete fusion of greater cornua for males is 50.74 $\pm$ 9.88 years and 51.4 $\pm$ 11.08 years on the right and left side respectively. However, for females the mean age of complete fusion of greater cornua is 48 $\pm$10.01 years and 48.92 $\pm$ 10.98 years on the right and left side respectively. Mean age for all the cases with bilateral complete fusion is 50.44 $\pm$ 10.283 years, whereas the mean age for males and females with bilateral complete fusion were 52.77 $\pm$ 10.895 years and 48.84 $\pm$ 9.816 years respectively. However, Deepak H D'Souza et al[8] observed that the mean age of bilateral fusion for males and females were 41.77 years and 45 years respectively. Achintya Biswas et al[10] found the mean age of fusion for males and females to be 53.16 years and 48.5 years respectively.

This study showed that as the age advances, the incidence of degree of fusion of greater cornua with the body of hyoid bone increases. In our study, 7 out of 10 cases in the age group of 61-70 years showed complete bilateral fusion of the greater cornua with the body of the hyoid bone, which accounts for 70% of cases (maximum). This observation was reinforced by Gupta et al, with 100% bilateral fusion of hyoid bones after the age of 60 years. On the contrary, Harjeet et al concluded that only 21.05% cases above the age of 60 years showed bilateral complete fusion.

**6. Conclusion:**

Based on the observations of our study, we were able to conclude that:

1. The mean age for bilateral complete fusion of greater cornua with the body of hyoid bone is **50.44 ± 10.283** years.
2. The mean age for bilateral complete fusion of greater cornua with the body of hyoid bone in males is **52.77 ± 10.9** years.
3. The mean age for bilateral complete fusion of greater cornua with the body of hyoid bone in females is **48.84 ± 9.82** years.

**Limitations:** The sample size was small for establishing a concrete conclusion. Future studies with a larger sample size need to be considered for more reliable results.

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*Original Research Article*

# Estimation of Age from the Rib by Phase Analysis - An Autopsy Study in Population of Central India

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**Key words:**
Age estimation,
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Abstract

**Introduction:** The rib technique has certain advantages over the pubic symphyseal method. Metamorphosis in the rib is detectable well beyond the maximum age that can be estimated reliably from the pubic symphysis. Aim of this study is to test the reliability and accuracy of Iscan's phase analysis method in estimation of skeletal age at death from fourth rib & to find out mean age for each phase in male & female population of central India. **Material & Methods:** As per defined inclusion & exclusion criteria the dead bodies brought for autopsy were selected & the costochondral junction of right & left fourth rib of 128 dead bodies of known age and sex were removed, processed and examined by phase analysis depending upon component stages. Findings were graded using phase analysis method originally used by Yasar Iscan & Padmakumar et.al. Each rib was placed in one of the phases extending from '1' to '8'. **Results:** Out of total 128 samples, 90 were of male (70.31%) and 38 were of female (29.69%) gender. Maximum number of male sample fall in phase 6 followed by phase 2, however most of female samples fall in phase 2 and 3. The morphological changes initiate earlier in female than male. No significant inter costal phase variation seen between right ribs and their left side counterpart. The most rapid changes were seen in phases 1 to 4 with an interval of 5 - 8 years. Statistical analysis inferred that phage analysis method of age estimation is safe and reliable in population of Central India. **Conclusion:** The age of unknown dead bodies can be estimated within range of ± 2 to 5 years up to 45 years of age by phase analysis. The phase analysis method was found to be useful in Central Indian population in both sexes, except in phase 6 to 8 where age can be determined only within a wide range.

## 1. Introduction

Identification of a person is important as it may pose many problems from medico legal point of view, especially in unknown dead bodies, decomposed/mutilated bodies and of skeletal remains. Accurate identification is mandatory for the establishment of corpus Delecti after

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homicide since unclaimed bodies, portion of dead body or bones are routinely brought to medical experts for examination. Determining age at death has always been considered the most challenging of the four main identifiers, especially in the adult skeleton.[1] After the age of 25 years, estimation of age becomes more uncertain, whether in living or dead. Microscopic method of age estimation is expensive and requires more time, equipment and skill. It is therefore not practicable. The macroscopic methods are faster and do not involve destruction of the specimen. The principle macroscopic changes found are closure of cranial sutures, metamorphosis of the pubic symphysis and degenerative changes in vertebral bodies and joints.

Iscan and associate developed two techniques (component and phase analysis) to determine age by direct examination of sternal extremity of the rib. Phase analysis was based on nine metamorphic stages (phases) observed in bones of both sexes of Whites.[2] The rib technique has certain advantages over the pubic symphyseal method. Metamorphosis in the rib is detectable well beyond the maximum age that can be estimated reliably from the pubic symphysis. Another factor is that rib is not directly affected by the stress of pregnancy and parturition as in the pelvic region. Histologically the most important factor underlying the observed changes is the continuous periosteal deposition of new bone, possibly accompanied by perichondral ossification. Thus, the “deepening” of the pit seen with increasing age is actually a build-up of periosteally produced walls of bone surrounding the sternal extremity of the rib and extending over the costal cartilage. Another factor, endosteal resorption, must also be considered. Following ossification of the growth cartilage, the sternal extremity of the rib has no active growth zone. However, endosteal resorption continues at an even greater rate than periosteal deposition, thinning, and in some cases eventually eroding through the floor of the junction.[3]

Aim of this study is to test the reliability and accuracy of Iscan’s phase analysis method in estimation of skeletal age at death from fourth rib & to find out mean age for each phase in male & female population of central India.

**2. Material & methods:**

The present observational study was carried out in the Morgue and the Department of Forensic Medicine and Toxicology, of Government Medical College from Maharashtra, a post graduate and undergraduate training institute. As per defined inclusion & exclusion criteria the dead bodies brought for autopsy were selected during the study period. Right and left 4$^{th}$ ribs of 128 dead bodies of known age and sex were removed, processed and examined by phase analysis depending upon component stages. Information about case including age was recorded in a prepared Performa, based on documents presented for conduction of post mortem & details as narrated by family member.

**Case selection criteria*:***

**Inclusion criteria:**

1. Individuals above 17 yrs.
2. Individuals of known age and sex.

**Exclusion criteria:**

1. Individuals with deformed or diseased ribs.
2. Cases of Road traffic accident with chest trauma.
3. Cases whose age not surely known.
4. Unknown bodies

The specimens were separated from body during autopsy by cutting at two points i.e., 3 cm inner to and 5 cm outer to costochondral junction using a rib cutter without damaging the costochondral junction. Scissors were utilized for cutting the muscles attached to the ribs. The portion of ribs was labeled and kept in water containers for three to four weeks. The remaining soft tissue and cartilages were removed by keeping the bones in boiling water for ten to fifteen minutes. Bones were thoroughly dried at room temperature and each rib was examined to ascertain the stage of morphological change. Based on metamorphosis of the features the specimens were separated into eight groups- phases 1 to phases 8. Phase 0 was excluded from study as all samples were of age above 17 years as changes in rib morphology are observed only after age of 17 years. These phases will be developed on changes noted in the form, shape, texture and overall quality of costochondral junction of ribs.

For determination of phase of each rib pit depth (component I), pit shape (component II), and rim and wall configuration (component III) were observed.

**Component I:** Pit depth- The sternal end of the rib shows one of the most apparent age-related changes detected which is the formation and deepening of a cavity (pit). The maximum depth of this pit is measured with a Vernier caliper depth calibrated to

0.1 mm. The site for taking measurement is place of maximum distance between the base of the pit and the adjacent anterior or posterior wall. The caliper is held perpendicular to the base of the pit.

**Component II:** Pit shape-Component II deals with changes in the shape of the pit. Initially, the pit is only a slight, amorphous indentation, which in about 1 year from its first appearance, develops into a structure which is V-shaped. The posterior and anterior walls of the rib form this V-shape. Over the next few years, the base of the V widens to become U-shaped. As age increases the walls of the pit grow thinner forming a progressively wider U.

**Component III:** Rim and wall configurations-Component III analyzes changes in the configurations of the rim and walls of the pit. The rim begins with even, consistent border around the pit that quickly adopts a scalloped but still fairly regular shape. Eventually, with advancing age the rim and walls become increasingly irregular, thin and sharp.[4]

**Component Division:** Each component was divided into six stages as follow:

**Component I:** Pit depth that is the maximum depth of the pit is measured with the Vernier depth caliper calibrated to 0.1mm.

It is divided into following six stages (**Fig. 1**):

0. Flat to slight billowy extremity with no indentation (pit) greater than 1.1 mm.
1. Definite pit formation with a depth ranging from 1.1 to 2.5mm.
2. Pit depth ranging from 2.6 to 4.5mm.
3. Pit depth ranging from 4.6 to 7mm.
4. Pit depth ranging from 7.1 to 10mm.
5. Pit depth of 10.1mm or more

**Component II:** Pit shape. It is divided into the following 6 stages(**Fig. 2**):

1. No pit formation at the flat and billowy articular surface.
2. A shallow amorphous indentation.
3. Formation of V shape pit with thick walls.
4. The pit assumes a narrow U shape with fairly thick walls.
5. Wide U shape pit with thin walls.
6. Pit is still wide U shaped, yet deeper, more brittle and poore texture with some disintegration of bone.

**Component III:** Rim and wall configuration. It is divided into following six stages(**Fig. 3**):

0. Smooth regular rim with no wall formation.
1. Beginning walls with a thick, smooth regular rim.
2. Definite visible walls that is thick and smooth with a scalloped or slightly wavy rim.
3. The scalloped edges are disappearing wall are thinning yet the walls are fairly without significant deterioration in the texture.
4. The rim is becoming sharper and increasingly irregular with more frequent bony projection, often more pronounced at the cranial and caudal margins. The walls Shows further thinning cranial and are less sturdy with noticeable deterioration in texture.
5. Texture shows extreme friability and porosity, rim is very sharp, brittle and highly irregular with long bony projection. Occasionally windows are formed in areas where the walls are incomplete.[5]

**Figure 1: Component I Pit Depth Stages**

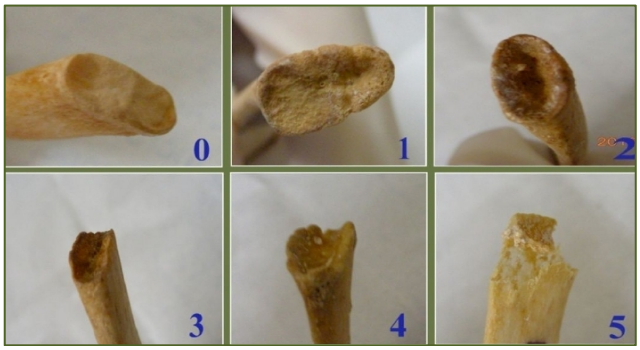



**Figure 2: Component II Pit Shape Stages**

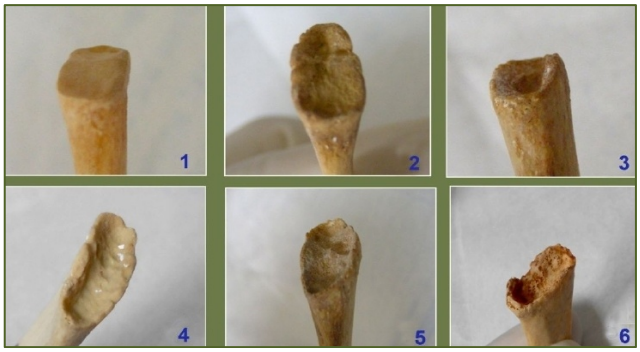
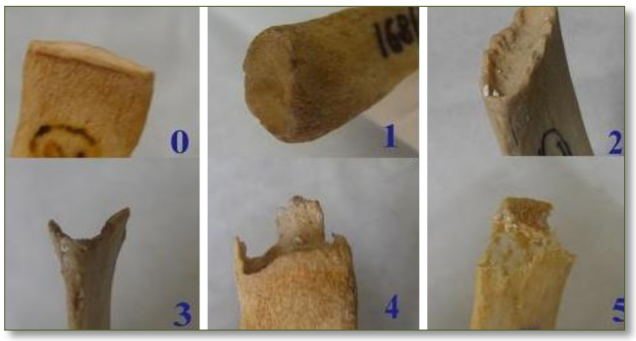



**Figure 3: Component III Rim and wall configuration Stages**



**Component I:** (0) nearly flat, billowy surface. (1) There is no pit formation pit has formed to a maximum depth of 1.2mm. (2) pit depth is 2.2mm. (3) pit depth is 3.7mm. (4) pit depth is 3.7mm. The bony projection on the superior border of the rib in not included in the measurement. (5) Pit depth has reached 11.1mm[5] (**Figure 1**). **Component II:** (0) billowy with no pit formation. (1) Amorphous pit between the anterior and posterior walls. (2)V-shaped pit is seen. (3)U shaped pit with thick walls. (4) U shaped pit fairly thinning walls. (5) U-shape pit is shallow, badly deteriorated and sharp, irregular rim with very thin wall, badly deteriorated[5] (**Figure 2**).

**Component III:** (0) the rim rounded, regular and no wall formation. (1) The rim still smooth, rounded, with incipient wall formation defining the shallow pit. (2) The rounded, wavy, rim shows some scallops forming at the edge and thick, smooth walls. (3) no regular scalloping remains, sharpening edge of the increasingly irregular rim but still fairly dense and smooth. (4)The sharp rim which is starting to show irregular long bony projections , thinning walls along with porosity and deterioration of bone. (5) Rim very sharp, badly deteriorated, porous walls with "window" formation[5] (**Figure 3**).

**Observed Phases:** On observation of different component stages each rib was placed in particular phase (**Figure 4)** as follows:

**Phase 0:** The articular surface is flat or billowy with a regular rim and rounded edges. The bone itself is smooth, firm and very solid.

**Phase 1:** There is a beginning amorphous indentation in the articular surface, but billowing may also still be present. The rim is rounded and regular. In some cases, scallops may start to appear at the edges. The bone is still firm, smooth and solid.

**Phase 2:** The pit is now deeper and has assumed V-shaped appearance formed by the anterior and posterior walls. The walls are thick and smooth with a scalloped of slightly wavy rim with rounded edges. The bone is firm and solid.

**Phase 3:** The deepening pit has taken on a narrow to moderately U - shape. Walls are still fairly thick with rounded edges. Some scalloping may still be present but the rim is becoming more irregular. The bone is still quite firm and solid.

**Phase 4:** Pit depth is increasing but the shape is still a narrow to moderately wide U. The walls are thinner, but the edges remain rounded. The rim is more irregular with no uniform scalloping pattern remaining. There is some decrease in the weight and firmness of the bone; however, the overall quality of the bone is still good.

**Phase 5:** There is little change in pit depth but the shape in this phase is predominantly a moderately wide U. Walls show further thinning and the edges are becoming sharp. Irregularity is increasing in the rim. Scalloping pattern is completely gone and has been replaced with irregular bony projections. The condition of the bone is fairly good; however, there are some signs of deterioration with evidence of porosity and loss of density.

**Phase 6:** The pit is noticeably deep with a wide U-shape. The walls are thin with sharp edges. The rim is irregular and exhibits some rather long bony projections that are frequently more pronounced at the superior and inferior border. The bone is noticeably lighter in weight, thinner and more porous, especially inside the pit.

**Phase 7:** The pit is deep with a wide to very wide U - shape. The walls are thin and fragile with sharp, irregular edges and bony projections. The bone is lighter in weight and brittle with significant deterioration in quality and obvious porosity.

**Phase 8:** In this final phase the pit is very deep and widely U-shaped. In some cases, the floor of the pit is absent or filled with bony projections. The walls are extremely thin, fragile and brittle with sharp, highly irregular edges and bony projections. The bone is very light weight, thin, brittle, friable and porous. 'Window' formation is sometimes seen in the walls.[6]

**Figure 4: Fourth sternal rib phase 0 to 8**


**Statistical analysis:** The statistical analyses of the data were carried out using the software 'statistical package for social sciences (SPSS 16.0). The CROSSTABS PROCEDURE was done for finding out statistical significance of the distribution of samples.

They were analyzed according to the age and phase distribution. With the help of chi-square test p-value calculated. Mean age and 95% confidence interval of mean age for each phase were calculated using one way ANOVA.

**3. Results**

Out of total 128 samples, 90 were of male (70.31%) and 38 wereof female (29.69%). Maximum number of cases 39 (30.5%) were from age group of 20-29 years followed by age group 30-39 years with 25 cases, 40-49 years with 24 cases, 50-59 years with 20 cases, 60-69 years with 11 cases. Only 3 cases were in age group of 17-19 years while 6 cases were above 70 years of age. Youngest case was of 18 years old while oldest was of 85 years. Though right and left 4$^{th}$ rib of all samples differ in some component stages, all rib of both sides falls in their same respective phase. No significant inter costal phase variation found in right and left 4$^{th}$ rib. Large number of ribs fall in phase 2 i.e., 28 (21.76%) followed by phase 3 i.e.,25 (19.53%). Maximum number of male sample fall in phase 6 followed by phase 2, however most of female samples fall in phase 2 and 3. There are only one female sample which falls in phase 5, phase 6 and phase 8.

The study male sample age ranges from 18 to 85 years while female sample age ranges from 18 to 80 years. The initial morphological changes in rib (phase 1) started at 18 years in both sexes. It can be stated that initial morphological changes start early in female however thereafter delayed maturation in female rib observed in all phases except in phase 4. Age range was found to increase as phase progresses and it is 5 years in male and 4 years in female in phase 1. Age range is between 5-8 years for each phase till phase 5 and thereafter age range shows very high variability. In male it is 18 years in phase 6 and as high as 25 years in phase 8. Highest age range found in female in phase 3 and 7 and it is of 10 years. Out of all 38 female samples only one sample fall in phase 5, 6 & 8 because of which age range for these phases could not be calculated (**Table 1 & 2**).

**Table No. 1: Phase wise 95% confidence interval of mean age in male**

| | | | | | 95% ConfidenceInterval | | Age | |
|---|---|---|---|---|---|---|---|---|
| Phase | N | Mean | Std. Deviation | Std. Error | Lower Bound | Upper Bound | Minimum | Maximum |
| 1 | 11 | 20.73 | 1.421 | 0.428 | 19.77 | 21.68 | 18 | 23 |
| 2 | 16 | 25.19 | 1.974 | 0.493 | 24.14 | 26.24 | 21 | 29 |
| 3 | 15 | 32.33 | 1.952 | 0.504 | 31.25 | 33.41 | 30 | 35 |
| 4 | 7 | 42.57 | 1.902 | 0.719 | 40.81 | 44.33 | 40 | 45 |
| 5 | 9 | 45.67 | 4.416 | 1.472 | 42.27 | 49.06 | 40 | 55 |
| 6 | 17 | 52.00 | 4.243 | 1.029 | 49.82 | 54.18 | 42 | 60 |
| 7 | 8 | 58.88 | 3.227 | 1.141 | 56.18 | 61.57 | 55 | 65 |
| 8 | 7 | 69.86 | 8.591 | 3.247 | 61.91 | 77.80 | 60 | 85 |
| Total | 90 | 40.77 | 15.511 | 1.635 | 37.52 | 44.02 | 18 | 85 |

**Table No. 2: Phase wise 95% confidence interval of mean age in female**

| | | | | | 95% ConfidenceInterval | | Age | |
|---|---|---|---|---|---|---|---|---|
| Phase | N | Mean | Std. Deviation | Std. Error | Lower Bound | Upper Bound | Minimum | Maximum |
| 1 | 4 | 20.25 | 2.062 | 1.031 | 16.97 | 23.53 | 18 | 22 |
| 2 | 12 | 25.58 | 2.353 | 0.679 | 24.09 | 27.08 | 22 | 30 |
| 3 | 10 | 33.80 | 3.676 | 1.162 | 31.17 | 36.43 | 30 | 40 |
| 4 | 6 | 42.50 | 2.739 | 1.118 | 39.63 | 45.37 | 40 | 45 |
| 5 | 1 | 50.00 | - | - | - | - | 50 | 50 |
| 6 | 1 | 60.00 | - | - | - | - | 60 | 60 |
| 7 | 3 | 65.00 | 5 | 2.887 | 52.58 | 77.42 | 60 | 70 |
| 8 | 1 | 80.00 | - | - | - | - | 80 | 80 |
| Total | 38 | 35.95 | 14.805 | 2.402 | 31.08 | 40.81 | 18 | 80 |

**Table 03: Frequency distribution of phase by age intervals**

| | | Age | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Phase | | 17 to 19 | 20 to 29 | 30 to 39 | 40 to 49 | 50 to 59 | 60 to 69 | 70 to 100 | Total |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Count | 3 | 12 | | | | | | 15 |
| | % ROW | 20.0% | 80.0% | | | | | | 100.00% |
| | % COLUMN | 100.0% | 30.8% | | | | | | 11.70% |
| 2 | Count | | 27 | 1 | | | | | 28 |
| | % ROW | | 96.4% | 3.6% | | | | | 100.00% |
| | % COLUMN | | 69.2% | 4.0% | | | | | 21.90% |
| 3 | Count | | | 24 | 1 | | | | 25 |
| | % ROW | | | 96.0% | 4.0% | | | | 100.00% |
| | % COLUMN | | | 96.0% | 4.2% | | | | 19.50% |
| 4 | Count | | | | 13 | | | | 13 |
| | % ROW | | | | 100.0% | | | | 100.00% |
| | % COLUMN | | | | 54.2% | | | | 10.20% |
| 5 | Count | | | | 7 | 3 | | | 10 |
| | % ROW | | | | 70.0% | 30.0% | | | 100.00% |
| | % COLUMN | | | | 29.2% | 15.0% | | | 7.80% |
| 6 | Count | | | | 3 | 13 | 2 | | 18 |
| | % ROW | | | | 16.7% | 72.2% | 11.1% | | 100.00% |
| | % COLUMN | | | | 12.5% | 65.0% | 18.2% | | 14.10% |
| 7 | Count | | | | | 4 | 6 | 1 | 11 |
| | % ROW | | | | | 36.4% | 54.5% | 9.1% | 100.00% |
| | % COLUMN | | | | | 20.0% | 54.5% | 16.7% | 8.60% |
| 8 | Count | | | | | | 3 | 5 | 8 |
| | % ROW | | | | | | 37.5% | 62.5% | 100.00% |
| | % COLUMN | | | | | | 27.3% | 83.3% | 6.20% |
| | Count | 3 | 39 | 25 | 24 | 20 | 11 | 6 | 128 |
| | % ROW | 2.30% | 30.50% | 19.50% | 18.80% | 15.60% | 8.60% | 4.70% | 100.00% |
| Total | % COLUMN | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% |

The CROSSTABS PROCEDURE was done for finding out statistical significance of the distribution of samples. They were analyzed according to the age and phase distribution and observation are shown in above **table 03**. As shown in above **table 03**, in phase 4 all specimens belonged to a single decade. The age groups twenty to twenty-nine, thirty to thirty-nine, forty to forty-nine & fifty to fifty-nine, sixty to sixty-nine and above seventy showed changes belonging to adjacent phases.

**Table no. 4: Chi-Square Tests**

| | Value | Df | p-value |
|---|---|---|---|
| Pearson Chi-Square | 429.2 | 42 | 0 |

After statistical analysis using chi square test (**Table 4**), the Pearson's Chi-square value obtained was 429.2 with degree of freedom=42. Degree of freedom= (row-1) x (column -1). From these values P value was estimated and obtained as p=0.000.

From these statistical values it can be inferred that phage analysis method of age estimation is safe and reliable in population of Central India.

## 4. Discussion

The costochondral junction of right & left fourth rib of 128 individuals were examined of which 90 samples were of male & 38 samples were of females. Findings were graded using phase analysis method originally used by Yasar Iscan & Padmakumar et.al. Each rib was placed in one of the phases extending from '1' to '8'. Maximum numbers of samples were from age group of 20 to 29 years i.e.,30.5%, however from age group of 17-19 years there were only 3 samples. In study of Iscan et al.[2] and that of Padmakumar et al.[6] study on Indian females also maximum numbers of cases were from age group of 20 to 29 years.

In present study, though right and left 4$^{th}$ rib of all samples differ in some component stages, all rib of both sides falls in their same respective phase. No significant inter costal phase variation found in right and left 4$^{th}$ rib in present study. Yoder C et al. (2001)[7] also found that there was no significant variation in fourth rib of both sides. Aktas et al. (2004)[8] examined intercostals variation in their study. There was some -1 or +1 variation at each rib whether left or right in

men. However, the number of cases with phase mistakes was the lowest at right 4th rib. For women, all the right and left ribs included in this study were in concordance with right 4th rib standards in all phases. Gupta P. et.al (2007)[9] found no significant changes in metamorphic developments at the sternal end of fourth rib of the two sides in Punjab population. Meena M.C. et.al (2012)[10] concluded that in male phase variation between right and left fourth ribs was not significant.

Results of present study are in accordance with various studies discussed above. In present study male sample age range from 18 to 85 years with mean age of 40.77 and standard deviation of 15.51, while female sample age ranges from 18 to 80 years with mean age of 35.95 and standard deviation of 14.80. The initial morphological changes in rib (phase 1) started at 18 years in both sexes with 20.73 mean age in male and 20.25 in female. It can be stated that initial morphological changes start early in female however thereafter delayed maturation in female rib observed except in phase 4. After calculating mean age for each phase from 1 to 8 it can be stated that as phase progresses common mean age increases. Common mean age and mean age in male and female in present study increases as phase progresses. These findings are similar to findings in study of Iscan et al.[4] in white population and Padmakumar et al.[6] in Kerala population. After comparing mean age with that of white male population studied by Iscan et al.[4] it can be stated that Indian population shows delayed changes in rib morphology.

Age range was found to increase as phase progresses and it is 5 years in male and 4 years in female in phase 1. Age range is between 5-8 years for each phase till phase 5 and thereafter age range shows very high variability. In male it is 18 years in phase 6 and as high as 25 years in phase 8. Highest age range found in female in phase 7 and it is of 10 years. Out of all 38 female samples only one sample fall in phase 5, 6 & 8 each, age range for these phases could not be calculated. One female sample in present study shows phase 8 changes in contrast to observation of Padmakumar et al.[6] in Kerala population in which no phase changes of phase 8 found in female samples of age ranging from 60 to 100 years.

Delayed maturation in present study population in comparison to Kerala population suggests that geographical factor plays role in rib maturation. In present study width of 95% confidence interval in male samples found to increase as age advances. In phase 1 width of 95% confidence interval is 2 years and gradually rises till phase 5 attaining maximum to 16 years in phase 8. In present study width of 95% confidence interval in female samples also found to increase as age advances. In phase 1 width of 95% confidence interval is 5 years and gradually rises till phase 5 attaining maximum to 25 years in phase 7. 95% confidence interval does not vary significantly in both sexes till phase 4 however afterwards differences in 95% confidence interval seen in both sexes of these two populations. About 95% confidence interval of mean age in both sexes are very much similar to Padmakumar et al.[6] study in Kerala population till phase 4 but afterwards it varies significantly.

**Table no.03** shows that in present study initial metamorphotic changes took place from age of 18 years in male and females. These changes are in accordance with Kerala population but are delayed than white American population.[4,6] Oettlé A.C. & Steyn M. (2000)[11] also found tendency toward delayed maturation, as well as a diversion of the appearance of female ribs perimenopausally. Sarajlic N (2006)[12] found that the phase 7 Bosnians reach and finish each phase a little later than Americans. However, phases 7 and 8 were achieved and ended earlier in Bosnian population. Tyagi et al. (2009)[13] found that morphological changes are delayed in Indian population up to the age of 35 years. Comparison between present study male and study by Iscan et al. suggest that morphological changes are delayed overall in Indian males.[4] Present study male shows delayed morphological changes than Kerala population by Padmakumar et.al.[6] Initial rib changes seen at age of 18 in present study male in contrast to 17 years as in Iscan male and Padmakumar et al. (2011).[6] Delayed rib changes observed in present study females than Padmakumar et al. (2011)[6] Kerala female in initial years but faster rib changes than Kerala female as age progresses. In Padmakumar et al. (2011)[6] study none of rib showed phase 8 changes while in present study single female rib shows phase 8 changes. Comparison between rib changes in older female samples was not possible as phase 5, 6 and 8 had only single rib. Mean age in Kerala male and present study male vary in older age group only. However, in females of these two populations mean age varies significantly. 95% confidence interval does

not vary significantly in both sexes till phase 4 however afterwards differences in 95% confidence interval seen in both sexes of these two populations. Variation in mean age and 95% confidence interval of mean age in Kerala population and present study population are suggestive of role of geographical factors in rib maturation.

In present study as shown in **table 3**, CROSSTABS procedure was done for finding out statistical significance of the distribution of samples. They were analyzed according to the age and phase distribution. As shown in **table 3**, all specimens belonging to a single decade in phase 4. The age groups twenty to twenty-nine, thirty to thirty-nine, forty to forty-nine & fifty to fifty-nine, sixty to sixty-nine and above seventy showed changes belonging to adjacent phases. After statistical analysis using chi square test, the value obtained was 429.2 with degree of freedom=42. Degree of freedom= (row-1) x (column -1). From these values P value was estimated and obtained as p=0.000.

Results after statistical analysis were similar to that of Padmakumar et al. (2011)[6] study in Kerala population and from this observation it can inferred that phase analysis of fourth rib can safely and reliably used for age estimation in population of central India also.

**5. Conclusions**

1. The initial morphological changes in sternal end of ribs appeared from 18 years onwards. The early phase changes did not extend into higher age groups.
2. No significant inter costal phase variation seen between right ribs and their leftside counterpart.
3. The most rapid changes were seen in phases 1 to 4 with an interval of 5 - 8 years.
4. The age of individual can be estimated within range of ± 2 to 5 years up to 45years of age by phase analysis.
5. The phase analysis method was found to be useful in Central Indian population in both sexes, except in phase 6 to 8 where age can be determined only within a wide range.
6. Significant differences were found in mean age of Kerala population and present study population of central India.

**Benefits of study:**

1. The method is very simple and requires no special training.
2. Study covers subjects having wide range of age (i.e.,18 to 85 years)
3. From this study we can estimate age of deceased individual of unknown agewith variation of 2-5 years from actual age till fifth decade.
4. In females this method has upper hand over pubic symphysis as ribs are notdirectly affected by parturition or pregnancy.

**Limitations of the study:**

1. Possibility of observer's error cannot be ruled out.
2. Population in Central India is mixed type comprising of various socio- economic status, so this study is not applicable for another topographical region.
3. Dietary, economic, environmental factors are not studied in the present context.

**Recommendations:**

1. Study to correlate the finding using sternal end of 4$^{th}$ rib and pubic symphysis is required to minimize the age range in years.
2. As the numbers of subjects are less, for confirmation of various variations found in this study, further studies about correlation of age estimated by various findings for a large sample size of both sexes are required.

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*Original Research Article*

# A Profile of Suicidal Deaths- A Prospective Study.

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**Key words**
Suicide,
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Abstract

Suicide is the common problem in India as well as in world. There are various methods to commit suicide. According to figures given by NCRB, in 2014 the suicide rate in India was 10.6/1 lakh population. Investigation of death is a feature of modern day's civilized system of society. Autopsy remains the most appropriate medical tool of investigation. The present study was undertaken to estimate the profile of suicidal deaths in respect with age, sex, marital status and socioeconomic status of the deceased. The study was conducted to find out the causative factors of suicidal deaths and to suggest the measure to prevent these deaths. It is observed that the most common age vulnerable to suicidal death is 21-30 years (41.58%), majority of cases 315(56.45%) of Suicidal deaths were Male, Victim with Low Socioeconomic Status is more vulnerable to suicide compared to high, It is also a significant finding that, the married persons living in joint family are less prone for suicide. Burn 127(22.55%) is most common method to commit suicide in female. In males, poisoning 183 (32.5%) is most common method to commit suicide. Most common cause of suicide is marital dispute 231 (41.03%) followed by illicit relations 119 (21.14%). To prevent these deaths certain suggestions are concluded.

## 1. Introduction

Suicide is a global public health problem. Asia accounts for 60% of the world's suicides, at least 60 million people are affected by suicide or attempted suicide in Asia each year. Even though the pattern is changing from females towards male but today also the burden of female suicidal behavior, in terms of total burden of morbidity and mortality combined, is more in women than in men. Women's greater vulnerability to suicidal behavior is likely to be due to gender related vulnerability to psychopathology and to psychosocial stressors.[1] Suicidal deaths of married women have been an increasing trend in Indian society during the recent decayed, the most obvious reason behind such deaths is unending demands of dowry (cash / kinds) by their husbands and / or in laws, for which they torture the bride in such a way that she commits suicide, either by burning, poisoning, hanging, jumping from terrace or by some other means.

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Death investigation is a feature of modern day's civilized system of society. The causes and factors responsible for bringing about the fatal outcome require thorough investigation. It is estimated that around 20% of global suicides are due to pesticide self – poisoning, most of which occur in rural agricultural areas in low- and middle-income countries. Other common methods of suicide are hanging and firearms.[2] Latur is the district place and one of the prominent cities in Marathwada region of Maharashtra. The city is known for junior college education, growing industrial businesses and agriculture market. In last 10-15 years it is going to develop very fast in the field of education, agriculture and Industry. Suicide is clearly an important and growing problem in the city. Very few researches were conducted in the past. So, this research was conducted. This may provide a framework from which one may do intervention to prevent such deaths.

**2. Aims & Objectives:**

- To estimate demographic profile of suicidal deaths in respect to age, sex, occupation, marital status.
- To estimate various method to commit suicide
- To estimate causes of death
- To estimate motivation to commit the suicide

**3. Material and Methods:**

The present study was conducted in the Department of Forensic Medicine and Toxicology at VDGMC Latur, Maharashtra. It is a prospective, cross-sectional study. The present study was undertaken to estimate the profile of suicidal deaths in respect with age, sex, marital status and socioeconomic status of the deceased and to find out the causative factors in these suicidal deaths to suggest the measure to prevent these deaths. The study was conducted for a period from 1 April 2016 to 31 March-2018. During this period out of 1748 cases, 558 cases were of suicide cases. Ethical clearance was obtained for the study. In this study, information is collected from inquest reports, hospital papers and relevant records. External and internal examination of deceased was carried out during medico-legal autopsy. Information was collected in the form of pro-forma. Which is then analyzed and conclusions are made. Data was statistically analyzed with the help SPSS20 software, windows -7, (Microsoft word and Microsoft Excel)

**4. Results and Observations:**

**Table No-1** shows that the most common age group susceptible to suicidal death is 21 to 30 years 232 (41.58%), followed by 11 to 20 years age. The extremes of age group show fewer incidences of suicidal deaths. Maximum death occurred between 15 t0 30 years in both male and female category. Age 15 to 60 is the most active and productive period of life.

**Table: 01: Age and sex wise (M-Male, F-Female, % Percentage) distribution of victims of Suicidal Deaths (n= 558).**

| Age (yrs) | M | % | F | % | Total | % |
|---|---|---|---|---|---|---|
| 00-10 | 00 | 00 | 00 | 00 | 00 | 00 |
| 11-20 | 26 | 4.66 | 62 | 11.11 | 88 | 15.77 |
| 21-30 | 127 | 22.77 | 105 | 18.81 | 232 | 41.58 |
| 31-40 | 63 | 11.29 | 55 | 9.86 | 118 | 21.15 |
| 41-50 | 45 | 8.06 | 12 | 2.16 | 57 | 10.22 |
| 51-60 | 36 | 6.45 | 07 | 1.25 | 43 | 07.70 |
| 61-70 | 11 | 1.97 | 02 | 0.36 | 13 | 02.33 |
| 71-80 | 07 | 1.25 | 00 | 00 | 07 | 01.25 |
| Total | 315 | 56.45 | 243 | 43.55 | 558 | 100 |

**Table 2** shows that the most of the victims belong to low socioeconomic status. Lack of education, unemployment and chronic addiction commonly observed in low socioeconomical class. Modified B G Prasad's classification of Per Capita Income is taken into consideration for estimation of socio-economic status in the present study.

**Table 2: Suicidal deaths according to victim's socioeconomic status.**

| Social Class | Cases | Percentage |
|---|---|---|
| I | 44 | 07.89 |
| II | 111 | 19.89 |
| III | 198 | 35.48 |
| IV | 139 | 24.91 |
| V | 66 | 11.82 |
| Total | **558** | 100 |

**Table: 3: Trends of suicide in relation to type of family and marital status (n=558)**

| Family type | Nuclear | | Joint | | Total | |
|---|---|---|---|---|---|---|
| Marital Status | No | % | No | % | No | % |
| Married | 264 | 47.31 | 106 | 19.00 | 370 | 66.31 |
| Unmarried | 70 | 12.54 | 62 | 11.11 | 132 | 23.66 |
| widow | 02 | 00.36 | 19 | 03.41 | 21 | 03.76 |
| Divorced | 02 | 00.36 | 07 | 01.24 | 09 | 01.61 |
| Separate/Other | 18 | 03.23 | 08 | 01.43 | 26 | 04.66 |
| Total | 356 | 63.80 | 202 | 36.20 | 558 | 100 |

**Table 3** shows that in married peoples with nuclear family suicide is most common manner of death 264 (47.31%), but population of peoples with

such category is much more as compared to others so, this finding is of little significance. However, the widows living in joint family 19 (3.41%) and divorced persons living in joint family 07 (1.24%) are also seen to be more vulnerable to commit suicide. It is also a significant finding that, the married persons living in joint family are less prone for suicide and the incidence of suicidal death is 106 (19.00%) which is far less than their counter part victims.

**Table 4** shows that the most preferred method for self-immolation among females is Burn 126(22.58%). Whereas poisoning 182 (32.62%) is most common preferred method to commit suicide in male. Hanging is also accounted a major method for self-immolation. Rail cutting is not taken as method of suicide in females, and burn 33(5.91%) is not a common method of suicide in males.

**Table: 4: Methods used to commit suicide by both sexes. (n = 558)**

| Methods of suicide | Male | | Female | | Total | |
|---|---|---|---|---|---|---|
| **Cases** | Cases | % | Cases | % | Cases | % |
| **Poisoning** | 182 | 32.62 | 63 | 11.29 | 245 | 43.91 |
| **Hanging** | 92 | 16.49 | 50 | 08.96 | 142 | 25.45 |
| **Burns** | 33 | 05.91 | 126 | 22.58 | 159 | 28.49 |
| **Drowning** | 04 | 00.72 | 03 | 00.54 | 07 | 01.25 |
| **Railway Cutting** | 02 | 00.36 | 00 | 00.00 | 02 | 00.36 |
| **Fall from height** | 02 | 00.36 | 01 | 00.18 | 03 | 00.54 |
| **Total** | 315 | 56.45 | 245 | 43.55 | 558 | 100 |

**Table 5: Distribution of Deaths as per Occupation (n=558)**

| Sr No | Profession | Male | Female | Total | Percent (%) |
|---|---|---|---|---|---|
| 1 | House wife/ House hold workers | 00 | 161 | 161 | 28.85 |
| 2 | Farmer/ Agriculture work | 57 | 03 | 60 | 10.75 |
| 3 | Student | 22 | 44 | 66 | 11.83 |
| 4 | Business Man | 16 | 1 | 17 | 3.05 |
| 5 | Government Service | 13 | 2 | 15 | 2.69 |
| 6 | Daily Wages Worker | 86 | 11 | 97 | 17.38 |
| 7 | Technical Workers | 28 | 04 | 32 | 5.73 |
| 8 | Clerical/ office workers in Private sector | 32 | 04 | 36 | 6.45 |
| 9 | Medical Profession | 04 | 01 | 5 | 0.90 |
| 10 | Un-employed | 58 | 11 | 69 | 12.37 |
| 11 | **Total** | **315** | **243** | **558** | **100** |

**Table: 6: Showing Percentage wise reasons for suicides. (n = 558)**

| Causes for suicide | Male | Female | Cases | Percent (%) |
|---|---|---|---|---|
| Marital disputes | 60 | 81 | 141 | 25.27 |
| Domestic Violence on parents & In-laws | 26 | 64 | 90 | 16.13 |
| Financial Problems | 69 | 28 | 97 | 17.38 |
| Alcohol Addiction | 46 | 00 | 46 | 8.24 |
| Psychiatric illnesses | 22 | 31 | 53 | 9.50 |
| Education & Failure in examination | 08 | 04 | 12 | 2.15 |
| Unemployment | 34 | 02 | 36 | 6.45 |
| Chronic / Terminal Diseases | 05 | 00 | 05 | 0.90 |
| Failure in love | 11 | 04 | 15 | 2.69 |
| Reproductive/ Sexual Reasons | 03 | 02 | 05 | 0.90 |
| Stress of work | 07 | 06 | 13 | 2.33 |
| Delay in marriage | 04 | 02 | 06 | 1.07 |
| Old Age | 03 | 00 | 03 | 0.54 |
| Not Known | 16 | 20 | 36 | 6.45 |
| **Total** | **315** | **243** | **558** | **100** |

**Table 5** shows that the females working in home or housewives are major group among females susceptible for self-immolation than females who are working women. In male, majority were daily wages workers like Hamal, cleaner, helpers in construction work etc. Unemployed people and farmers, as well as technical workers like driver, tailor, electrician painter, plumber etc. Students are also seen to be more prone for self-immolation that may due to failure of exam or fear to fail in exam or overburden of ambitions. Student may commit suicide due to failure in love affairs. **Table 6** shows that the intent as to cause of committing suicide is varied and multifactorial. Most of the suicides are to be seen to occur due to Marital disputes 141 (25.27%) and domestic problems 90 (16.13%). Financial problems, alcohol addiction, unemployment, failure in exam and love are the reasons which stimulates self – immolation.

**5. Discussion:**

Every year 70300 people take their own life and there are many people who attempt suicide. Suicide occurs throughout the lifespan and was the fourth leading cause of death among 15–29-year old's globally in 2019. Suicide does not just occur in high-income countries, but is a global phenomenon in all regions of the world. In fact, over 77% of global suicides occurred in low- and middle – income countries in 2019.[2] Suicide is the third leading cause of death among young adults worldwide. There is a growing recognition that prevention strategies need to be tailored to the region-specific demographics of a country and to be implemented in a culturally-sensitive manner. There has been an increase in the rates of suicide in India over the years, although trends of both increases and decline in suicide rates have been present. Distinct from global demographic risk factors, In India, marital status is not necessarily protective and the female: male ratio in the rate of suicide is higher. The motives and modes of suicide are also distinct from western countries.[3]

The suicide rate in India is comparable to that of Australia and the USA; and the increasing rates during recent decades is consistent with the global trend. Data on suicide in India are available from the National Crime Records Bureau (NCRB; Ministry of Home Affairs). The suicide rates in India rose from 6.3 per 100,000 in 1978 to 8.9 per 100,000 in 1990, an increase of 41.3% during the decade from 1980 to 1990, and a compound growth rate of 4.1% per year.[4] More recent data, however, reveal a different picture. The rate of suicide showed a declining trend from1999 to 2002 and a mixed trend during 2003-2006, followed by an increasing trend from 2006 to 2010. From 2011 onwards rate of suicide remains more or less constant till 2019 except slight dip in 2017. In year 2020, there has been surge in the incidence of suicide attributed to lockdown due to COVID 19.[4] The present study was undertaken to evaluate the pattern and burden of suicidal deaths in respect with age, sex, marital status, socio-economic status of the deceased and to find out the causative factors in these suicidal deaths to suggest the measure to prevent these deaths.

Analysis of our data shows Males (n=315) outnumbered females (n=243). Male to female ratio was 1.30:1. Global statistics too indicate that males die by suicide more frequently than do females however; reported suicide attempts and suicidal ideation are more common among females. This gap is known as the "gender paradox of suicidal behaviour'. The extremes of age group show fewer incidences of suicidal deaths. This finding is very much similar to the findings of Anjanamma et al [5] Santhosh et al [6], Baruah et al[7] and Jha S et al. [8] This finding is due to the fact that the age from 15-40 years is the most active period of life, in which the peoples are generally healthy and exposed to the outer environment. It is observed that, suicides 243(43.55%) are the common manners of death in females. This finding is also nearly similar to the observations in the study of Yousufani et al [8] and Rathod et al.[9]

In this study (**Table-2**), we found that the most of the victims belong to low socioeconomic status. This finding is very much similar to the findings of Santhosh et al[6] and Baruah et al.[7] It is observed that (**Table-3)** in married peoples with nuclear family suicide is most common manner of death 264 (47.31%), but population of peoples with such category is much more as compared to others so, this finding is of little significance. However, the widows living in joint family 19 (3.41%) and divorced persons living in joint family 07 (1.24%) are more vulnerable to commit suicide. It is also a significant finding that, the married persons living in joint family are less prone for suicide and the incidence of suicidal death is 106 (19.00%) which is far less than their counter part victims. Probable explanation for this is in joint

family the divorced woman is degraded in our community and she may go in depression, however in the joint family the married men feel more secure and they remain mentally more stable even in the worst situations.

In this present study (**Table-4**) it is observed that in females Burn 126(22.58%) is method of choice to commit suicide. In males Poisoning 182 (32.62%) is most common method to commit suicide. Rail cutting is not taken as method of suicide in females, and burn 33(5.91%) is not a common method of suicide in males. This finding is similar to study of Jha et al.[8] Possible reason is that, for female, fuel (Kerosene) is easily available and they are regularly near to the fire in the kitchen. In both sex the motive for suicides is different, so as the method varies. Saraswathi et al[11] found poisoning is the commonest method in both male and females. Niraj Kumar et al[11] were found that hanging was most preferred method among males whereas self-immolation by fire was most common among females. According to Bulletin of the World Health Organization on methods of suicides three methods of suicides- hanging, pesticide suicide and firearm suicide dominate country specific suicide patterns. Hanging and pesticide suicide are more prevalent in developing Asian countries whereas firearm suicide predominates in several countries in the Americas and also in some European countries.[12]

In present study we found that the category from house wife and house hold workers include 161 (28.85%), category from daily wage workers includes 97 (17.38%). Saraswathi et al [10] found that 15.67% were housewife and 16.56% were daily wage workers, Niraj Kumar Arun Kumar Singh [11] found that 11.41% were housewife in their study. In Indian culture females are supposed to do all house hold work. They are less listened by the other family members. Most of the times family members whether they are from the side of parents or from spouse expect from women to adjust with any problems or any odd surroundings. Female may not get support from the family whenever she needed so she could not fulfill her needs or ambitions. Most of the times women are mistreated in their own house. Girls expect or look for the best after their marriage but get disappointed after marriage due to unforeseen surroundings or treatment by in laws and spouse. The uneven situations may give rise to act like suicides after marriages. Unemployed peoples and daily wage workers cause self-emollition as of financial crisis. Basic need is not to be satisfied due to financial problems which leads to stress, depression and feelings of worthlessness that brings on act of suicide.

Among the causes or intent or motive of suicide (Table-6), the most common cause is marital dispute 141(25.27%) the second most common cause of suicide is financial problems 97 (17.38%), and the third common cause is Domestic violence on parents and in laws 90 (16.13%), these three of comprises 328(58.78%) of the total cases of suicide. And Marital Disputes and domestic violence on parents and in laws comprises 231 (41.40 %) nearly similar findings observed in the study of Santhosh et al[6], Baruah et al.[7] Suicidal deaths due to alcohol addiction found in 46(8.24%) and education and failure in examination found in 12 (2.15%) cases, however Saraswathi et al [10] found that the alcohol addiction contributes 16.72% and exam failure contributes 6.27% of total suicidal deaths in his study. Children face competitive and comparison stress sometimes from parents, teachers or their friends. Unemployment, workload stress, failure of crops in the farm, uncertainty of jobs, problems like infertility and sexual problems are also give rise to act of suicide. Deepak Sharma et al [13] observed in their study that the most common manners of committing suicidal deaths were poisoning followed by hanging, burns, drowning and etc. The males outnumbered the females. More married persons committed the suicide. Their study also reveals that age group 21-30 includes most suicides. These findings of their study are similar to our study.

In females, Vinka Maini et al [14] found that poisoning is most common method for suicide which is followed by hanging, burn and drowning. However, we found that burn is the commonest method to commit suicide which is followed by poisoning, hanging and drowning. In females, family disputes were most common underlying cause for suicide in their study which is similar finding to our study.

**6. Summary and Conclusions:**

In this present study it is observed that, the young males with Low Socioeconomic Status are more vulnerable to suicidal deaths compared to counterparts. It is also a significant finding that, the married persons living in joint family are less prone for suicide, in females Burn is method of choice to

commit suicide. In males Poisoning is most common method to commit suicide, most common cause of suicide is marital dispute followed by domestic violence on parents and in laws. The females involved in domestic or household work are the more cases which is followed by daily wage workers.

**7. Recommendations:**

Suicide is not caused by any one factor, but likely by a combination of more than one factor. Depression can play a massive role in teenage suicide. Promoting overall mental health among people is the key to reducing possible suicidal thoughts. The government and concerned authorities should focus on school education programs, crisis center hotlines, screening programs that seek to identify at-risk adults and adolescents, media guidelines and efforts to limit handling dangerous weapons.

Providing effective, targeted and community-based mental health services for children and adolescents who are identified to be at risk for suicide is the primary suicide prevention tactic. Research shows that early intervention strategies that target risk factors for depression, substance abuse and aggressive behaviors and building resiliency may have promise in preventing suicide. Establishment of working relationships with other prevention programs, such as alcohol- and drug-abuse treatment programs, may enhance suicide prevention efforts.

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*Original Research Article*

# Profile of Poisoning Cases in a Tertiary Care Hospital in Tamil Nadu, South India – A 4 Year Retrospective Study

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**Key words:**
Suicide,
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Abstract

**Background:** In India the incidence of poisoning ranges between 4 and 6 for per lakh population, with poisoning being considered as the fourth most common cause of death in India. The socio-demographic and epidemiological factors are the factors that which influence the nature of the poisoning agent which have an impact in the clinical manifestations and the outcome of the poisoning patient. **Methodology:** A retrospective study was conducted in the department of forensic medicine for a period of 6 months by retrospectively analysing the data of the poisoning patients who got admitted in our hospital during the period between Jan 2015 and Dec 2019. **Results:** Among the various poisonous substances that were taken by the study subjects the most common substance used by them was cow dung powder followed by organo-compound substances, sedation tablets, rat poison and oleander seeds.76% of the patients were cured and discharged from the hospital after the treatment, 25 (8.5%) study subjects were expired, 41(14%) of them got discharged against medical advice and 3(1%) of them had absconded from the hospital during the treatment. **Conclusion:** The overall mortality rate due to poisoning was found to be 8.5%.With increasing rates of the incidence of suicide due to depression or work-related stress, there is a need for early detection and prevent further complications by creating more awareness through various help groups at the primary care level.

## 1. Introduction

Acute poisoning is one of the major causes of death particularly among young adults. Poisoning is a global problem although the associated morbidity and mortality depends on the type of poison which varies from country to country.[1] According to the medico-legal system of our country death due to poisoning is considered as an unnatural death and autopsy is being done on a routine basis.[2]

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Modern toxicology is a multi-disciplinary science that deals with identifying the exogenous chemical that is present in the biological specimen that was made available for medico-legal investigation.[3] Based on the reports of world health organization 0.4 million people die annually due to poisoning and among them more than two thirds are due to organo-phosphorous compound poisoning. The incidence is higher in developing and under-developed countries where the resources are limited.[4] In India according to the studies the incidence of poisoning ranges between 4 and 6 for per lakh population, with poisoning being considered as the fourth most common cause of death in India. Agriculture being a major occupation in India and the use of insecticides and other chemical fertilizers are very common and it is easily available and so poisoning with those agents are more common.[5]

Apart from the organophosphorus compound the other agents that are commonly used as poisoning agents are rat poison, cow dung and drugs such as benzodiazepine compounds. The socio-demographic and epidemiological factors such as geographical area, educational level, occupation, income, cultural and religious beliefs are the factors that which influence the nature of the poisoning agent which have an impact in the clinical manifestations and the outcome of the poisoning patient.[6,7] All patients with history of poisoning intake either with or without clinical manifestations needs admission in ICU(Intensive care Unit) either for organ support and further management or for observation.[8]

There are various factors that determine the course and outcome in a poisoning patient. The most important factor among them is the type of poison and apart from it, the time interval between the poison consumption and the patient presenting to the health system and the onset of multi-organ failure, as because the late presentation and the early occurrence of multi-organ failure are the important causes of mortality among poisoning patients.[9] The pattern of poisoning varies from region to region as it depends upon various factors such as availability, access to poison and socio-demographic status of an individual. Earlier studies showed organophosphates (OPs) as the most common agents of poisoning in India but recent studies have found change in the trends of poisoning with aluminium phosphate poisoning being more common.[10] Moreover periodic epidemiological studies are warranted to understand the pattern of poisoning in each region, which would help the health-care facilities to plan and reduce the poisoning-associated mortality rate the poisoning profile data would help in implementing preventive strategies in the near future. So, the present study was conducted with an objective to assess the pattern of acute poisoning cases and to study their socio-demographic determinant and the clinical outcome of victims of in a tertiary care hospital in Salem district.

**2. Methodology:**

The study was started after getting approval from the institutional ethics committee. It was a retrospective study done in the department of forensic medicine where the data of all the poisoning cases admitted in our hospital during the period of past 5 years from Jan 2015 to Dec 2019 collected from our medical records department.

All type of poisoning cases that includes chemical poisoning, drugs and pesticides were included in our study. We included patients of all age group those were got admitted in the emergency department with the history of poison intake either accidentally or intentionally. Data that were obtained from the case sheets were demographic details such as age, sex, marital status, educational qualification, and occupation. Details related to patients age, sex, marital status, occupation, type and mode of poison, place of consumption, cause of poison consumption and cause of death were taken from the hospital cases sheets.

The time of poisoning, time of hospital arrival, the lag time in reaching the hospital, and reasons for the same, and mode of transportation were noted. Data about diagnosis, any co-morbid illness, any previous history of poisoning, mode of poisoning, whether accidental/suicidal/ homicidal and any recent precipitating event were also recorded. The final outcome was measured in the form of either the patient got discharged after cure, death or patient left the hospital against the medical advice. If any of the above details were missing in a particular case those patients were excluded from the study.

All data were entered and analysed using SPSS version 24. Mean and standard deviation were calculated for all parametric variables and percentage for all frequency variables. Chi-square test was used for deriving the statistical inference between variables.

## 3. Results:

In the present study majority of the study subjects were in the age group between 10 and 30 years with only 4% of the subjects were above 30 years and 1.3% was below 10 years (table 1). Males and females were almost in equal numbers with a slight male predominance (53% vs 47%). Among these poisoning patients 56% were married with house wife constituting 27% (table 2).

**Table 1: Age wise distribution of the study subjects**

| Age group | Frequency | Percentage | Mean ± SD |
|---|---|---|---|
| **<10 years** | 4 | 1.3% | 28.8 ± 13.2 |
| **10 – 20 years** | 70 | 24% | |
| **21 – 30 years** | 136 | 46.7% | |
| **31 – 40 years** | 38 | 13% | |
| **41 – 50 years** | 20 | 6.8% | |
| **51 – 60 years** | 11 | 3.7% | |
| **>60 years** | 12 | 4.1% | |
| **Total** | 291 | 100% | |

**Table 2: Socio-demographic variables among the study subjects**

| Socio-demographic variables | | Frequency | Percentage |
|---|---|---|---|
| **Gender** | Male | 155 | 53.2% |
| | Female | 136 | 46.7% |
| **Marital status** | Married | 164 | 56.3% |
| | Unmarried | 127 | 43.6% |
| **Occupation** | Student | 66 | 22.6% |
| | House wife | 79 | 27.1% |
| | Farmer | 53 | 18.2% |
| | coolie | 39 | 13.4% |
| | Semi-skilled workers | 32 | 10.9% |
| | Others | 22 | 7.5% |

**Table 3: Profile of poisoning patients**

| Variables | | Frequency | Percentage |
|---|---|---|---|
| **Place of poisoning** | Indoor | 271 | 93.1% |
| | Outdoor | 20 | 6.9% |
| **Time of poisoning** | <12 noon | 80 | 27.4% |
| | >12 noon | 211 | 72.7% |
| **Type of poison** | OPC | 56 | 19.2% |
| | Oleander seed | 35 | 12% |
| | Rat poison | 39 | 13.4% |
| | Mosquito killers | 8 | 2.7% |
| | Sedation tablets | 45 | 15.4% |
| | Sani powder (cow dung) | 61 | 20.9% |
| | Corrosive substances | 21 | 7.2% |
| | Paraquat | 14 | 4.8% |
| | Other and unknown agents | 12 | 4.1% |
| **Nature of poisoning** | Suicidal | 286 | 98.2% |
| | Accidental | 5 | 1.8% |
| **Route of administration** | Oral | 290 | 99.6% |
| | Inhalational | 1 | 0.4% |

**Table 4: Duration of ICU stay, alcohol usage, psychiatric co-morbidity and outcome of the poisoning patients.**

| Variables | | Frequency | Percentage |
|---|---|---|---|
| **Duration of ICU stay** | <5 days | 226 | 77.6% |
| | 5 and more days | 65 | 22.4% |
| **Alcohol usage along with poison** | Yes | 28 | 9.6% |
| | No | 263 | 90% |
| **Previous history of poisoning** | Yes | 20 | 6.8% |
| | No | 271 | 93.1% |
| **Associated psychiatric co-morbidity** | Yes | 7 | 2.4% |
| | No | 284 | 97.5% |
| **First AID measures given** | Yes | 103 | 35.3% |
| | No | 188 | 64.6% |
| **Outcome** | Cured | 222 | 76.2% |
| | Expired | 25 | 8.5% |
| | Against medical advise | 41 | 14% |
| | Absconded | 3 | 1.03% |

In our study more than 90% of the patients had consumed poison in their houses and majority (73%) had taken it in the evenings. Among the various poisonous substances that were taken by the study subjects the most common substance used by them was cow dung powder followed by organo-compound substances, sedation tablets, rat poison and oleander seeds. About 4% of poisonous agents used by the patients were found to be unknown. Oral route was the route of administration of the poison that was followed by almost all the patients (table 3). Majority (77.6%) of the patients required ICU admission for less than 5 days and the mean duration of ICU stay was 3.74 days. The alcohol consumption along with poisonous agent was present in less than 10% of the study subjects. In our study past history of poison intake was present in only 7% of the subjects and

2.5% of them had associated psychiatric illness. After consuming the poisonous substance 35% of the patients had received first aid measure before coming to our hospital and the commonest type of first aid received by them was stomach wash. In our study 76% of the patients were cured and discharged from the hospital after the treatment, 25 (8.5%) study subjects were expired, 41(14%) of them got discharged against medical advice and 3(1%) of them had absconded from the hospital during the treatment (**table 4**).

**Table 5: Multi-logistic regression analysis for the factors influencing the outcome among the poisoning patients**

| Factor | | Outcome | | Exp (B) | 95% CI | P value |
|---|---|---|---|---|---|---|
| | | Recovered | Death/AMA | | | |
| **Age** | <30 (n=210) | 152 (72.3%) | 52 (26.7%) | 0.666 | 0.29 – 1.50 | 0.329 |
| | >30 (n=81) | 71 (87.6%) | 16 (12.4%) | | | |
| **Gender** | Male (n=155) | 104 (67%) | 32 (33%) | 1.11 | 0.56 -2.17 | 0.761 |
| | Female (n=136) | 119 (87.5%) | 36 (12.5%) | | | |
| **Marital status** | Married (n=164) | 129 (78.6%) | 34 (21.4%) | 1.091 | 0.52-2.25 | 0.814 |
| | Unmarried (n=127) | 94 (74%) | 34 (26%) | | | |
| **Stay in ICU** | <5 days (n=226) | 164 (72.5%) | 63 (27.5%) | 0.198 | 0.07-0.54 | **0.002** |
| | >5 days (n=65) | 59 (90.7%) | 5 (9.3%) | | | |
| **Presence of psychiatric illness** | Yes (n=7) | 7 (100%) | 0 | 0.0003 | 0.0003-0.00032 | **0.050** |
| | No (n=284) | 216 (76%) | 68 (24%) | | | |
| **Nature of poisoning** | Suicidal (n=286) | 218 (76.2%) | 68 (23.8%) | 1874.4 | 0.0001-0.00014 | 0.070 |
| | Accidental (n=5) | 5 (100%) | 0 | | | |
| **Alcohol consumption** | Yes (n=28) | 21 (75%) | 7 (25%) | 1.075 | 0.37-3.05 | 0.892 |
| | No (n=263) | 202 (76.8%) | 61 (23.2%) | | | |
| **First aid given** | Yes (n=103) | 78 (75.7%) | 25 (24.3%) | 1.52 | 0.79-2.90 | 0.202 |
| | No (n=188) | 145 (77%) | 43 (23%) | | | |
| **Previous history of poisoning** | Yes (n=20) | 14 (70%) | 6 (30%) | 2.98 | 0.91-9.75 | 0.070 |
| | No (n=271) | 209 (77%) | 62 (23%) | | | |
| **OPC poisoning** | Yes (n=56) | 49 (87.5%) | 7 (12.5%) | 3.52 | 1.14-10.82 | **0.028** |
| | No (n=235) | 174 (74%) | 61 (26%) | | | |
| **Oleander** | Yes (n=35) | 30 (85.5%) | 5 (14.5%) | 4.164 | 1.17-14.82 | **0.028** |
| | No (n=256) | 193 (75%) | 63 (25%) | | | |
| **Rat poison** | Yes (n=39) | 31(79.5%) | 8 (19.5%) | 2.128 | 0.68-6.64 | 0.193 |
| | No (n=252) | 192 (76%) | 60 (24%) | | | |
| **Sani powder** | Yes (n=61) | 42 (68.8%) | 19 (31.2%) | 1.409 | 0.52-3.80 | 0.498 |
| | No (n=230) | 181 (78.5%) | 49 (21.5%) | | | |
| **Sedation tablets** | Yes (n=45) | 37 (82.2%) | 8 (17.8%) | 3.467 | 1.04-11.54 | **0.043** |
| | No (n=246) | 186 (75.6%) | 60 (24.4%) | | | |
| **Corrosive agents** | Yes (n=21) | 16 (76%) | 5 (24%) | 1.255 | 0.3-5.24 | 0.756 |
| | No (271) | 207 (76.3%) | 63 (23.7%) | | | |

A multi-logistic regression analysis was done to assess the various factors influencing the outcome in the poisoning patients, by measuring the outcome in the form of either recovered, death or discharged against medical advice. Among the various factors, stay in ICU for less 5 days found to have a significantly favorable outcome compared to stay for more than 5 days and patients with associated psychiatric co-morbidity the rate of recovery was found to be more ($p<.05$). Among the various poisonous compounds used by our study subjects a favorable outcome was seen with OPC poisoning, oleander seeds and sedation tablets in which the death rates were lower compared to the death rate that was occurred due to rat poison or cow-dung powder and the difference was also found to be statistically significant ($p<.05$). All other demographic factors such as age, gender and marital status did not have statistically significant

difference with respect to the outcome of the poisoning patients, similarly other factors that were associated with consumption of poison such as associated psychiatric morbidity, influence of alcohol, previous history of poison intake, first aid given before arrival to our hospital and the nature of poison intake did not influence the outcome of the patient (p>.05) (**table5**).

**4. Discussion:**

This retrospective record analysis of patients who had consumed poison was intended to study the socio-demographic details of the patients and the factors that had influenced the subjects to consume poison and the factors which had influenced on the outcome of these patients. The present study revealed that majority of the patients were in the age group of less than 30 years, with males were slightly being more involved than females, and this was the pattern to be seen in most of the studies that were done earlier.[11,12] Suicidal type of poisoning (98%) was found to be much more common than accidental poison intake and considering the current trend, with more than 70% of the patients who tried committing suicide were in the age group of less than 30, being the most productive age group and men still being considered as the sole breadwinner inmajority of the Indian families and such a trend seems worrying. As mentioned by Kanchanand Roshan Mathew et al in the study conducted from south India and North India respectively, in our study also we found that increase stress in jobs, huge loss met the farmers due to their agriculture lands, lack of employment, pressure among the peer groups, and conflicts with in the family members were few of the reasons mentioned by the patients for taking this extreme step.[13,14]

In the present study the most common poisonous agents used by the patients are cow dung powder followed by organo-compound substances, sedation tablets, rat poison and oleander seeds.This finding was almost similar to the previous studies where they had mentioned pesticides were the most commonly used agents.[15] A recent study conducted in Tamil Nadu showed that organophosphorus compound poisoning constituting 58.6% followed by rat poison which was the second most common agent.[16] In our study consuming of excess of sedation tablets was also found to be the most common agent which shows that patients are able to get the hypnotic drugs directly from the pharmacy as over the counter medication without the prescription of doctors and so a more stringent law should be in place to monitor the pharmacy for not giving any sedation tablets over the counter without a doctor's prescription. Drug overdose constituted a significant number in recent studies even when pesticides were found to be the most common cause.[17,18]

A study in UK, in 2001, showed a substantial increase in self-poisoning with paracetamol and that with non-opiate analgesics, which rose from 48%, in 1985, to 60.6%, in 1997.[19] A recent study done by Vibah C Santosh in 2018 had found that the most common drugs that were used for committing suicide were paracetamol and analgesics which constitutes around 26.4% and the other drugs that were used are sedatives, antipsychotics, antiepileptic, antihistamines bronchodilators, and thyroxine.[20]Eddleston in his study in the year 2000 had reported that self-poisoning with drugs was being increasingly reported more in urban areas compared to rural areas.[21]A study recently done in a corporate hospital in New Delhi had reported benzodiazepines as a most common agent which is almost similar to the present study.[22]

The route of poisoning was oral in almost all the cases and it is similar to the results mentioned in other studies.[18-25]In the present study associated psychiatric illness was present in only 2.5% and it is much less when compared to other studies, the reason would be due to the retrospective design of the present study, where detailed questionnaire for assessing the psychiatric illness might have not administered. Similarly, the prevalence of alcohol abuse among the male patients was also less in our study when compared to the previous studies.[15-17]

The overall mortality rate in the present study was 8.5%and it was almost similar to the study done by Vibah C Santosh and in most of the other studies the death rate ranged between 1.5% and 15%.[20]The median time for the point of first medical contact among our patients was 1.15 hrs, it was time either the patient had come directly to our institute or they have received the first aid treatment outside and in our study only 35% of the patients had received the first aid care before coming to our hospital. The mean first contact time was between 1.00 and 1.30 hrs in most of the previous studies.[20-25]

In the current study all the patients reported to the emergency room with the history of poison intake were all admitted in ICU and were treated symptomatically and proper antidotes were given

after identifying the poisonous substance. Lesser the duration of stay in ICU, usage of poisonous substances such as OPC, oleander seeds and sedation tablets found to have a favourable outcome and patients who stayed in ICU for a longer duration and who had consumed poisonous agents such as cow-dung powder and rat poison showed a significantly poorer outcome and it is in sync with few other studies done earlier and in some of the studies worst outcome was seen in patients who had consumed pesticides such as organo-phosphorous compounds.[18-25]

With increasing trends in the suicide rate, there is a need of a holistic approach to manage common psychiatric illness at the primary care level which would help in preventing the people from taking extreme steps.

**Limitations:**

There were certain limitations in the present study: our study being a retrospective study we were not able to get the complete details pertaining to the poisoning patients and the patients who were discharged against medical advice were considered as not cured.

Another limitation was the sample size, still a bigger sample would be needed to further validate the trend. As the general public were worried about the compensation claim in case of snake bite and free supply of anti-snake venom in government hospitals, minimal snake bite poisoning cases were admitted in our hospital and so we were not able to see the trend in snake bite poisoning.

**5. Conclusion:**

The overall mortality rate due to poisoning was found to be 8.5%. Cow- dung powder poisoning was found to be most commonly used agent followed by OPC and sedation tablets. Patients who had stayed in ICU for more than 5 days and patients who had consumed cow-dung powder or rat poison showed a significantly poorer outcome. With increasing rates of the incidence of suicide due to depression or work-related stress, there is a need for early detection and prevent further complications by creating more awareness through various help groups at the primary care level.

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*Original Research Article*

# Common Mental Health Morbidities Among Married Women Attending A Rural Health Training Centre.

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Abstract

**Background:** Women's equality and empowerment are among the 17 Sustainable Development Goals adopted by the United Nations. Women's health plays a decisive role to attain the set goal. Promoting mental health and wellbeing is found to reinforce empowerment. This study aimed to estimate the prevalence of common mental health morbidities among married women. **Method:** The study involved 500 married women in the age group of 18-60 years attending the Rural Health Training Centre of a medical college using the purposive sampling method. The study was conducted for one year. General Health Questionnaire-12 was used to assess the mental health morbidities. Those with a score $\geq 4$ underwent psychiatrist evaluation using ICD-10 criteria for diagnosis. **Conclusion:** The most common mental health morbidity among the women was depression which was found to be 13% followed by generalized anxiety disorder which was 6.8%. However, other mental health morbidities such as panic disorder, dysthymia, panic attacks, phobia and obsessive-compulsive disorder were observed in less than 5% of the study population. Implementation of mental health policies that support women's mental health is critical for overall societal development.

## 1. Introduction

World Health Organization estimated depression to be the prime source of disability in the developing world by the year 2020. It was predicted that mental disorders will constitute 12% of the global burden of disease and this will result in approximately 15% of disability-adjusted life years lost to morbidity. It was foreseen that the impact of this major psychiatry morbidity will be suffered inordinately among the developing countries. (WHO, Mental Health Context 2003).[1] In a study conducted to assess the global burden of diseases across 204 countries and territories, it was found that depression and anxiety disorders were the two most disabling mental disorders, and both ranked among the top 25 leading causes of disease burden worldwide in 2019.[2]

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The mounting problem is further compounded by the fact that women in urban areas are more vulnerable to psychiatric morbidity due to inadequate social support and poor resources for living conditions in slum dwellings. Adding further evidence to the increased vulnerability of women to mental disorders in urban slum settings is the study done by Patel et al, who reported that the underprivileged experience poor environmental and psychological adversity. The main psychiatric disorders namely anxiety and depression are more common among urban women when compared to men and more prevalent among underprivileged women. This is further linked to the alcoholism in men and the abuse of their partners. [3]

Examination of the correlates of mental health of the women yielded violence as its one of the close associations. Hence, these findings clearly state the main factors associated with the mental well-being of women are the urban underprivileged area of residence, violence inflicted by their partners and alcohol use among their partners. The trend of mental health morbidity among the women in the urban slum is ever dynamic from the observations which have been made by different researchers.

A study done by Balbir S Deswal et al across the urban areas of Pune found that the overall lifetime prevalence of mental illness is 5.03%. The same study revealed that among women, somatic disorders and anxiety were significantly higher than men and more among unmarried women/widowed/divorcees compared to married women. Thus, there is a varying range depending on different regional, cultural, socioeconomic, and demographic patterns.[4] Our study intended to determine the prevalence of common mental health morbidities among married women attending a Rural Health Training Centre.

**2. Objective:**

- To estimate the prevalence of common mental health morbidities among married women attending a Rural Health Training Centre.

**3. Methodology**

A descriptive study was undertaken among 500 married women between the age group of 18-60 years attending Rural Health Training Centre of *Adichunchanagiri Institute of Medical Sciences, Bellur, Mandya District, Karnataka* by using the purposive sampling method. The total duration of the study was one year from Jan 2017 till Dec 2017. Using pre-tested semi-structured proforma, information on Socio-demographic and other variables were obtained. General Health Questionnaire 12 was used to assess the mental health burden in the study population. Those individuals with a score $\geq$ 4 underwent a detailed psychiatric evaluation by the psychiatrist for diagnosis using ICD- 10 Criteria. Data were analysed using MS Excel and descriptive statistics.

**4. Results**

Age-wise distribution of the study population is shown in table 1, distribution of study population based on marital status shown in table 2, distribution of study population based on socioeconomic status shown in table 3, distribution of study population based on Psychiatric Morbidity shown in table 4.

**Table 1: Age-wise distribution of the study population.**

| S. No. | Age group | Frequency (%) |
|---|---|---|
| 1 | 18 - 27 years | 50 (10) |
| 2 | 28 - 37 years | 200(40) |
| 3 | 38 - 47 years | 155(31) |
| 4 | 48 - 57 years | 60(12) |
| 5 | More than 58 years | 35(7) |
| **Total** | | **500(100)** |

**Table 2: Distribution of study population based on Marital status.**

| S. No. | Marital Status | Frequency (%) |
|---|---|---|
| 1 | Married | 295(59) |
| 2 | Divorced | 85(17) |
| 3 | Widowed | 70(14) |
| 4 | Separated | 50(10) |
| **Total** | | **500 (100)** |

**Table 3: Distribution of study population based on Socio-Economic Status.**

| S. No. | Socio-economic status | Frequency (%) |
|---|---|---|
| 1 | Class I | 85(17) |
| 2 | Class II | 205(41) |
| 3 | Class III | 125(25) |
| 4 | Class IV | 35(7) |
| 5 | Class V | 50(10) |
| **Total** | | **500(100)** |

**Table 4: Distribution of study population based on Psychiatric Morbidity.**

| S. No. | Morbidity of psychiatric illness | Frequency (%) |
|---|---|---|
| 1 | Depression | 65(13) |
| 2 | Generalized anxiety disorder | 34(6.8) |
| 3 | Dysthymia | 10(2) |
| 4 | Panic disorder | 22(4.4) |

| | | |
|---|---|---|
| **5** | **Panic attacks** | 4(0.8) |
| **6** | **Phobia** | 3(0.6) |
| **7** | **Psychosis** | 3(0.6) |
| **8** | **Suicidal attempts** | 2(0.4) |
| **9** | **Obsessive-compulsive disorder** | 5(1) |
| **Total** | | 148(29.6) |

The prevalence of common mental health morbidities was 29.6%. Amongst, depression was the most common mental health morbidity found in 13% of the study population followed by generalized anxiety disorder (6.8%), panic disorder (4.4%,) dysthymia i.e., persistent depressive disorder (2%) and the other mental health disorders were found in few subjects respectively.

## 5. Discussion

The coping mechanism towards psychological distress and disorders amongst men and women are not alike. "Women have a higher mean level of internalizing disorders while men show a higher mean level of externalizing disorders." Gender variance occurs predominantly in the rates of common mental disorders, wherein there is women preponderance.[5] "Common Mental Disorders (CMDs) are depressive and anxiety disorders that are typically encountered in community and primary care settings."[6] Women are one and a half to two times more likely to suffer from CMDs as compared with men.[7] In this study, the prevalence of common mental health morbidities was found to be 29.6% according to ICD 10 criteria.

In a population-based study conducted to study the association of socio-economic, gender and health factors with common mental disorders among the married women of rural India, the researchers reported that the prevalence of CMDs was 10.7 % in their study sample. The authors concluded that socio-economic and gender disadvantage have an independent association with common mental disorders in women.[8]

Intimate partner violence, lack of independence in decision making, lack of assistance for daily activities, early marriage and childbearing during adolescence are certain examples of gender disadvantage. In a community survey conducted at Goa, India to determine the association of factors indicative of gender disadvantage and reproductive health with the risk of common mental disorders in women, it was found that the risk of CMDs was significantly higher among individuals who had been married during teenage years, those who had reduced independence in decision making and among the women who received less support from their families.[9] In the present study, most of the study subjects had depression (13%) followed by generalized anxiety disorder (6.8%). Similarly, a higher incidence of depression and anxiety disorders was reported in women and have been related to violence, sexual abuse, stress related to pregnancy and hostile socio-cultural customs.[10] Hormones related to the reproductive cycle also plays a part in increasing the susceptibility of women to depression.[11]

Drunkenness and alcohol abuse by the husband is linked with poor mental health and spousal violence amongst married women in India. A study reported that there is a two to threefold increase in the risk of mental health disorders among individuals whose partners are habituated to excessive alcohol.[12] As reported in the literature, the mental health of women is affected by various factors ranging from socio-economic conditions, gender disadvantage, reproductive health, early marriages, spousal addiction, and violence. A robust implementation of existing legislative measures can go a long way in reducing instances of sexual and physical violence against women, child marriage and gender disparity.

Since mental health disorders are multifactorial and the prevalence of mental health morbidities is high, it calls for further research on associated factors and strategies to prevent the occurrence of the common mental health disorders which would pave the way to attain the sustainable development goal of gender equality and empowerment of women set by the United Nations.[13] Combined efforts from legislators, judiciary and effective implementation of criminal justice response can contribute to improving women's mental health.

## 6. Conclusion

In the present study, depression and generalized anxiety disorders were the most prevalent mental health ailment among married women. Since studies conducted across the country have suggested that women are more vulnerable, tackling the risk factors is crucial to reduce the mental health morbidity among them. Planning strategies to educate women about their rights and

legal avenues available for them to address physical/ sexual violence against them is essential. Hence, implementing mental health policies that support women's mental health is critical for overall societal development.

**Limitations:** The study is conducted in the hospital setup using purposive sampling hence the findings of the study cannot be generalized.

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**Contributor ship of Author:** All authors have equally Contributed.

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*Original Research Article*

# Forensic Characterization of Waterbodies In Malnad Region By Diatomological Mapping.

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**Key words:**
Diatom test, Drowning, Diatomological mapping.

Abstract

**Background**: The 'Diatom test' is a reliable method which helps to determine the cause of death due to drowning based on quantitative and qualitative analysis of diatoms in human body and reference water sample. Positivity of this test is considered as an indicator of antemortem drowning. **Methods**: It was a prospective study where Samples were collected from ten different water bodies which included lakes, rivers, canals and reservoirs, for a period of one year and all the seasons were included by sampling once in two months and totally six samples of water were collected. The pH and temperature of water were recorded during sampling. From each of water samples, diatoms were extracted using concentrated nitric acid method. The sample was centrifuged, the resultant aspirate was poured over a clean microscopic glass slide, dried and analyzed with optical compound microscope fitted with light source at different magnifications. **Result:** The results show that, Total 22 genera of diatoms were identified. Most of them were pennales and few were centrales. Diatoms like Navicula, Cymbella and Synedra were present commonly in almost all water bodies, Melosira, Achnanthes and Brachysira were particularly seen in Lake water, Diatoma and Thalassiosira were commonly present in River water. Amphora and Ctenophora were commonly found in Lake water. Eunotia pectinalis and Tabellaria were particular to dam water. Thalassiosira, Surirella, Diatoma Cocconeis, Cyclotella were more commonly found in flowing water bodies. Melosira, Ctenophora, Brachysira, Achnanthes, Fragillaria were common to stagnant waters. **Conclusion:** Diatomological Mapping is a new tool in Forensic Biology as well as in Forensic Medicine, it must be constructed as organized research database.

## 1. Introduction

When a body is recovered from water, two critical questions require resolution: Was the victim alive or dead when he entered the water? Is the cause of death drowning? It is difficult to answer

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the both questions for the bodies recovered from water, especially in decomposed bodies in drowning or any other cause of death. It is also important to ascertain whether death of the person occurred at the place where the body was recovered. It imparts further necessity for the precise localization of site of drowning particularly when the body is found on land and no reference water body is available, or when the body is found away from the actual site of drowning which may be due to flow of water or any other reason.[1]

The diatom test where analysis of diatoms could provide a supplementary evidence, answers most of the above questions raised. The diatom test for the diagnosis of drowning is based on the assumption that diatoms, which are eukaryotic unicellular algae, reach the lung with inhalation of liquid and if effective cardio-circulatory activity exists, penetrate the pulmonary filter and disseminate to organs through the blood stream. Conversely, if a corpse is submerged Postmortem, the diatoms may penetrate passively into the airways, but, owing to the lack of cardiac activity, will not be transported to other organs.[2] Acid digested extracts of various internal organs demonstrate the presence of diatoms similar to those found in the drowning medium. Various genera and species of diatoms establish themselves within the specific water bodies based on their nutrient and light requirements and therefore they can differ from one water body to another both qualitatively and quantitatively with climatic or seasonal changes.[3] Some local factors like mineral content of water, temperature, water stratification, acidity, the distance from shore, the depth of sea and the tide, etc. do affect the diatom concentration in any water bodies.

Study of diatom flora over a period of time from different types of water bodies can be used as a suitable tool for generating Diatom profiles, which can be used not only as a standard for comparison with the diatom flora found in the tissues of drowned victims but also can be utilized to generate diatomological Maps which records the profiles of diatom flora of any water body with seasonal variation.[4] The foremost Global Burden of Disease (GBD) study by the World Health Organization (WHO) and the World Bank demonstrated that drowning is one of the most common causes of death throughout the world and reported 5,04,000 deaths due to drowning.[5] Hence here an attempt has done to collect and analyze water samples from different freshwater bodies likes rivers, lakes, dams, canals etc., from different parts of Malnad region for diatom distribution pattern and their seasonal variations. Thus, to create a profile of diatoms or diatomological map in at least ten water bodies of this area to help in positive diagnosis of drowning.

## 2. Materials and method

### 2.1 Materials used for analysis

1. **Plastic Water Sampling Jar of one litre capacity**
2. **Laboratory Thermometer** (from -5° C to +100°C with 0.5°C divisions)
3. **pH meter**- ESICO, Model 1012 microprocessor-based pH system
4. **Conc. Nitric Acid** - for extraction of diatoms by chemical digestion method
5. **Sterile conical measuring glass jar**- used to hold the water and acid mixture for acid digestion of particles in water
6. **Glass pipette**- to transfer test solutions
7. **Sterile plastic centrifuge tubes-** used for centrifugation in centrifuge machine
8. **Centrifuge Machine:** Remi, laboratory medical centrifuge.
9. **Glass microslides and coverslip-** to hold the water sample residue for analysis of diatoms
10. **Compound Microscope**

### 2.2 Methods

#### 2.2.1 Collection of water sample:

This particular study is a prospective study for a period of one year, diatom samples were collected from different geographical localities of Malnad region. The water samples were collected from 10 different selected water bodies numbered S1- S10 (which include 3 – Lake, 2 – canals, 2 – rivers, 2 dams and 1 domestic source) once in 2 months covering all the seasons i.e., winter, spring, autumn and summer.[6] Six collections were made during a span of one year. The dates of sample collection were kept almost same. The water samples were collected just below the surface of water using sterilized plastic containers of one litre capacity. The pH and temperature of water were recorded during sampling. The pH was measured using a digital pH meter. Temperature was recorded using laboratory thermometer (**Table 1**).

#### 2.2.2 Extraction and Analysis of Diatoms:

Extraction of diatoms from water was done using chemical digestion by concentrated nitric acid method. From each of the water sample 100ml of

water was taken and was transferred into an acid washed glass beaker. Samples were added with concentrated 25ml of nitric acid and then samples were allowed to stand undisturbed for 2 h. These samples were transferred to properly label plastic centrifuge tubes and centrifuged at 3000 rpm for 10 min. The supernatant was pipetted out leaving behind only a residual material at the bottom of tube. This residual material was suspended in distilled water and again centrifuged in the same way to ensure that even the traces of acid were removed. After final centrifugation except for 1ml the whole supernatant was discarded by pipetting out. The left-over aspirate is poured over a clean microscopic glass slide dried and mounted with DPX39 analyzed with optical compound microscope fitted with light source at different magnifications. Diatom species were identified on the basis of available literature.

**Table-1: Description of Water Bodies**

| Station code | Water body | Source | Geographical area type |
|---|---|---|---|
| **S-1** | River | Tunga river | Plain |
| **S-2** | River | Badra river | Plain |
| **S-3** | Dam | Gajanur dam | Foot hills |
| **S-4** | Check dam | Purdal check dam | Foot hills |
| **S-5** | Lake | Mattur lake | Plain |
| **S-6** | Lake | Shimoga lake | Plain |
| **S-7** | Lake | Purale lake | Plain |
| **S-8** | Canal | Canal near jail road Shimoga | Plain |
| **S-9** | Canal | Canal near sharavathi dental college | Plain |
| **S-10** | Domestic source | Tap water | - |

### 2.2.3 Diatom identification:

The diatom genera were identified by observing them at 100X magnification under compound microscope and the diatoms identified were compared with standard species chart available.

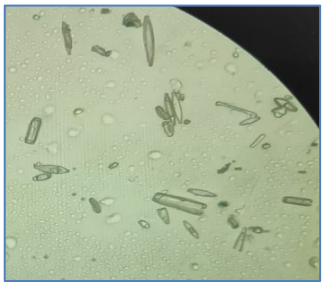
## 3. Observation & result

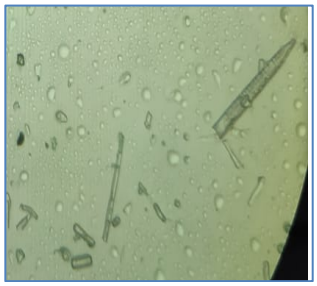
After analysis of water samples from 10 different water bodies (S-1 to S-10) during different seasons for a period of one year, diatoms were observed in all samples. Totally 22 different genera of diatoms were identified. The cell wall or frustule of diatoms were of either of two body plans pennales and centrales, and most of them belong to pennales and few were centrales. The observed diatoms were –Achnathesis, Amphora, Astrerionella, Brachysira, Calonies, Cyclotella, Cymbella, Cocconeis, Ctenophora, Diatoma, Eunotia Pectinalis, Fragilaria, Gomphonema, Melosira, Navicula, Nitzschia, Pinnularia, Pleurosira, Surirella, Synedra, Tabellaria, and Talassiosira. Out of which melosira, cyclotella, talassiosira belonged to centrales (**Figure 1-3**).

In this study the diatom of slightly larger size is more observed in lakes than in river suggesting that larger ones are more common in stagnant waters than moving waters.

**Figure no. 1 : Microscopic View of Diatoms**

**Figure no. 2 & 3: Microscopic View of Diatoms**





Noticeable divergences of diatoms are noted depending on pH level of the water body. Distribution pattern of diatoms has shown characteristic variation among the selected sites. Navicula genus was seen in all water bodies including the domestic source tap water. And they were present in all samples in all seasons but in varying quantity. Synedra genus was present in all the fresh water bodies except in the domestic source tap water. Cymbella was seen in most of the water bodies except in two lakes. Navicula, Cymbella and Synedra were common to

most of the water bodies studied. Melosira, Achnanthes and Brachysira were particularly seen in Mattur Lake and Purle Lake. Diatoma and Thalassiosira were commonly present in Badra River. Amphora and Ctenophora were commonly found in Purdal check dam and Shimoga Lake. Eunotia pectinalis and Tabellaria were particular to Purdal check dam and Gajanur dam. Thalassiosira, Surirella, Diatoma Cocconeis, Cyclotella were more commonly found in flowing water bodies Melosira, ctenophora, Brachysira, Achnanthes, Fragillaria were common to stagnant waters (**Table no-2**).

**Table-2: List of Diatoms and their distribution in various Water Bodies**

| Diatoms | S-1 | S-2 | S-3 | S-4 | S-5 | S-6 | S-7 | S-8 | S-9 | S-10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Achnanthes | - | - | - | - | + | - | + | - | - | - |
| Amphora | - | - | - | + | - | + | - | - | - | - |
| Astrerionella | + | - | + | + | - | + | - | - | + | + |
| Brachysira | - | - | - | - | + | - | + | - | - | - |
| Calonies | - | + | - | - | - | - | - | - | + | - |
| Cyclotella | + | + | + | - | - | - | - | - | - | - |
| Cymbella | + | + | + | + | - | - | + | + | + | + |
| Cocconeis | + | - | - | - | - | - | - | + | - | - |
| Ctenophora | - | - | - | + | - | + | - | - | - | - |
| Diatoma | - | + | - | - | - | - | - | - | + | - |
| Eunotia Pectinalis | - | - | + | + | - | - | - | - | - | - |
| Fragilaria | - | - | - | - | + | + | + | - | - | - |
| Gomphonema | - | - | - | - | + | - | + | - | + | - |
| Melosira | - | - | - | - | + | - | + | - | - | - |
| Navicula | + | + | + | + | + | + | + | + | + | + |
| Nitzschia | - | - | - | - | - | - | - | + | - | - |
| Pinnularia | - | + | - | + | - | - | - | - | - | - |
| Pleurosira | - | - | - | - | - | - | - | + | - | - |
| Surirella | + | - | - | + | - | - | - | - | + | - |
| Synedra | + | + | + | + | + | + | + | + | + | - |
| Tabellaria | - | - | + | + | - | - | - | - | - | - |
| Talassiosira | - | + | - | - | - | - | - | + | - | - |

Noticeable divergences in the seasonal distributional of diatom species were recorded in the selected water bodies. On the whole Diatoms were present in large numbers during the early post monsoon season and in a considerable amount during the summer season. Their population steeply decreased during winter season and monsoon.

**4. Discussion**

Among 22 different genera of diatoms identified, Navicula, Synedra were common to most of the water bodies these were the most frequently observed diatoms in all water bodies in all seasons, thus they were found to be widespread or common to this region. This was similar to the results obtained in a study conducted by Sane R, Verma P in Indore (MP) where they found Navicula in almost every water body with variation in their quantity.[7] Mattur Lake and Purle Lake where both the lakes are habitat for various aquatic plants. Melosira, Achnanthes and Brachysira were particularly observed from these two water bodies making them more specific for water bodies with aquatic vegetation and also these two water bodies were more alkaline in nature compared to the others. Amphora and Ctenophora were commonly found in Purdal check dam and Shimoga Lake. Both the water bodies have clear water and minimal pollution.

Eunotia pectinalis and Tabellaria were particular to Purdal check dam and Gajanur dam. Both of which reservoirs and are present at the foot hills. Thalassiosira, Surirella, Diatoma, Cocconeis, Cyclotella were more commonly found in flowing water bodies. Melosira, ctenophora, Brachysira, Achnanthes, Fragillaria were common to stagnant

waters. Nitzschia, Pleurosira were commonly found in the canal near Lakshmi theatre. This canal is highly polluted by domestic activities and lot of waste disposal. Nitzschia and Pleurosira were more common for the polluted waters. The size of the diatoms also varied with the conditions, water bodies with stagnant water like lakes had comparatively larger size diatoms, while small size diatoms were more frequently present in flowing waters. This was in contrast to the results obtained in a study conducted by Thakar MK, Singh R [8] in Punjab where they found larger size diatoms were more frequently observed in flowing waters.

Selected water bodies showed significant differences in the cyclical distributional of diatom species. Diatoms were present in large numbers during the early post monsoon season and in a considerable amount during the summer season. Their population steeply decreased during winter season and monsoon. Water samples collected from five water sites (Lake, canal, well and pond) on a seasonal basis, winter (December), spring (March), summer (June) and autumn (September) from the different geographical area of Haryana, India (Himalaya foothill, plain area and Aravali hills also revealed the significant difference in diatom distribution as the environmental condition varies in these selected sites.[9] Similar observations were also made by Pollanen M S[10], the diatom test was most likely to be positive in April (40%), and November (30%) and least likely to be positive in the Winter months. In a study undertaken by Tyagi GD, Dogra TD[11] wherein an analysis of the water samples of various ponds and lakes of Delhi showed two population maxima one in spring and another in autumn and 14 species of diatoms were observed.

Winter season has short days, and temperature declines to a very low level. Intensity of natural light remains very low and conditions are mostly dry. The temperature in summer were reaching maximum up to 32.2.0°C and that in winter up to 19.5°C. pH was in range greater than 6.6 and less than 8.6. pH was more towards acidic during summer and towards alkaline during rainy and winter.

Distribution of diatoms in water bodies of different geographical localities were affected by some physical and environmental parameters. The locality with low temperature, less salinity and less polluted water had less quantity of diatoms.[9] Generally, winter had a 'dilution effect' on diatom diversity because climatic conditions are not favorable for the growth of diatoms therefore very low population of diatoms existed in winter. But a substantial diatom bloom occurs in autumn season when range of temperature increases and a huge amount of natural light helps in photosynthesis and ultimately in growth of a variety of diatoms. A significant change in the qualitative and quantitative distribution of diatoms takes place in warm summer season. Due to the higher temperature growth conditions of diatoms follow a very slow and tidy pace. Time to time monitoring of water bodies is necessary for the updating of diatomological Mapping.[12]

**5. Conclusion**

The objective of the study was to understand the distributive pattern of diatoms in different water bodies of Shimoga. Recognition and study of regional distribution of diatoms can be used in postmortem diagnosis of drowning and to locate the particular area of drowning. Results have shown that there is diatom diversity at different water bodies and also slight changes during the different seasons within the same water body. It might have happened due to the difference in the geographical conditions that can affect the nutrient content of the water for the growth of diatoms. Change in the diatom diversities in different water bodies can be very interesting and useful in Forensic point of view in postmortem diagnosis of drowning.

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*Original Review Article*

# Cannabis - Dilemma on Law Amendment.

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Abstract

In Indian society cannabis was used before 1000CE as spiritual and religious occasions. There are 483 identifiable chemical constituents known to exist in the cannabis plant, and at least 85 different cannabinoids have been isolated from the plant. Cultivation of cannabis for industrial purposes such as making industrial hemp or for horticultural use is legal in India. Although NDPS allows consumption of bhang, various states have their own laws banning or restricting its use. In some states, only authorized dealers are allowed to sell bhang. Some states also have rules about the maximum amount of bhang one person can carry and the minimum age of the buyer. The British Parliament enacted a tax on bhang, ganja and chars in 1798 and Attempts at criminalizing cannabis in 1838, 1871, and 1877. Though the NDPS Act doesn't mention anything about Smoking paraphernalia, making it completely legal to buy or sell smoking accessories like Rolling Papers, Smoking Pipes, and more. In all evidence based research from meta-analysis have indeed shown that cannabis is associated to violence and therefore measures should be taken to mitigate the risk. But similar current evidence, it is clear that while legalization does not necessarily eliminate illegal production, distribution, sale and adulterations of cannabis it tends to diminish it dramatically. As a result, it relieves the burden placed on courts, law enforcement and prisons, allowing for greater focus on violent crime. Hence, its create "Cannabis – Law Amendment Dilemma". Our study concluding this dilemma to promote Bio psychosocial research should continue to monitor the association following policy change more thoroughly by examining different type of violent outcomes.

## 1. Introduction

Many evidence- based studies from meta-analyses have shown that cannabis use is associated with violence and Crime; measures must be taken to mitigate the risks. Violence is a complex and multifactorial issue that has serious health and social consequences.[1] Legalization might be expected to reduce the number of people involved in illegal activities related to cannabis production, distribution, sale and use. In Indian society, common terms for cannabis preparations

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include charas (resin), ganja (flower), and bhang (seeds and leaves), with Indian drinks, such as bhang lassi and bhang thandai made from bhang being one of the most common legal uses. Bhang is consumed as prasad of Shiva, and is popular between Mahashivaratri and Holi.[2]

Amidst Sikh Nihangs, bhang is popular, especially during HolaMohalla.[3] Muslim Indian Sufis place the spirit of Khidr within the cannabis plant, and consume bhang.[4] In this review article concluding various aspects of "Cannabis – Law Amendment Dilemma" this dilemma to promote Bio psychosocial research should continue to monitor the association following policy change more thoroughly by examining different type of violent outcomes.

**1.1 Biochemistry and Taxonomy**

*Cannabis* plants produce a group of chemicals called cannabinoids, which generate mental and physical effects when consumed. There are 483 identifiable chemical constituents known to exist in the cannabis plant, and at least 85 different cannabinoids have been isolated from the plant.[5] The two cannabinoids usually produced in greatest abundance are cannabidiol (CBD) and $\Delta^9$-tetrahydrocannabinol (THC), but only THC is psychoactive and CBD, which has no psychotropic effects by itself [6] (although sometimes showing a small stimulant effect, similar to caffeine),[7] attenuates, or reduces[8] the higher anxiety levels caused by THC alone.[9]

**1.2 Cannabis Psychosis**

The amount of tetrahydrocannabinol or THC, active principle producing psychoactive sensations determines the addictive factor of cannabis. A 2016 study in the National Centre for Biotechnology Information showed that out of 36,000 samples of illegal cannabis from around the world, THC levels had risen from around 4 per cent in the 1990s to nearly 12 per cent in 2014, shifting the ratio of THC to CBD from 1:14 in 1995 to about 1:80 in 2014.[10] The first clinical pilot study in India on the use of cannabis as a restorative drug for cancer patients was conducted in collaboration with the Gujarat Ayurved University, Jamnagar on cancer patients undertaking treatment at the Tata Memorial Hospital in Mumbai. CCRAS (Central Council for Research in Ayurvedic Sciences) Director General Vaidya K.S. Dhiman stated, It was found in the pilot study performed in earlier part of the year that pain as well as other symptoms in post chemo and radiotherapy cancer patients were alleviated by cannabis leaves-based drugs." [11]

The Indian Institute of Integrative Medicine (IIIM) of the CSIR announced that it was developing three cannabis-based medicines to treat cancer, epilepsy, and sickle-cell anaemia.[12] The first medical cannabis clinic in India was opened in Koramangala, Bangalore on 1 February 2020.[13,14] The clinic, operated by Odisha-based Hemp Cann Solutions, sells cannabis infused tablets and oils under the brand name Vedi Herbals. [15]

**1.3 Indian statistics**

As of 2000, per the UNODC the "prevalence of usage" of cannabis in India was 3.2%.[16] According to the UNODC's World Drug report 2016, the retail price of cannabis in India was US$0.10 per gram, the lowest of any country in the world.[16] Within last year, about 7.2 million Indians had consumed cannabis as per the 2019 study performed by the All India Institutes of Medical Sciences. The Ministry of Social Justice and Empowerment's "Magnitude of Substance Use in India 2019" survey found that 2.83% of Indians aged 10-75 years (or 31 million people) were current users of cannabis products, with 0.66% of the population considered to be using cannabis "in a dependent pattern".[17] Naxalites are heavily invested in illegal production of Ganja.[18] The International Narcotics Control Board's 2019 annual report noted that "India is among those countries worldwide with the greatest extent of illicit cannabis cultivation and production.[19]

In India permission for cultivation of cannabis is for industrial purposes such as making industrial hemp or for horticultural use. The National Policy on Narcotic Drugs and Psychotropic Substances recognizes cannabis as a source of biomass, fiber, and high-value oil. The Government of India encourages the research and cultivation of cannabis with low THC content.[20] There is variation in the laws related to ban or restricted use of bhang consumption in spite of NDPS had permitted the consumption of bhang. In some states, permission to sell bhang is provided to only authorized dealers. Some states also have rules about the maximum amount of bhang one person can carry and the minimum age of the buyer.[21]

**2. History**

Bhanga is mentioned in several Indian texts dated before 1000 CE. Cannabis Sativa identify as one of the plant that was used to prepare soma in Vedic period.[22] Soma was an intoxicating ritual drink that has been highly praised in the Rigveda (c. 1700–1100

BCE).Atharvaveda (c. 1500–1000 BCE) mentions bhanga as one of the five (the darbha, hemp, barley, saha) sacred plants that relieve anxiety. Sushruta Samhita (c. 600 BCE) mentions bhanga, as a medicinal plant, and recommends it for treating catarrh, phlegm and diarrhea. Chikitsa-sara-sangraha (c. late 11th century) mentions bhanga as an appetiser and a digestive, and suggests it in two recipes for a long and happy life. Sharngadhara Samhita (13th century), mentions it as one of the drugs which act very quickly in the body. [23] In Ayurveda or Sanskrit text mention cannabis as *vijayaand* as an ingredient in various recipes of pain relievers and aphrodisiacs, but in small quantities. It is noted that large quantity or long time consumption can be addictive and that it is more dangerous than tobacco for lungs and liver.[24]

**2.1 In British India**

In 1978, the British Parliament had imposed a tax on bhang, ganja and charas, stating that the purpose of the tax was to minimize the consumption of cannabis"for the sake of the natives' good health and sanity".[25] Attempts at criminalizing cannabis in British India were made, and mooted, in 1838, 1871, and 1877. In 1894, the British Indian government completed a wide-ranging study of cannabis in India.[25]

**2.2 Legal status**

The NDPS definition of "cannabis", excluding bhang from its purview:

**"Cannabis (hemp)" means:**

a. charas, that is, the separated resin, in whatever form, whether crude or purified, obtained from the cannabis plant and also includes concentrated preparation and resin known as hashish oil or liquid hashish;
b. ganja, that is, the flowering or fruiting tops of the cannabis plant (excluding the seeds and leaves when not accompanied by the tops), by whatever name they may be known or designated; and
c. any mixture, with or without any neutral material, of any of the above forms of cannabis or any drink prepared therefrom;

**— Narcotic Drugs and Psychotropic Substances Act (India), Chapter I, Section 2.iii.**

NDPS banned the production and sale of cannabis resin and flowers, but permitted the use of the leaves and seeds, allowing the states to regulate the latter. Though the NDPS Act doesn't mention anything about Smoking paraphernalia, making it completely legal to buy or sell smoking accessories like Rolling Papers, Smoking Pipes, and more.

**2.3 Reform**

In the past few years, there has been a growing clamour by non-governmental organizations' to legalize the recreational use of cannabis, as other countries have done. In 2015, the first organised efforts to re-legalise cannabis in India appeared, with the holding of medical marijuana conferences in Bangalore, Pune, Mumbai and Delhi by the Great Legalisation Movement India.[26] In July 2019, the Delhi High Court agreed to hear a petition, filed by the Great Legalisation Movement Trust, challenging the ban on cannabis. The public interest litigation argues that grouping cannabis with other chemical drugs under the NDPS Act is "arbitrary, unscientific and unreasonable".[27]

India voted in favor of removing cannabis and cannabis resin from Schedule IV of the 1961 Single Convention on Narcotic Drugs at the United Nations Commission on Narcotic Drugs (CND) on 9 December 2020. The resolution was passed with 27 member countries voting in favour, 25 against, and one abstention.[28]

Why India needs to legalize the use of cannabis or not……

**The pros**

- Will eliminate illegal Trade and associated crimes.
- Taxing cannabis will increase government's revenue.
- Will reduce drug stigma and open up discussion on responsible use
- Cannabis has both medicinal and industrial benefit; hemp makes for great fibers.
- Will help create jobs for local producers.
- Will enable quality control law to be enacted for cannabis, preventing its adulteration with more harmful chemicals
- Prohibition has failed to control the use of domestic production of cannabis.

**The cons**

- Could lead to increased usage; cannabis is not entirely free of risks and studies have shown repeated use mimic the pattern of addiction to other drugs.
- Cannabis psychosis is a growing medical problem and without laws to regulate over consumption its prevalence could further increase

- The black market for cannabis, especially of low-grade products, is so well- established that a simple decriminalization won't eradicate poor quality goods.
- There have been recorded instances of cannabis dependency to cope with stress; cannabis use has also become a stepping stone to refine drugs sometimes.

**3. Discussion**

Recently June 2022, the first Asian country Thailand legalized the growing of marijuana and its consumption in food and drinks, with the aim of boosting its agriculture and tourism sectors, but smoking pot is still against the law. In 2019 study by the Vidhi Centre for Legal Policy noted that most people arrested for cannabis possession are the poor and marginalized, while bigger sellers escape unscathed. “Usually, more seizures are made where cannabis is cultivated and not sold,” says Romesh Bhattacharjee, a former Narcotics Commissioner of India. “It is the small and medium farmers who get harassed, not the larger sellers and buyers in big towns and cities.” He points out; cannabis is cultivated in nearly 60 per cent, or 400, of India’s 670 districts. It is considered a medicinal plant that has benefited humans and animals over the centuries. “Since we criminalized cannabis in India [in 1985],” he says, “We haven’t curbed production or consumption. The law is redundant and has become a tool to harass small-time or poor buyers and sellers. Bhang is already legal in some states. There are millions of weed and hash users in major cities. You might as well legalize cannabis, and follow it with drug awareness outreach if you are worried about addiction. Sensitization and dialogue are more effective in curbing addiction than half-hearted criminalization.” As to how to legalize cannabis, he has a simple answer: “Just remove it from the Narcotics Act. It is already ‘legal’ on the streets given its availability, only ‘illegal’ on paper.”

According to Dr. Rahul Luther, psychologist and founder of the Hope Trust, a DE addiction center and rehab clinic in Hyderabad; “Cannabis is no longer the milk drink had at a festival or a substance smoked in a chillum—there is a bewilderingly wide range of creative products,” like, ‘weed pizza sauce’, ‘weed wine’‘ weed coffee’ Cannabis-spiked paan, brownies, chocolates and beers. The young can now look forward to cannabis bath products, lip balm, toffee, cheese and dried noodles. The ABCD report shows Delhi to be among the top 10 cities in the world for cheap weed, second only to Latin American countries. Cheap ‘weed dust’ can be bought for as little as Rs 50, while 10 grams of average quality weed can cost anything between Rs 100 and Rs 250 in Delhi.

**4. Conclusions**

Today, there is a booming market for cannabis and related products, particularly among the youth. The legalization of cannabis, the organization believes, can help create jobs, battle stress, improve human concentration, resolve medical problems and provide sustainable agricultural incomes, among other things. Cannabis, the petition argued, is integral to the country’s cultural fabric; its criminalization leads to needless harassment and stigma. The Narcotics Drugs and Psychotropic substances Act, 1985, define cannabis as the flower or fruit of the cannabis plant out of which the resin has not been extracted. Seeds and leaves are not been included. The act deems 'production, manufacture, possession, sale, purchase, transport, inter-state import or export or use' of cannabis as illegal and punishable depending upon quantity and product.

In all evidence-based research from meta-analysis have indeed shown that cannabis is associated to violence and therefore measures should be taken to mitigate the risk. But similar current evidence, it is clear that while legalization does not necessarily eliminate illegal production, distribution, sale and adulterations of cannabis it tends to diminish it dramatically. As a result, it relieves the burden placed on courts, law enforcement and prisons, allowing for greater focus on violent crime. Hence, Bio psychosocial research should continue to monitor the association following policy change more thoroughly by examining different type of violent outcomes. Research should account for trends before legalization and consider the profiles of individuals using cannabis before and after legalization. Future research should investigate in more detail crime-related consequences of cannabis use under different legal jurisdictions.

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*Original Review Article*

# Future and Scope of Forensic Neurosciences in Criminal Investigation System towards Justice.

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Abstract

All crimes do not have their basis only in neuropsychology, but they may have organic neurological diseases like brain tumours, psychoses, sociopathy, sleep walking, etc. Our brain is a time clocked bomb, because, it is difficult to predict when a crime will be strategized and executed. Neuropsychology proposes that various theories of mind and childhood experiences bear an impact on adult behaviour being civic or criminal. The application of Neurology in crime investigation facilitates the understanding of criminal behaviour. The derived concepts and evidence from neuroscience helps to flesh out specific components of a larger psychological-level etiological model. Forensic neuroscience may play a pivotal role to develop and refine etiological models of crime-related behaviours.

## 1. Introduction

The human brain is the main commander of actions performed by the body. To understand any crime, the crime suspect's brain must be studied in and out. All crimes do not have their basis only in neuropsychology, but they may have organic neurological diseases like brain tumours, psychoses, sociopathy, sleep walking, etc. That's where the role of forensic neuroscience emerges. Forensic Neuroscience is a growing field in which the regulation of certain behaviours, including criminal, antisocial, sociopathic, and psychopathic, are viewed in light of neural mechanisms that determine such behaviours.[1]

## 2. Background/Need

Our brain is a time clocked bomb, because, it is difficult to predict when a crime will be strategized and executed. Both physiological and/or pathological states of the brain can lead to crime formation, which, with the help of neuroscience, we must aim to decipher.

Neuropsychology proposes that various theories of mind and childhood experiences bear an impact on adult behaviour being civic or criminal. Now, there is a huge wealth of data to suggest aetiologies of the crime lying in neurological aetiologies, pertaining to specific brain areas or structural idiosyncrasies. Hence, a comprehensive approach involving multiple disciplines of science like psychology, psychiatry as well as neurology is a better way to approach a crime. Causation of crime has been theorised of being due to a person's innate neural structure and its functioning. It is classified into two theories: crime aetiology and crime composition.

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The etiological causation includes the causative processes leading to the incidence of crime. This can be a bitter experience or a personality trait possessed by the individual including failure to regulate emotions, acquisition of cognitive biases, empathy failures, the guilt associated with it, aggressive inclinations, deviant sexual desires, emotional isolation, unrestrained impulsive behaviours, substance dependence, abuse, etc. For instance, some researchers have explored the connection between alterations in brain structure and deviant sexual preferences in males diagnosed with paedophilia.[1]

On the other hand, *Compositional* explanations for crime involves the persons' own constituents, experiences, behaviour and mindset, i.e., what actually makes the person. For instance, a fruit salad is composed of apples, oranges, peaches, and so on. The fruits do not cause the salad, but in fact, they are themselves, a part of the fruit salad. These theories need to be supported by the identification and outline of psychological and social mechanisms that underlie problems related to crime. Neurological evidence would build the case in order to support this. Such conclusions invite the knowledge of the neurology to work along with forensics in order to wholly understand a criminal event or behaviour.[2] A few other aspects in this discipline include:

- Lie Detection.
- Memory analysis
- Detection of malingers
- Attribution of crime to specific brain areas
- Bedside neurological examination

**Lying** is second nature to man, and the best liar is the one who has complete conviction in his lie, because he doesn't think it's a lie. This counter measure I.e., a strong conviction, easily can manipulate the tests for lie detection available today. Therefore, they are difficult to accept in the court of Law. A more detailed research and study into the science of lying, is the need of the hour.

**Memory tests** have multiple implications. For the onlookers, they are important in order to recreate crime scenes during interrogation, as a part of the crime investigation. For the criminals, it is memory which is relied upon when asked regarding trivial details to corroborate their testimony with situational evidence. This is a raw area in forensics & can be explored in great detail, especially when clubbed with investigative technologies like functional MRI so as to have increased admissibility value in legal matters.

One more requirement for this science to flourish is to detect malingering and at the same time, assess the suspect, unbiasedly, so as to not criminalize genuine mental insanity. Last, but not at all the least, is the role of bedside neurological examination in confirmation of suspicion or other supplementary evidence. For example, a thorough neurologist can pick up chronic arsenic toxicity by the presence of tiny horizontal whitish lines in the nails of the person being poisoned or exposed to arsenic in any form.[3] Another example is the case of a 23-year-old engineer, who presented with acute onset of mildly dilated pupils, sluggishly reacting to light with extrapyramidal features. Thoroughly investigated neurologically with no positive test results, this clinical picture was foxing for all the clinicians, until the relatives revealed how he recently had installed a gas geyser in his bathroom, with limited ventilation. This led to chronic carbon monoxide emission, which he inhaled and poisoned himself. This was picked up clinically and then the diagnosis was confirmed in the neuroimaging. He removed the causative factor and was treated with hyperbaric oxygen and supportive therapy, which helped him recover.[4]

**3. Indian And International Scenario**

The future and scope of forensic neuroscience in our country depends on how we train our experts. National Forensic Sciences University, the erstwhile Gujarat Forensic Sciences University established in 2009 has accorded the status of Institution of National Importance and then also as a central university in October 2020. It has 69 subbranches and courses imparting knowledge about sub branches of forensics have also flourished therein. Ministry of Home Affairs, Government of India has already annexed the Delhi Centre, the erstwhile National Institute of Criminology and Forensic Sciences with this university.[5]

We have found a huge chunk of information since extensive research is ongoing on criminal neuroscience especially at Centres like NIH, USA; Institute of Criminology under Victoria University of Wellington; Keele University, Staffordshire, in the United Kingdom; Departments of Criminology, Psychiatry and Psychology at the University of Pennsylvania. These centres are conducting aggressive research in forensic neurosciences and the teaching programs for the same. A body of ongoing

research work called the NIH BRAIN (NIH Brain Research through Advancing Innovative Neurotechnologies) [6] is predominantly working on generating novel technology to change our understanding of the brain and its many connections internally, which manifest as our actions. Neuroethics is an important part of the research effort.

An investigative field which when clubbed with Neurology has multiple modalities of approach to a crime. Some forensic neuroscience investigations have been debated vastly in India.

**3.1 Lie detection**

In technical terms, known as Deception Detection Tests (DDT), lie detection methods have come a long way. It began as a primitive method, long back, when fists full of rice were stuffed into the mouths of all the suspects and they were vehemently accused of committing the crime or threatened of grave consequences. Intense stress leads to activation of the sympathetic fight or flight response, which leads to dryness of mouth. The spitting time of rice was clocked for each of the suspects and the one taking maximum time would be thought of as the culprit. After this extremely crude method, today technology has brought us to much refinement in reaching the conventional polygraph test which records respiration, heart rate, blood pressure, and galvanic skin response or moisture in the fingertips. This procedure via the polygraph test can be used on the accused in India, only after the accused has consented for it. The silence of the accused shouldn't be mistaken for consent. Its admissibility in the court of law is still questionable. Since according to the Article 21(3) of constitution of India, a person cannot be a witness against his/her own crime.[7]

**3.2 Functional MRI**

fMRI is a developing science now more commonly available at radiology centres in major metro cities in India. Some studies trying to understand the rich connections between the amygdala and the prefrontal cortex, have analysed a wealth of data. The entire prefrontal cortex is a region, whose deficits have usually been associated with crime, aggression and disinhibited behaviour.[8] The right temporoparietal junction (rTPJ) plays special roles in processing criminal offenders' state of mind and that the right dorsal lateral prefrontal cortex (rDLPFC) plays roles in resolving moral conflicts involved in legal judgments.[9] The ventromedial PFC (vmPFC) has been implicated as a critical neural substrate mediating the influence, rather overpowering of emotion on moral reasoning. There have been instances where people with damaged prefrontal cortex have harmed kin to save strangers.[10] The major problem with fMRI is that the areas of the brain that light up during visualizing and lying about performing the crime, also light up while imagining the crime. It detects mental familiarity of the images shown with approximately 70% accuracy[11]. While interpreting functional MRI – The region of interest (ROI) may show a highlight when we do a task, and similar highlight may be seen in multiple tasks, because each region might cater to multiple functions – deception, desire, etc. Some artefactual differences might also appear. Another aspect that revolves around conducting fMRI's on populations is that there are no constitutional or legal protections for the crime suspect to safeguard themselves from the police or the investigating agency so as to prevent them from performing the scans on patients. Functional MRI violates multiple themes including privacy, expression of self-thought, and fundamental cognitive liberty.

**3.3 PET Scan**

These show brain glucose activity, which might be increased or decreased in specific disease states, which may have behavioural repercussions. A case in the court of state of New York, USA, of a man murdering his wife and throwing her out of the window of their 12 storey building in a fit of rage, pleaded mercy against his sentence of life imprisonment. The defendants used PET scans in the courtroom proceeding where a cyst was found on the PET results of the accused. He had an arachnoid cyst in the left sylvian fissure compressing the left frontal, temporal and insular regions. These regions have been proven to lead to disinhibited behaviour. But the admissibility of PET scan and its consequence on the legal proceedings is still questionable. The man was given a reduced charge of manslaughter.[12]

**3.4 Electroencephalogram**

Electroencephalogram (EEG) is a regularly used procedure in Neurology for seizure detection, localization and lateralization in epilepsy patients. The use of electricity in the body to interpret bodily functions is an old concept, which is now being used to understand the human brain psyche. Research does show how criminal populations have more abnormalities in their EEG's as compared to the

normal general public. Most common pathologies include presence of excessive theta activity, focal temporal lobe pathology, instability of patterns, often epileptic in nature. The age of the person undergoing EEG, needs to be considered while analysing various EEG's across populations since the maturation of EEG with age is a topic of vast information and must be studied by a dedicated neurologist prior to analysing the EEG's done with a forensic purpose. Aggressive behaviour, whether paroxysmal or as a baseline perennial behaviour- idiosyncrasy is shown to be a common denominator in the fundamental structure of these populations.[13]

When pitted against other methods of crime investigation, nobody disputes that EEG can reflect brain states, including the presence of memory traces, and measuring brain activity is inherently more direct than measuring secondary effects such as skin conductance. The extremely short time period to response, i.e., the latency period of the EEG response is an advantage since it provides less time for response modification or suppression by the subject. This suggests how it is harder to cheat on an EEG than a conventional polygraph test, even when both are no different in principle from handwriting, fibre or DNA evidence. There is no reason to deny the stamp of authority to EEG as a standard of evidence, once a rich wealth of data is available on studies done on criminal populations as well as patients showing uninhibited anger, aggression, personality traits of violence and lack of empathy. Data mining in forensic neuroscience is another aspect of crime analysis.[14]

**3.5 Mind Reading technology**

*Brain computer interfaces* (BCI) and *neural decoding* is a new technology. The usual mental states include imagination, emotions, intentions, perception, decision making, and so on. Using the understanding of these in neurosciences, technology has now been able to highlight some correlations between mental states and cerebral activity. This can indirectly or directly, on some occasions be used to analyse criminal behaviour, of course in some context of neurobiology. Some branches like anthropometry, dactyloscopy, photography, DNA fingerprinting, biometrics also aid in neurological recognition. The basic principle behind these technologies is recording of the electrical brain waves using surface EEG, Magnetoencephalography or Scalp EEG or even more comprehensive techniques like Electrocorticography (ECoG).[13]

In 2013, an experiment conducted using neurointerface technology in the form of a game for the participants. The 'P300' wave showed its role in extracting confidential information stored in one's brain like PIN numbers, or personal beliefs which one might not wish to communicate externally. The consequences and implications of such investigations are like a double-edged sword and must be used within the boundaries of the legal framework.[15] The main problems in accepting these investigations as evidence in the legal system include a small number of subjects studied in the control as well as study groups, which affects statistically acceptable comparisons between the two groups; the inadequacy of randomization in those trials; sample selection criteria discrepancies; inadequate drug abuse history; incomplete disease and family history disclosed by crime suspects, all of which resulting in incorrect interpretations or spurious examination findings. There also might be an associated existence of psychiatric conditions, which confounds the diagnostic validity of the brain imaging results, etc.

**4. Discussion**

Neuroscience helps us in the procurement of information about the psychological aspects of crime-related behaviours. The derived concepts and evidence from neuroscience can help us flesh out specific components of a larger psychological-level etiological model, so that we can appreciate those particular components in a newer light [16] Such constitutive explanations can do more than simply redescribe key psychological phenomena; they can suggest new targets for intervention. For example, by identifying the physiological events that underpin sudden bursts of rage – for instance, dramatic surges in adrenaline, we may be able to develop interventions that operate directly upon such events (for example, exercise techniques). Such ideas may not be present themselves so readily if we restrict ourselves entirely to neuropsychological-level descriptions.

Perhaps the most important role that neuroscience explanations can play is in helping to develop and refine etiological models of crime-related behaviours. This includes integrative pluralism since it takes different levels of description into account while preserving the potential explanatory uniqueness of each level. When it comes to forensic psychology, our psychological models of behaviour can benefit from the knowledge of the

corresponding neural events, and also the broader biological changes that accompany these events.

The trick is ultimately to let neuroscience illuminate the culprit at hand and not end up muddying the water. fMRI and event-related potentials generate direct markers of the brain activity occurring during a particular task. There is no need of the participant to interpret that activity. They therefore provide a source of evidence that is complementary to that obtainable from first person methods. For example, one question that has interested forensic researchers for decades is whether people who commit harmful acts may do so because they lack empathy. It is difficult to study empathy using methods that rely on self-report as it involves subject-bias. Individuals may under- or over-report the degree of empathy they feel. However, by examining fMRI signatures that have previously been found to be associated with empathic responses in general – for example, activation of the amygdala – we may be able to tackle this question in a new way.

When we run thousands of statistical tests on a big data set, there is an increased likelihood of finding significant, but essentially spurious, results. Even if statistical corrections are applied to reduce the number of such outcomes, this is unlikely to solve the problem. In this situation, researchers can be tempted to “cherry pick” results that support what they might have expected to see based on an existing theory or hypothesis, and gloss over those results that are awkward to explain.[16] The problem with this approach is that the data are no longer being used to challenge our understanding of the phenomenon, but rather to confirm our pre-existing beliefs. There is a loss of randomization. Many upcoming techniques include:

- Narcoanalysis
- Brain mapping
- Voice stress analyzers (This test detects miniscule/inaudible voice variations called laryngeal microtremors in neurology- they speed up during deception)
- thermal images of facial-skin temperature.

**5. Conclusion and Recommendations**

The derived concepts and evidence from neuroscience bring out specific components of a larger psychological-level etiological model. The forensic neuroscience may play a pivotal role to develop and refine etiological models of crime-related behaviours. Empathic responses may be studied with the help of fMRI signature examination. There is need of hour to work on the upcoming neurological investigational techniques in criminal investigations. In consideration with the ethical perspective, there should be appropriate legal provisions.

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*Original Review Article*

# Forensic Odorology Scientifically Validated: Odor as Silent and Unforgettable Evidence

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Abstract

"Forensic odorology" is a set of investigative practices to extract and examine the human odor to find the relation of criminal/suspect to a crime scene. Whenever any crime is committed, the forensic personnel are called for collecting the evidences. There is a latent evidence present at the crime scene i.e. human odor. The use of trained sniffing dogs has been increased for the investigation but still there is a need for the exact and accurate knowledge of human odor composition. Human odor is a complex mixture composed up of many chemical substances and expected to adhere many odor traces in the skin. Human odor detection technologies have gained the attention due to their applications in the areas including biometrics, forensics, criminal investigation etc. Recent developments on human odor identification along with the use of specially trained dogs in searching the evidences have been discussed. The results obtained from various studies had shown that the odor can be considered as significant evidence in the investigation purpose. Along with the scientific justification attempts, this approach may prove a significant tool in the forensic investigation across the worldwide.

## 1. Introduction

The Odorology or science of smells is a technique used specially in criminology for judicial identification. Each individual has its own odor. Based on this fact, this scientific method is used to detect the criminals present at the crime scene i.e. Forensic Odorology. This strategy utilizes specially trained dogs to recognize human fragrance. There is no worldwide standard on how these dogs are trained. Moreover, this scientific method is practiced by legal enforcement authorities to investigate whether a particular individual was present at the crime scene or not.[1]

The accessible logical examinations researching the source and meaning of human smell have focused basically on the human perspiration composition along with the cleanliness as well as

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organic passageway as opposed to an increasingly broad depiction of human odor. In this way, the recognizable proof and portrayal of key human smell volatiles assume a basic job in understanding human fragrance proof as an individualizing physical quality.[2] The substances which carry the odor are the volatile aromatic substances/ compounds (VOCs') which further as a group of substances causes the olfactory sensations; which includes the ability to detect the smell of the substances spread in the air, dissolved in water etc.[3] VOCs have been recognized as markers for the determination of race/ ethnicity and gender using the hand odor samples of individuals. The accuracy rate observed for the race/ ethnicity and gender determination were 72% and 80% respectively. The results achieved from the study had represented that the odor can be considered as significant evidence in the investigation purpose.[4] Human fragrance is a complex mixture composed up of many chemical substances and expected to adhere many odor traces in the skin. A study was conducted to identify that at what temperature the human odor degrades where the dogs would not be able to detect. And the results were like, the dogs were not able to detect at a temperature more than 1000 degree Celsius.[5]

In a study, the dogs were trained to identify hand odor sample. The results were obtained as the dogs were able to identify the females hand odor samples more accurately than males due to the difference in the chemical compounds.[6] In each crime scene, the culprit left behind his/her remarkable odor. The odor identifying dogs are capable of distinguishing the culprit's remarkable odor from the suspect's odor. The crime location samples and reference samples are the bases of this practice. To preserve the odor for a long period, it should be stored in the glass jars.[7] Forensic odorology have achieved an extensive improvement process and along with the scientific justification attempts, this approach may prove a significant tool in the forensic investigation across the worldwide.[8] The present article describes the emerging field of Forensic Odorology, various analysis methods, advancements, significant role of sniffing dogs in investigations, legal status of odor as evidence and future trends.

**2. Human body odor in biometric identification:**

Biometric identification has gained the attention across the worldwide due to the advancements in the sensor technologies and matching algorithms. Researches in biometrics have been increased including the biometric systems such as face, retinal scan, fingerprint, hand, signature etc. which are still in use and also having their own limitations.

Recent studies have revealed the uniqueness of the human odor. Lowest error rate around 15% was reported in human body odor as compared to other biometric identifiers. Human body odor has its own chemical composition which makes it different from other individuals. Human odor has been categorized into three basic categories such as primary, secondary and tertiary. The primary odors containing the constituents are stable over the time derived from the genetic makeup of the individual. Whereas, the secondary odor constituents are due to the existence of nutritional and environmental factors. Tertiary odor constituents are due to the effect of external sources such as lotions, creams, fragrances & other cosmetic products etc. The remarkable human body odor is referred as ''body odor signature''. For the personal identification of an individual, there should be primary odor possessing the constituents which are steady over a long period and miscellaneous across individuals.[9,10]

**2.1 Applications and advantages of body odor as biometric identifier:**

Human body odor is unique. Even the perfumes and deodorants can't hinder the actual odor of an individual. Human odor can be utilized in the security checkpoints at airports and national borders. Using individual odor as a biometric marker will reduce the human efforts and password administration expenses. Another important application is that it could also be helpful in the identification of terrorists to fight against the crime.[10]

**2.2 Applications and advantages of E-nose:**

The applications of Electric nose have been recommended for telesurgery which can recognize the odor in the distant surgical environment. Nowadays, E-noses have the application in the medical diagnostics which can indicate the gastrointestinal, sinus, diabetes and liver problems and some infections. Portable version of e-noses can be used for the detection of drugs smuggled airports and harbors etc. E-nose can also detect the contaminated and harmful wastes. Along with it, E-noses could also be helpful for the identification of human beings who get buried in debris such as in the disaster cases like earthquakes, accidents in coalmines.[10]

**2.3 Role of Sniffing Dogs in Forensic Odorology:**

Odor identification line-ups had been performed by dogs in various countries in several ways. Diverse trial structures were tried utilizing affirmed Dutch law enforcement tracker hound/handler combinations. The standard aroma identification line-up design as of now utilized in the Netherlands is contrasted and a more seasoned structure and with two new plans that provide food for fluctuating inspiration, singular inclinations and physical constraints of the dogs. The plans are assessed on execution and legal requirements. Exploratory plan fundamentally influences the presentation of the combinations, consolidating a control preliminary as a compulsory "alignment" for the dogs prompts the best outcomes and meets the most legal essentials[6]. Prior examinations have appeared to set up whether human monozygotic twins which are hereditarily indistinguishable likewise having the indistinguishable unique fragrances. The dogs were not ready to recognize any one of the cases of all the unique and specific fragrances of monozygotic twins living in a similar situation if the fragrances introduced to them independently. Ten uncommonly prepared police German shepherd dogs of three Czech Republic Police Regional Headquarters were used for odor identification as evidence in the investigation. The dogs should coordinate aromas of two monozygotic sets (5 and 7 years of age) and two dizygotic twin sets (8 and 13 years of age). Fragrances gathered on cotton squares put away in glass containers. Dog supervisors were heedless to the analysis information. In every preliminary (line-up), an aroma utilized as a beginning fragrance and then the dog was sent to decide whether any one among the 7 introduced glass containers enclosed a coordinating aroma.

Aromas of offspring of comparable age groups were utilized as distractors. Perfectly trained dogs are able to distinguish between the mono-zygotic twins when both are living in the similar conditions and eating the same kind of food.[11] The utilization of canines (*Canis* is a genus of Canidae having multiple extent species like as wolves, dogs, dingoes and coyotes), *Canis lupus familiaris* –search dogs are broadly acknowledged in law implementation across the worldwide. The utilization of sniffing dogs has been utilized in European countries for human-fragrance line-ups, however not increased far reaching acknowledgment in the United States. There is restricted logical information to approve the selectivity and unwavering quality of sniffing dogs utilized by law implementation operators for finding the location of drugs, explosives, combustible and ignitable fluid build-up, and the human aroma. Study as of late distinguished a portion of the unpredictable natural mixes present in human fragrance, however there is as yet restricted learning about the character of target-vapor signature and the transport and detection mechanisms related with a trained dog.[12]

**2.4 Instrumental Analysis:**

Instrumental human fragrance investigation is without a doubt alluring for many medical and forensic applications. The head space- solid phase micro-extraction gas chromatography/mass spectrometry (HS-SPME-GC/MS) used to break down the majority of the past human fragrance contemplates centered around unstable natural mixes (VOCs'). Such kind of technique is essentially less responsive to "heavier" less unstable mixes discharged from the human skin. These less unpredictable natural aroma particles presumably make the premise of the unique human fragrance mark, and thusly, the main consideration of the study was centered fundamentally on those "bulky" mixes. The human fragrance adsorbed on to the sanitized glass beads and tests that were set up as hexane arrangements acquired by the extraction from the examined glass beads. To detect the hexane aroma arrangements, the thorough *2D- gas chromatography with time-of-flight mass spectrometer* (GCxGC-TOFMS) was utilized. Utilizing the procedure, in excess of 137 less unpredictable atoms including natural unsaturated fats, esters, aldehydes, ketones, alcohols, and particularly different fatty acid esters along with various C- chains (carbon chains) were recognized. For the first time, a significant number of these particles were recognized in the fragrance tests (**Table 1-3**).[13] As of late, curiosity has expanded in regards to the distinguishing proof of unpredictable natural mixes (Volatile organic compounds i.e. VOCs) for metabolic profiling, human fragrance ID of the living and perished and the demonstrative possibilities for specific sicknesses that are known for its relationship with particular smell. In the investigation, a strategy has been built up that is fit for inspecting, recognizing, and separating the VOCs' present in different natural

examples of scientific significance i.e. buccal cell, blood, inhalation and urine taken from similar people.

The developed technique needs a prior treatment step to separate the desired VOCs' from the exploratory device earlier to the testing of individual examples. The VOCs' gathered from the organic examples were portrayed by solid phase micro extraction and gas chromatography/mass spectrometry with proportions of the most bottomless and successive VOCs' by quantitative and semi quantitative techniques. VOCs' looked at utilizing subjective and semi quantitative strategies. Blood, inhalation, and buccal cells had required extraction strategies going from 18 to 21 h so as to advance the breaking point of location, which arrived at the midpoint of 5–15 ng over these examples. The ideal strategy for estimating pee VOCs' was finished in less than 60 minutes; be that as it may, the farthest point of identification was elevated by a scope of 10–40 ng quantifiable. The exhibited affectability and reproducibility of the strategies created take into account populace investigations of human aroma VOCs' from different organic example accumulation packs utilized in the forensic and medical fields.[14]The sniffing dogs were also utilized for the analysis of the field-testing street cocaine samples analysis. To separate the aroma chemicals from the street-cocaine samples, the SPME is considered which further proved as sensitive and rapid method. For the detection, analysis, optimization and quantitation including extraction time and desorption time, SPME-GC and ACS (activated charcoal strip) / (ACS)-SPME-GC methods have been developed.[15]

**2.5 Recent Advancements in Human Odor Recognition Technologies:**

Human odor identification technologies have gained interest due to the inclusive likelihood of possible relevance in various fields like as criminal investigation, forensics and also biometrics, security checkpoint screening and search for the survivors under debris in mass disaster cases. Gas chromatography combined with mass spectrometry (GC/MS) has been considered as a powerful technique for the detection of human odor. With the help of this approach hundreds of human odorants have been identified. In the course of recent decades, innovative work of Electronic - nose advancements has been speed up at a rapid rate, and in time may give a reciprocal innovation to those dependent on GC/MS.

**Table 1: Table depicting Detected VOCS'**

| Human Odor Categories | Detected VOCS' |
|---|---|
| Human Skin | Aliphatic Fatty Acids, Lactic Acid, Pentanal, Hexanal, Heptanal, Octanal, Nonanal, Decanal, Undecanal Etc. |
| Foot Malodour | Acetic Acid, Butyric-Acid, Isobutyric Acid, Propionic Acid, Valeric Acid and Isocaproic Acid Etc. |
| Breast Milk | Hexanal, Octanal, Nonanal, Decanal Etc. |
| Human Male Armpit Sweat | 2-Methyl Butanal, Acetic Acid, 3-Methyl –Butanal, 2-Pentanone, 2-Methyl-Pentanal, Lactic Acid, Isovaleric Acid, Squalene Etc. |
| Human Male Axillae | C6-C11 Normal, Branched and Unsaturated Acids. |

**Table 2: Summary of Detection Techniques**

| Technology | Detection Technique | Human Odor Detection Capability | Real Time Detection |
|---|---|---|---|
| GC/Detector | GC/MS | Identification of individual VOCs' | Nil |
| | GC/IMS, MCC/IMS | | Near Real Time |
| | GC/GAS Detectors System(GC/SAW) | Detection of target VOCs' components | Yes |
| E-Nose | Metal Oxide Array | Classification of human odor sample in case of two-subject identification | Yes |
| | Saw Array | Detection and classification of VOCs' | Yes |
| | Nano-sensors | Discrimination of VOC mixtures with same number and types with numerous differential information | Yes |
| Other Technologies | Mass Spectrometry | Discrimination of hand aroma for 17 subject's recognition | yes |

| | | | |
|---|---|---|---|
| | Fluoreodor Imaging Sensors | Detection of acid odorants in Perspiration Sample | Yes |

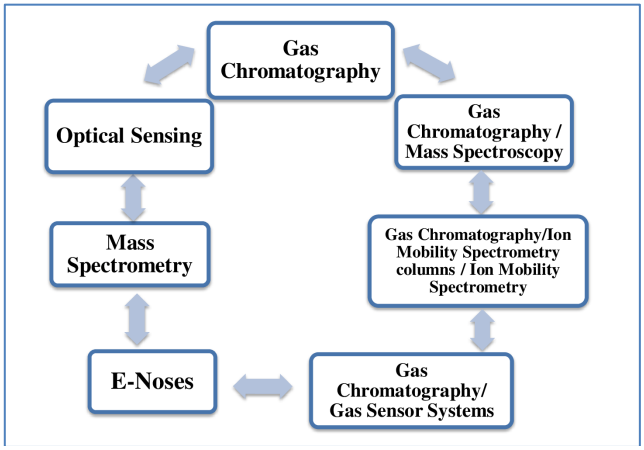
**Table 3: VOC's Detected in Human Odor by GC/MS Method**

| Human Odor Categories | VOCs' Detected |
|---|---|
| Human Urine | 2-butanone,2-methyl-1-propanol,2-methyl-2-butenal,2-pentanone,3-hexanone |
| Human Skin | Ammonia, propanal, ethanol, 2-methyl-2-butanal, n-butylacetate, benzaldehyde, octanal, nonanal, decanal, 3-methyl-2-butanone, 3-hexanone, acetone, dimethylsulphide, disulphide, ethyl acetate, furan, isoprene, methyl-acetate, pentanal, octanal, toluene etc. |

**2.6 Detection Technologies (Figure 1):**

Customary logical strategies for recognizing VOCs' in human aroma utilize a mix of GC with a worldwide identification procedure, for example, flame ionization detection (GC/FID), mass spectrometry (GC/MS) or ion mobility spectrometry (GC/IMS). MS gives the broad spectrum of VOCs' present there in human odor. When GC /MS was combined with TD (thermal desorption), more than three hundred of VOCs' have been detected such as aldehydes, ketones, esters, amines, alcohols, amides etc. GC/IMS detects the VOCs' in human odor which can be used as markers to identify the human who got collapsed under the buildings. MCC/IMS (Multicapillery columns/ion mobility spectrometry) has detected that there are about twenty-three universal VOCs' in the human urine and also discovered that among those twenty-three VOCs', fourteen are supposed to be exist in the urine HS (headspace).

**Figure 1: Figure Depicting Odor Detection Technologies**




The GC/gas sensor system has points of interest, for example, little measurements, simple arrangement in field activities, and low cost. E-noses as the sensor frameworks which are intended to imitate the mammalian as nose. These are ordinarily made out of a variety of non-explicit sensors which react to either single or groups of volatile synthetic substances. E-noses play a vital role in different fields such environmental monitoring, biomedicine and monitoring of food and beverage quality. Mass spectrometry has been recently used for the real – time recognition based on the classification of human subject hand odors.[16-17]

**3. Legal Status of Odor Evidence:**

Odor collections are an integral asset in the examination of crimes. With legitimate strategies, both forensic as well as legal, odor collections can be important evidence for a jury to think about. Sadly, numerous courts have been eager to concede ineffectively directed techniques, regardless of whether giving empty talk to the way that the odor collection was inadequate by saying that its affirmation was innocuous mistake. Tracking cases have set essential prerequisites from since a long time ago apprehended societal and legal suspicions about the precision of dogs. Even though no particular arrangement of preparing strategies or testing conventions be forced leading the aroma collections, conventions along with components which have been created exceptionally dependable outcomes ought to be created by law requirement specialists and demanded by courts. The creators accept that aroma lineups under such conventions would now be able to fulfill the Daubert standard for acceptability of logical proof, however may not be the Frye standard (as a consequence of the nonexistence of common acknowledgment in mainstream researchers). Since the possibility of a bogus ID can't be totally dispensed with, verification by other proof ought to be required, likely at a distinctive and persuading level.[18]

**4. Discussion:**

Forensic odorology have achieved an extensive improvement process and the results obtained from various studies had shown that the

odor can be considered as significant evidence in the investigation purpose. Along with the scientific justification attempts, this approach may prove a significant tool in the forensic investigation across the worldwide. Human odor conveys rich data on human body science. The odor recognition has a wide assortment of possible applications at various places, for example, biometrics, legal examination, illness diagnostics, survivor salvage, and so on.

Current methodologies utilized for human smell identification have either of the accompanying abilities to –

1. Detect, segregate between, as well as distinguish different VOCs' in human odor tests;
2. Detect and segregate among odor tests (a blend of VOCs') of various subjects.

GC/identifier frameworks, for example, high affectability have been exhibited by GC/MS, GC/IMS, and MCC/IMS for identifying each and every VOCs'. Various volatile organic compounds at a certain quantity have been detected in human odor using these approaches. The above study highlighted the importance of dog's powerful sense of smell and their role in criminal identification by discriminating a particular odor from others, so representing the odor as silent and unforgettable evidence. Identifying the compounds present in human odor will allow developing the new proceeding guidelines with current conception. So, there is a need of various fields of criminalistics to establish methods and methodological support. Studies are in progress to enhance the concept of forensic odorology and various new techniques or methods to be developed. Odor evidence can be one of the powerful means in criminal investigation procedures. With appropriate measures, both the forensic and judicial, odor collections can be an important confirmation for a jury to believe. The thought of identifying individuals from their odor is not new; however, there is limited literature available on the human odor chemical composition.

**5. Conclusion:**

It has been interpreted from the various studies that the forensic odorology has achieved substantial growth and odor can be considered as significant evidence in the investigation purpose. Along with the scientific justification attempts, this approach may prove a significant tool in the forensic investigation across the worldwide. More analysis and research is needed in this aspect of forensic odorology. In such a way, the odor can be used for suspect identification, prosecution and can be further interpreted in courtrooms as valid evidence.

Along with the application of human odor compounds in criminal investigation, it can also be helpful in biometric identification, cosmetics production, training of dogs/canine, mosquito trapping field and many more. However, further study for optimization, collection and analysis of odor collecting unit is cost effective but it should be explored.

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*Original Review Article*

# Violence, Hate Speech, and Hostility Against the Healthcare Professionals in India: A Contemporary Legal Review

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Abstract

**Background:** Doctors, nurses, and paramedics are mistreated by impatient patients having prejudice, hatred and unruly behaviour. The recent COVID-19 pandemic has highlighted hate speech and hostility against healthcare professionals and workers. **Objectives:** To identify reasons for the abuse and violence. To examine the statutory provisions and judicial interpretations about protecting the rights of the healthcare professionals against hate speech, abuse and violence by the patients and their near relatives. To identify the shortcomings in the existing legal framework. **Methods:** Analysing and reviewing of research papers, articles, judgments, statistical studies, and news reports that are related to hate speech, abuse and violence against doctors and healthcare workers in the past ten years in India. **Results:** Although some states have legislated exclusive law about the present issue, instances of abuse, and violence have not been reduced, rather increased as seen after the COVID-19 pandemic. Therefore, there is a lack of deterrence in the existing penal law. **Conclusion:** Physicians who are victimised face a special kind of occupational vulnerability. Because general physicians work in a variety of therapeutic settings, the possibility of violence, hate speech, hostility is a legitimate issue. Because of the huge emotional, psychological, and financial implications of violence, it is a concern not for policy makers alone, but for everyone.

## 1. Introduction

The stress of practicing medicine might be exacerbated by the burden of prejudice for physicians who are cultural and religious minorities. Hospitals have procedures in place to safeguard employees against workplace discrimination at the hands of co-workers or superiors. However, when a patient is racist or prejudiced against a physician or other health care professional, there is sometimes

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little remedy. Doctors and nurses, as well as paramedical personnel, mess boys, laboratory technicians, ambulance drivers, and security personnel, are among the healthcare professionals. Most of them have faced discrimination in some form or the other. Some might have faced verbal abuse and hate speech, while others faced physical violence, or both. What speech amounts to hate speech and in which context it is said, is a matter of dispute. Hate speech, while not universally accepted in definition, can be understood as the promotion, endorsement, and encouragement of vilification of others based on innate differences. Doctors are abused and at times assaulted; hospitals are damaged after a patient dies, and rioters are seldom prosecuted.[1]

**2. Reasons Attributed**

Certain internal medicine physicians engaged in the emergency department, on psychiatric wards, in drug misuse programs, and jails, are prospectively at higher risk. However, no matter where one trains or practices, there is always the risk of encountering an aggressive or dangerous individual. Reports of abuses and violence against physicians, sometimes resulting in serious injury or murder, have made headlines throughout the world in recent years. Several comparable incidents have been reported in India as well; nevertheless, this threat has received insufficient attention.[2] The form of such abuse in western countries has evolved subtly during the previous 40 years. In most European countries and Canada, the government pays for healthcare, and the patient's first point of contact with medical services is often with designated general practitioners who make house calls 24 hours a day, seven days a week; thus, there is no financial concern for medical treatment in these countries.[3] However, in the United States, while the grade of medical treatment may be excellent, it is expensive, primarily via payments to insurance and corporations or direct out-of-pocket costs.

A fundamental aspect of abuses against physicians in government and corporate hospitals is the perception that doctors are wrongdoing for financial gain or to evade their responsibilities. Anxiety and long waits before speaking with a doctor and the belief that the doctor is not paying enough attention to his or her patients all contribute to irritation, which can lead to abuse. In India, the majority of hospitals lack an effective complaint handling mechanism. Besides, the legal process takes an abnormal amount of time, mostly in India, aggravating the malady. The general public's perceived lack of respect for the medical profession, a widespread misunderstanding of how a busy tertiary care centre works (particularly triage), and unrealistic treatment expectations were also prominent reasons. If we look at how patient violence is classified in our nation, the majority of the time, it relates to verbal abuse, to the extent of hate speech, vandalism, and physical threat. In 2016, 41% reported being assaulted and 16% reported being battered at some point in their career by either a patient or a patient's relative. Many of these incidents occur during residency training when violence is considered "normal". The prevalence of violence against psychiatrists is highest in emergency rooms, prisons, and state hospital forensic units.[4]

Further, a 2019 study by Indian Critical Care Medicine reveals the extent of violence and its effects. The 2019 statistics show: "Out of 295 HCWs (Health Care Workers), 11 (3.7%) HCWs faced physical violence, whereas verbal abuse was faced by 147 (50%) HCWs. A higher number of incidents of physical violence (91%) and verbal abuse (64%) were faced by HCWs in the age group of 20-30 years. Verbal abuse was faced by 49.3% of nurses, 53% of junior residents, 61% of senior residents and 36% of consultants. Out of 158 incidents of workplace violence (WPV), the maximum occurred in ICUs (62.0%) and emergency (21%)." [5] These numbers only affirm that violence against doctors is not new and had subsisted well before the COVID-19 pandemic as well.[6] However, the recent sharp rise in such incidents is worrisome. It is of utmost importance to safeguard the health of society in the larger interest.[7] Given that our healthcare system is already in a precarious state, violence at this pace will only lead to several medico-legal and ethical consequences.

Multiple ethical issues were arising among healthcare professionals due to the limited supply of resources. As a result, health services have been faced with ethical dilemmas such as deciding whom to treat considering the shortage of resources and incompetence in providing treatment to every individual. This is against the principles of ethics like justice, non-maleficence, autonomy and the right to dignity irrespective of the helpless situation. Proper elucidation of the current situation is extremely essential to defend the treating doctors and paramedical staff who are pushed to serve society in

this vulnerable condition. This pandemic has not only brought significant changes in the lives of people but also for the medical fraternity and exposed the flaws of the healthcare system.[7]

**3. Recent Judicial Observations**

In the case of Jerryl Banait v Union of India,[8] the Hon'ble Supreme Court of India considered a matter in which physicians who went to test particular patients were assaulted and stoned. It made the following observation and directive: "The virus that is sweeping the country is a national disaster. In the aftermath of a disaster of this magnitude, all inhabitants of the country must act responsibly to provide a hand to the government and medical personnel in carrying out their obligations to control and battle COVID-19." It further held that "Doctors and medical personnel are also given police security when they visit locations to evaluate individuals for illness signs." The Hon'ble High Court of Jammu and Kashmir stated in a recent case of Azra Usmail and Others v Union Territory of Jammu and Kashmir[9] that such violence against doctors during the peak of the pandemic spread has grave repercussions such as the transmission of illness, endangering the lives of healthcare staff, and causing damage to public property. The court observed that "the professionals engaged in the treatment of COVID-19 patients and the prevention of infection would be working beyond the call of their usual tasks, as well as overtime." It further held that "it is vital to keep professionals dealing with COVID-19 concerns free of personal pressures and needs in order to assure their complete focus."

The case of Sanpreet Singh v Union of India[10] was another one in which the Hon'ble High Court of Uttarakhand ordered the Uttarakhand government to provide sufficient nutrition and care to healthcare practitioners who are involved in the fight against COVID-19 pandemic. The Hon'ble High Court of Kerala held in Abdul Naser v State of Kerala[11] that "In addition to causing pain and misery to physicians, assaults and violence against them have a negative impact on the care of all patients. It effectively brings all functions to a standstill, putting many people's health in jeopardy, which is a serious problem." There are always methods to handle these challenges in a balanced manner. The Court further held that three elements must be considered in instances while examining the plea for anticipatory bail. They are: i) The kind and severity of the doctor's/ hospital employee's injury, if any; ii) The amount of any damage to the property, if any; and (iii) The context in which the acts of violence were carried out. No physician, no matter how attentive or cautious, can predict when or which day or hour he or she will not be the target of an unjustified assault, malicious allegation, extortion, or claim for damages. As a result, general physicians are in an ethical dilemma: to perform or not to perform their obligations.

**4. Statutory Provisions**

Currently, the Indian Penal Code (IPC) establishes the broad criminal law that applies across India. These legal provisions in the existing penal code already address many of the components of "violence". However, it doesn't specifically mention violence against healthcare workers, nor does it define the term "hate speech". The IPC prescribes penalties for both wilfully inflicting harm and serious harm[12] and provides punishment for the same.[13] Besides, it stipulates that assault or the use of criminal force against any person resulting in harm is punishable under the law.[14] In addition, there is a special penalty for criminal intimidation.[15] In terms of property damage, the IPC stipulates penalty for mischief, which includes property destruction.[16]

While there is a dearth of national statistics on the enforcement of state-specific legislation criminalising violence against healthcare workers, information from a few states shows that prosecutions under these laws have been exceedingly rare. A study reveals that no one had been prosecuted under state statutes, and that in many cases, the complaints were not even filed as First Information Reports (FIRs).[17] FIRs were registered in certain situations. However, they were later dismissed after the aggrieved parties reached an agreement and a cancellation report was submitted with the local magistrate. While the Indian criminal court system's well-known sluggish speed has undoubtedly contributed to this predicament, the sheer absence of published judgments also suggests that existing State laws have experienced virtually little enforcement. This may have prompted medical professional groups like the IMA (Indian Medical Association)[17] to call for a federal statute to curb violence. However, it is unclear how enacting a new, central legislation will better address the issue of violence if current state laws are only partially enforced and structural faults in India's criminal justice system are not addressed. As the IPC didn't

define the word 'hate speech' nor any law in India, the Law Commission of India, as per the direction of the Hon'ble Supreme Court, proposed the Criminal Law (Amendment) Bill, 2017 to amend the IPC, and the Code of Criminal Procedure, 1973. It suggested insertion of two new Section (s), namely, Section 153C IPC and Section 505A IPC.[18]

In 2019, as a ray of hope, the Health Services Personnel and Clinical Establishments (Prohibition of Violence and Damage to Property) Bill, 2019 was introduced in the Parliament. All types of violence that the new Bill seeks to criminalise were already covered by current IPC prohibitions. However, the Bill differs from current IPC provisions in terms of enhanced jail sentences and fine amounts. Unlike the IPC, which classified each of the offences (injury, serious harm, property damage, etc.) differently, the Bill classified all acts of violence against healthcare staff and clinical institutions as cognizable and non-bailable.[19] The said Bill sought to punish people who assault on-duty doctors and other healthcare professionals by imposing a jail term of up to 10 years. It was a legislation for the first time addressed violence against healthcare professionals at national level. It criminalised both the commission and incitement to commission of violence against healthcare professionals and damage to the property of clinical establishments.[20] Unfortunately, the Bill was stalled, citing reasons that the existing provisions under IPC already covered the elements of 'violence' as defined in the said Bill and another clarification given was that most of the States are having legislations like the Medicare Service Persons and Medicare Service Institutions (Prevention of Violence and Damage to Property) Act, 2008.

After the COVID-19 pandemic, the Epidemic Diseases (Amendment) Act, 2020 was passed and it defines 'acts of violence' committed by any person against the healthcare service professional serving during an epidemic as one, which may cause, harassment, hurt, injury, a hindrance to services, damage to property or documents in custody. The statute also defines 'health care professional' and 'property', providing a wide ambit for better protection. **Section 2B** provides that no person shall indulge in any act of violence against a healthcare service professional or cause any damage or loss to any property during the epidemic. **Section 3 (2)** provides punishment for commission or abetment of commission of an act of violence. **Section 3 (3)** deals with committing an act of violence against a healthcare service professional, causing grievous hurt as defined in Section 320 IPC. When prosecuting a person for causing grievous harm to a healthcare service professional, the Court will presume that person is guilty of the offence unless the contrary is proved. Moreover, the statute states that in case of damage to any property or loss caused, the compensation payable shall be twice the amount of fair market value of the damaged property or the loss caused.[21]

**5. The Way Forward**

Doctors, nurses and paramedics are mistreated by certain patients having prejudice; hatred and unruly behaviour. Although no civilization exists without prejudice and hate, the difference could be minimized largely by social actions, the spread of awareness, and legal remedies. Doctors must be able to detect many types of violent conduct, address the clinical and institutional issues that both cause and result from patient aggression, and know what security measures to take in a risky scenario. Granting health care professionals and health care facilities with immunity from suit and civil liability for damages, alleged to have been sustained by an act or omission occurring in the course of providing health care services during the period of the COVID-19 emergency, provided the health care services were provided in good faith and damages were not caused by gross negligence, recklessness, or conduct with an intent to harm or discriminate.[22]

India's healthcare legislation and administration are in desperate need of correction. The current scenario is the result of a number of systemic forces. As previously stated, there are severe worries about public healthcare facilities' capacity to meet the healthcare demands of India's rapidly growing population. This also highlights the need for a deeper look at the government's healthcare policies, which are aimed at improving access and meeting patient requirements, as have been pointed to numerous malpractices in private healthcare facilities that have jeopardized patient rights.[23] While the Clinical Establishments (Registration and Regulation) Act, 2010 establishes basic criteria for healthcare establishments, it is currently only in effect in a few states and union territories.[24] As an outcome, the problem of violence against healthcare workers highlights the need to

delve further into the regulatory and governance difficulties that plague Indian healthcare.

Simultaneously, it is essential to address public perception. While the intricacy of India's healthcare system cannot be articulated in a few words, the day-to-day operations of hospitals and the everyday issues encountered by physicians may be communicated to the general population. This would assist patients become more aware of the limits that most healthcare professionals face today, as well as let them think on their own rights and responsibilities. Thus, media campaigns, public service announcements, and testimonials from doctors about the challenges they face on a daily basis in a hospital, what triage means, the desired etiquette of citizens in a hospital, and the type of punishment that would be applicable to perpetrators of violence in a healthcare setting should be broadcast on popular media.

There is a pressing need for structural reforms in medical education and healthcare delivery systems, just as there is a pressing need for citizens to modify their views. Patients and their kinfolk may be more empathic toward physicians if they are aware of the obstacles they confront, which may help to establish trust in doctor-patient interactions. Several prescriptions for averting violence against doctors have been provided in the literature, ranging from changing the curriculum of study to developing more communication skills, understanding by taking note of patients who may be violent, being cautious at violent venues, preparing to flee the scene if necessary, educating patients and their relatives, improving healthcare, and so on.[25]

**6. Conclusion**

While concluding the need for a comprehensive legislation to protect health care providers from undue harm, the legislative barrier also needs to be addressed. The matter of Public Health falls under Entry 6 of State List; this raises a difficulty in the formulation of central law for the same. However, the Centre may resort to Article 249 in order to frame this law in the national interest. This importance of this legislation is more than clear.

Even though several states have enacted laws on this matter, instances of violence have not been reduced. The law is needed for proper deterrence, compensation, enforcement, and to bring the confidence of health care providers in the protection of the law. This law is necessary to assure health care providers about the sanctity attached to the service and the respect they garner for providing that service.[26]

Physicians who are victimised by the individuals, for whom they care, face a special kind of occupational vulnerability. Because general physicians work in a variety of therapeutic settings, the possibility of violence, hate speech, hostility is a legitimate issue. Because of the huge emotional, psychological, and financial implications of violence, it is a concern not for policy makers alone, but for everyone.

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*Short Communication*

# Role of Forensic Medicine in Jordan's Criminal Justice System (Rape Crimes)

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Abstract

This study aims to understand better the function of forensic medicine within the criminal justice system in Jordan (Rape crimes). Forensic medicine plays an important part in identifying criminal activity and, therefore, in the assessment of criminal conduct and its repercussions. According to the study, what is meant by forensic medicine during an investigation, and how it is related to Jordanian law and judicial procedures in addition to the judge's discretionary authority to require the rhetorical report in the case of sexual crimes, the field of forensic medicine has a practical and technical role in identifying the rhetorical evidence that leads to the discovery led to an appropriate conclusion for the study.

## 1. Introduction

As a result, forensic medicine plays an important part in identifying criminal activity and, therefore, in the assessment of criminal conduct and its repercussions. As a result, it impacts the path of analysis and, therefore, on the legal learning of facts. In the case of death, in wounds of many types and causes, as well as sex crimes and sex abuse, this is often visible. In addition, the field of forensic medicine has a practical and technical role in identifying the rhetorical evidence that leads to the discovery[1] of clues in unexplained crimes when the inquiry fails to identify the reasons and, therefore, identify the offenders. The searches and investigations carried out in these axes are intended to find the evidence on which the axes' success or failure is predicated. Either the subject is found guilty or not guilty of the charges leveled against him[1].

Among the general public tasks that the forensic medicine doctor does throughout the investigation, phase is that he conducts activity medical evaluations on the victim's impact part and documents the kind and outline of the damage and the reason and date of its occurrence[2]. It may also reveal the nature of the attacked sexual biological components, as well as the likelihood of the presence of a permanent disability, the evaluation of its stability, and the link between the committed assault and the victim.

It is the duty of the forensic medicine doctor, upon being deputized to assist him at the scene of a crime, to perform these exams credibly and honestly in order to give a study verifying the examination. As well as performing an autopsy on the deceased in criminal cases and investigating possible causes of death, regardless of how or when they occurred, as well as investigating

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the connection between death and any injuries the body has sustained; as well as obtaining precise technical opinions in connection with accidents and errors, examining blood and the types of blood, spermatozoon material, scrutiny hair, and examining samples taken from bodies to understand The sexually violated portions of the body.[3]

Article 292 of Law No. 16 of 1960 (the Penal Code of 1960) and its amendments stipulate Rape and sexual intercourse with a minor.

1. Whoever has sexual relations with a female (other than his wife) without her consent, whether by force, threat, deception, or deception, shall be punished with temporary labour for no less than fifteen years.
2. Every person who rapes a girl under fifteen shall be punished with death.

The penalty shall be twenty years' imprisonment if the victim has completed fifteen years and has not completed eighteen years of age.

Article 293 of Law No. 16 of 1960 (the Penal Code of 1960) and its amendments states: A female (other than his wife) who cannot resist due to physical, psychological, or mental weakness or incapacity is considered to have committed the offense stipulated in Article (292) of this law and shall be punished with the penalty stipulated therein.

**2. Rape Crime**

Rape, according to what is established in jurisprudence and jurisprudence, is considered unlawful intercourse with a female without her consent. Consensual intercourse ends, and the crime of Rape ends, and if the act remains criminalized and subject to another legal text. The places of chastity that it is keen to preserve and cover, and since the actions that the accused committed were with the victim's consent and acceptance, then what he did does not constitute the crime of Rape referred to in Article 292 of the Penal Code but constitutes the crime of indecent assault, contrary to the provisions of Article 298/1 of the Penal Code.

Rape an attack that involves penetration into the vagina.[4] Frequently, general traumatic manifestations are seen in sexual crimes, whether on the victim's body or the accused's body, as a consequence of resistance (the phrase "generic injuries" refers to damage to any region of the victim's body save the genital area). However, the absence of injuries does not rule out Rape, as there are numerous possible explanations, including Subjugating the victim through emotional interaction or the threat of violence or murder, the perpetrator's violence or the victim's resistance is insufficient to cause the injuries, the bruises may not appear until 48 hours after the assault, or they may not appear at all, the victim's delay in reporting the assault.[5] Consent does not exist, for example, if sexual contact happens under fear or compulsion. Threatening a lady with a weapon capable of murdering her, her kid, or herself, and threatening her with photographs of her or messages she had previously written.[6]

Article 296 of Law No. 16 of 1960 (Penal Code of 1960) and its amendments states the following: (1) Whoever assaults a person with violence or threats shall be punished with labour for a period not less than four years; (2) The minimum penalty shall be five years if the victim is the victim. He has completed fifteen and has not completed eighteen years of age; (3) the minimum penalty shall be seven years if the victim has completed twelve years and has not completed fifteen years of age.[7] When dealing with rape crimes, the forensic physician must keep the following in mind:- (1) The purpose of the forensic medical examination is to document injuries and evidence in order to aid in the prosecution of the perpetrator or the acquittal of the accused in the case of a false rape allegation; (2) Respecting the plaintiff's modesty and not impinging on it by stripping her completely naked during the examination; (3) Because the plaintiff may be unaware of some of the injuries sustained during the assault, the forensic doctor must examine the plaintiff's entire body using a strong light source and a magnifying lens (if necessary). Additionally, natural body openings such as the inside of the lips and the scalp are included.[8]

Sexual violence may take on a variety of forms and manifest itself in various contexts. The violation may occur prior to the arrest of one or more persons (for example, gang rape); this occurrence may or may not be spontaneous and unplanned. Although sexual violence is often committed in the victim's home (or the perpetrator's home), it also happens in various other locations, including workplaces, schools, jails, automobiles, and public places (such as parks or farms). The offender may be on a date with the victim, a close acquaintance with her, a friend, or a victim's family member. The perpetrator may be an unknown stranger to the victim of an intimate partner or ex intimate partner. There is no one-size-fits-all perpetrator. Sexual

assault offenders come from all walks of life, whether they are wealthy or impoverished, educated or uneducated, religious or non-religious. Sexual assault is unlikely to have been perpetrated by someone in privileged positions or positions of respect and trust (such as police officers, physicians, teachers, tour guides, and pastors).[9] When it comes to sexual violence against an adult female victim, the time between sexual activities and medical examination is critical because evidence disappears over time or if the victim changes her clothes or bathes. It also depends on the experience, knowledge, and skill of professionals from the medical, psychological, social service, and law enforcement sectors who interview the victim and learn about the type of sexual activity she was exposed to and the potential consequences of that exposure.[10]

Article 298 of Law No. 16 of 1960 (Penal Code of 1960) and its amendments stipulates the following: (1) whomever assaults, without violence or threats, a child - male or female - who has completed fifteen and has not completed eighteen years of age, or induces him to commit a crime An act of indecent assault shall be punished with temporary labour for a period not exceeding ten years; (2) The minimum penalty shall be five years if the victim has completed twelve years and has not completed fifteen years of age. Even though the forensic medical examination is vital and significant, it cannot serve as the only source of evidence of sexual assault against the girl. In addition, the test results are incomplete unless they are combined with a police investigation and a psychological assessment.[10] They can occur in either the labia majora or labia minora, and the severity of the injury is determined by the amount of violence that occurs during sexual activity. The injury usually manifests as bruises or tears in the posterior spinal cord (the region connecting the labia majora). However, in very rare cases, the injury can be quite severe, extending a tear from the external genitalia to the perineum (the area between the anus and the vulva). It is not believed that external sexual behaviours, such as interviewing the genitals and sucking the penis, would inevitably affect the outcome. There is no purpose in managing these regions once the swabs have been checked for animals, sperm, and genetic fingerprints.[11]

**3. Role of Forensic Medicine**

As soon as a criminal offense is committed, members of the judicial police, the public prosecutor, and also other experts rush to the scene of the crime in order to determine the nature of the crime, its causes, and also the circumstances surrounding it, and also to determine who committed the crime. However, individuals working in law enforcement or judicial administration and public prosecutors and judges may encounter scientific or technological issues that are not covered by their data of specific judicial and legal competencies that are outside the scope of their authority and specializations. As a result, the Jordanian legislator who approved the Jordanian Code of Criminal Procedure No. 9 of 1961 and its revisions and the Jordanian Code of Civil Procedure No. Nonetheless, the court and also the prosecuting attorney may seek the assistance of forensic medicine to clarify what is ambiguous and difficult for the court or the general public prosecution to comprehend, as provided for in Article twenty of an equivalent law, which states that if someone dies by murder or unknown causes that raise suspicion, the general public prosecuting officer may seek the assistance of one or more doctors to arrange a report of the causes of sexual abuse.[12]

Criminal cases, particularly regulatory offenses, are particularly important in forensic medicine, whether or not at the preliminary investigation stage or the trial stage, and the accused's conviction or a final judgment is generally dependent on the forensic medical evidence presented during the investigation or trial. In order to determine the legal nature of the competence, several viewpoints were expressed. This means that forensic medicine reports include evidence and supporting factors such as proof of the crime's occurrence and evidence of the crime's attribution to its offender. Another side has said up to this point that it is how to examine the evidence that the judge uses to determine whether or not he is telling the truth, and that he cannot use it if he is not pleased with him, and we agree with this point of view as well.[13] Later, the forensic doctor prepares a forensic doctor's expertise report. This report is the essence of the professional method because it contains the results of the forensic doctor's analysis that represent the necessary technical and scientific components that assist the choose or investigator in instructing them about reality and providing them with the opportunity to form their judgments in the light-weight of that reality. After the evidence has been released and its aspects have been described in-

depth, a suggestion from a medical and scientific perspective on the value of the proof is made, and the principle of judicial conviction[14] is applied, the professional opinion is completed. The court may or may not be convinced by the forensic doctor's report, depending on whether or not it is applicable, consistent with the conscience principle stipulated in Article 174, Jordanian Criminal Procedure Law, as long as, i.e., there is no evidence of a conspiracy.[15]

The trial court has a discretionary authority to weigh the evidence, take it and put it forward, and the Court of Cassation has no control over it in that as long as the conclusion is rationally and legally plausible and has a firm origin in the case papers under the provisions of Article 147 of the Code of Criminal Procedure. 2- Having sexual intercourse with a female (other than the wife) without her consent by threat is an act that constitutes a crime of Rape, based on the text of Article (292) of the Penal Code. 3- To implement the aggravating circumstance stipulated in Article (1/301/a) of the Penal Code, two or more persons have committed the crime of indecent assault and successively committed indecency with it. 4- The decision of the trial court shall be considered legal and correct if it includes a summary of the facts mentioned in the indictment, the trial, a summary of the demands of the personal claimant, the public prosecutor, the defense of the accused, the evidence and the reasons for incriminating or not under the text of Article (237) of the law Principles of criminal trials.

To this end, the Jordanian Supreme Court ruled in its call No. 96/2000 that, while the trial court's conviction of proof is not subject to the Court of Cassation's management, this court has the authority to review it in terms of whether or not the proof is legal proof, as this issue is based on legal applications and not on factual matters, and to determine that his conviction is within the proof contained within the case.

## 4. Conclusion

The criminal investigation is a conflict between the investigator and the criminal, with the one attempting to establish reality and the second attempting to obfuscate it to avoid prosecution. In its broadest meaning, the inquiry should include the use of all authorized procedures and means necessary to ascertain the truth. The route leads a path for walking and searching for evidence. Forensic medication is a word that encompasses both medicine and law.

Regarding medication, it is the science that deals with everything related to the material body, whether living or dead, and Sariah law implies that it is the law that resolves conflicts between individuals6. Forensic medicine is not limited to producing medical reports or examining victims; it is, in fact, a living science, which is critical for staying current with recent and rapid advances and advanced ideas in analysis and identification.

Because the forensic doctors' opinion does not bind the court, and because the choice is completely free to take evidence if he is satisfied with his conscience, and evidence is excluded if they are not, it has become necessary to design a special criminal sciences program for law students in Jordanian universities in an exceedingly legal manner.

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*Case Report*

# A Case Report of Dyadic Death with Husband as a Perpetrator

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Dyadic Death,
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Abstract

The dyadic death is a fatal event in which one individual kills another and subsequently commits suicide within a short time interval ranging from one hour to one week. These are the most violent acts involving the most intimate partner or family members. Perpetrators are usually male. The causes in India range from domestic quarrels due to strained relationships, broken love affairs, infidelity, addiction, ill physical health, financial crisis, etc. Here we are reporting a case of dyadic death in which the perpetrator was 40 years old male, chronic alcoholic, auto-rickshaw driver. He killed his wife who was 35 years old. Autopsy examination shows injuries over the body as chop, stabs, incised injuries, and contusions. After killing his wife, the perpetrator hanged himself in his home. The detailed history was obtained from police and relatives, and the reason revealed as suspicion of infidelity and regular domestic quarrels. Legally and for police investigation, these are not high-profile cases since they just demand proper investigation and correct recording. It is better to undertake proper social, psychological, and psychiatric investigations to decrease or to stop such incidences. It is necessary to establish a national surveillance system for such episodes to know the exact circumstances of each case.

## 1. Introduction

Dyadic death also referred to as homicide-suicide to an incident where homicide is committed followed by the perpetrator's suicide almost immediately or soon after the homicide. Homicide suicides are relatively uncommon and vary from region to region.[1,2] In India, there are no such statistics available, and also the National Crime Record Bureau doesn't have data regarding incidences of dyadic deaths. In situations, where murder has occurred and the perpetrator has been found dead at the scene, the most likely scenario in such cases could be homicide-suicide or dyadic death.[1,3,4] When comparing homicides with dyadic deaths, research suggests that the perpetrator is more likely to commit suicide later when the motive is related to possessiveness, jealousy, sickness, or stress and these incidents are more likely to be premeditated than a homicide alone. [5]

Also, the reasons behind Dyadic Death may vary from case to case but in the Indian scenario,

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marital disharmony and financial burden are the major reasons for dyadic deaths. Other causes of dyadic death could be domestic quarrels due to strained relationships, infidelity, broken love affairs, addiction, financial crisis, psychiatric illness, ill physical health. Here a case of Dyadic Death is discussed related to infidelity leading to regular domestic quarrels.

**2. Case history -**

As per the police inquest, two bodies were recovered at home, of which one was male and the other was female. Both the deceased were brought for medicolegal autopsy at our center. The autopsy was conducted on the deceased who was 35 years old female. On external examination, multiple injuries (**Fig 1**) in the form of chop stabs and incised injuries were observed on the body. A single chop injury was observed over the chin with a cut fracture of the underlying mandible. Also, multiple stab injuries along with incised injuries were observed over the neck and back. On internal examination (**Fig 2**), the stab injuries over the neck showed penetration deep up to the tracheal lumen and cut transection of the left carotid artery along with gross hemorrhagic areas in the muscles of the neck. The cause of death was issued as “Death due to chop and stab injuries” and the manner of death was homicidal in nature.

An autopsy was conducted on 40 years old male deceased, an auto-rickshaw driver by profession, and a chronic alcoholic. On external examination, a single ligature mark was observed over the neck, above the level of the thyroid cartilage, extending upward and backward. On internal examination of the neck, a faint, pale, parchment-like ligature mark was observed in relation to the external ligature mark. The cause of death was issued as “Asphyxia due to hanging” and the manner of death was suicidal in nature.

The detailed information obtained by the investigating officer revealed that the perpetrator and victim were married 10 years back and had one male child. After marriage, there were frequent quarrels among husband and wife, also he had a suspicion of the infidelity of his wife. He killed his wife for the reason of infidelity with the use of a sharp weapon and then he hanged himself. At autopsy, a ligature mark over neck was observed (**Fig. 3**). By profession, he was an auto-rickshaw driver and addicted to alcohol. The history revealed that the husband was not under any kind of psychiatric treatment and a suicide note was not observed at the scene of the crime. So, in this particular case as per the police investigation report, it was observed that the husband was depressed, stressed, and was addicted to alcohol leading to Dyadic Death.

**Fig. 1: Photograph showing multiple injuries over the body of the female victim.**

**Fig 2: Photograph showing neck dissection with internal injuries to the neck structures.**

**3. Discussion –**

Homicide suicides are rare unusual deaths with social importance. These kinds of cases refer to an episode wherein a homicide is committed

followed by the suicide of the perpetrator. These are human tragedies in which the perpetrator, more often a male, kills one or more victims, typically his wife and or children and or some other intimates from family. It is infrequent, can aggravate family commotion, psychological trauma, and public concern.[6]

**Fig 3: Photograph showing ligature mark over the neck of the perpetrator.**

Ghormade PS et al, Gupta S et al and Byard RW et al reported cases of dyadic deaths in which the husband was a perpetrator of a crime.[7,8,9] Dhawane SG et al and Gupta BD et al had described homicide-suicide episodes involving males as a perpetrator but only a few reports with mother as perpetrator had been published.[10,11] Bardale RV et al reported two different cases of dyadic deaths in which perpetrators were married mothers who killed their children by drowning and then they committed suicide by drowning.[12] Gadhari RK et al reported a case in which a mother was a perpetrator who killed her two children by drowning.[13] In our present case report the perpetrator was the husband who killed his wife with the use of a sharp weapon. The male perpetrators are often involved in crimes due to high concentrations of testosterone which have been reported in populations characterized by high aggression, including criminals with personality disorders, alcoholic violent offenders, and spousal abusers.[14]

Milroy CM et al had reported 52 cases of the homicide-suicide pact and also reported common causes for dyadic death as a breakdown in a relationship (46%), mental illness (21%), physical ill-health (11%), financial stress (10%).[15] The case report by Ghormade PS et al reported three different cases of dyadic deaths with three different reasons as financial burden, unemployment, and fear of not continuing love relationship.[7] In our case report, strained relationship due to suspicion of his wife's infidelity was the reason for such violent tragedy. Bossarte RM et al reported common methods of committing suicide in perpetrators of dyadic deaths as shooting (80.4%), sharp weapon injuries (11%), hanging (6%), poisoning (4%), fall from height (3%), burns (1%) and vehicular injuries.[16] Byard RW et al and Santoro JP et al reported suicidal hanging by perpetrators in homicides-suicides cases.[9,17] In our present case, the perpetrator preferred a method of committing suicide by hanging. As ligature material is easily available, the perpetrator prefers to commit suicide by hanging himself after the crime.

Legally and for police investigation, such types of cases are not high-profile cases as they just demand proper investigation and correct recording. These kinds of deaths not only affect single families but also have a tremendous impact on society regarding strained family relationships and the reason behind such tragic events of dyadic deaths. So, it is better to undertake proper social, psychological, and psychiatric counseling in order to decrease such incidences. It is absolutely essential to establish a national surveillance system for such episodes to know the exact circumstances of each case.[18] Every post-mortem center should be requested to keep data regarding these kinds of death and should be reflected on the National Crime Record Bureau website. So it will be easy to calculate the exact numbers of dyadic deaths region wise and also we can find the reasons behind such violent acts and minimize their prevalence.

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*Case Report*

# Sexual Gratification in Lockdown

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Abstract

Foreign objects introduced into rectum either for sexual gratification or by accident or as a result of assault or torture. Removing the foreign object is an emergency procedure and if not done in time can lead to dangerous complications. The case herein reported is that of a male with an alleged history of insertion of foreign object i.e., deodorant bottle in his rectum by himself for sexual gratification but the bottle slipped, and sucked into the rectum which was beyond his reach of grasp.

## 1. Introduction

Foreign body inserted into the rectum through the anal canal is usually to gain sexual pleasure and many at times it slips beyond the grasp of an individual and get lodged in the rectum or beyond it. Sexual gratification by an object is often achieved by self or with help of a partner. These objects may vary from beer bottles, cans, bulbs, cups, candles, vegetables, etc. Excess exposure to internet contents and developing of ideas of experimentation in sexual desires has brought society to the edge. Medical fraternity is supposed to deal with these sexual perversions and their physical and psychological consequences.

Sodomy though commonly practiced unnatural sex these days, got its name from city Sodom.[1] These days it is getting more attention due to liberalization of laws towards choice of sex and forming of same sex communities like LGBT and more. The foreign body when inserted in to the rectum of an individual with an intention to assault, it causes great physical trauma along with mental trauma and social stigma. Physical trauma and depth of insertion in rectum or beyond it will lead to different method employed for extraction of the foreign body. The Indian penal code does not account for the mental pain and social embarrassment but physical trauma is dealt in section 319, 320, 302 IPC[2-4] depending upon the delayed consequences of trauma intended. If simply removed without complications or hospital stay then tried for IPC 319, any hospitalization more than 20 days will attract Grievous hurt, further complications leading to death the perpetrator will be charged with murder (302 IPC).

## 2. Case Report

A male of 21 years of age was brought to the Emergency and Trauma section of J.N. Medical College, AMU, Aligarh at around 12:00 AM on 12th June 2020 with history of self-introduction of foreign body in rectum along with bleeding per anum. Further the patient told that he is a homosexual and is in same sex relationship from past 3 years. He was unable to reach out to his partner due to complete lockdown because of Corona pandemic.

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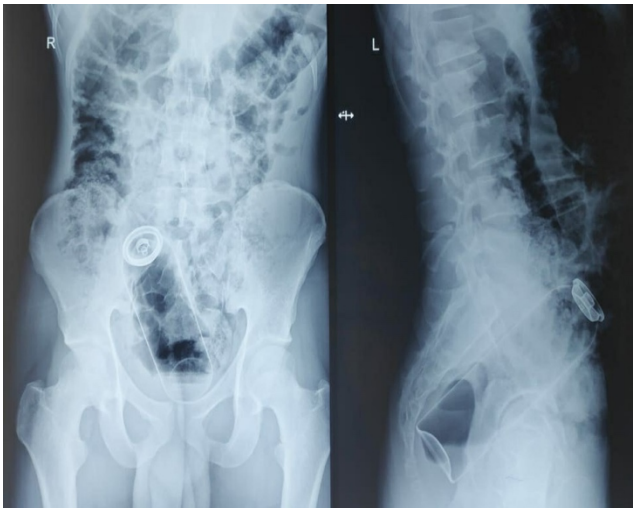
So due to paucity of source for sexual gratification he tried to get sexual satisfaction by inserting the deodorant bottle (Fig. 1) into his anus but the bottle slipped, and sucked into the rectum which was beyond his reach of grasp. After that pain and bleeding started.

There was bleeding from the anal canal. Abdomen was soft and non-tender and locally little bleeding was found in anal region with bruising of the perianal tissue. On Per rectal examination foreign body was found impacted above the dentate line in the anal canal. X-ray of pelvis (Fig. 2) showed well defined radio-opaque structure in the region of pelvis lying anterior to the sacrum and no gas under the diaphragm. Foreign body was removed per rectum under local anaesthesia, further fresh bleeding occurred after the removal of foreign body. Later course of patient was uneventful and patient was discharged eventually.

**Fig. 1: Deodorant bottle (125 ml capacity) retrieved from rectum.**

**Fig. 2: X-ray of pelvis showing deodorant bottle in rectum**




## 3. Discussion

The cases of impacted foreign body in rectum show patient as victim varying incidences in different part of the World tend not to disclose the actual history how it happened because of the embarrassment he may face in the society towards the incidence.[5] Therefore the total number of cases which are reported may be lower than the actual number of cases. With a ratio of 37:1, a systematic review shows that the incidence of retained colorectal foreign body is disproportionally higher in men.[6] At presentation, 90% of patients give inaccurate history, some reported to present with peritonitis and were not forthcoming even when facing life threatening situation. [7-9] In most of the cases the foreign body can be extracted trans-anally, though some patients require anaesthesia for the management of the case. Patient usually come to the hospital when attempts of self-removal fails. For the classification of rectal organ injury, the use of a system for penetrating and blunt injuries created by the Association of American Trauma Surgery (AAST) is helpful for evaluation of rectal foreign objects.[10,11]

AAST rectal organ injury scale-

- Grade 1: Contusion or haematoma (without devascularization and/or partial laceration)
- Grade 2: Laceration ≤50%, peripheral
- Grade 3: Laceration ≥50%, peripheral
- Grade 4: Full-thickness laceration extending to the perineum
- Grade 5: Devascularized segment

Section 377 IPC refers to unnatural offences and says whoever voluntarily has carnal intercourse against the order of nature with any man, woman or animal shall be punished with imprisonment for life or with imprisonment of either description for a term which may extend to 10 years and shall also be liable to pay a fine.[12] On 6th September 2018, the Supreme court of India unanimously ruled that section 377 IPC is unconstitutional as it infringed on the fundamental rights of intimacy, identity and autonomy thus legalizing homosexuality in India. The court explicitly overturned its 2013 judgement. This has passed way for more sexual choices and needs for sexual gratification.

## 4. Conclusion

While handling these types of cases of rectal foreign body impaction, the history should be taken carefully as there may be difference in the history given by the patient and family members. The cases

of foreign body insertion in rectum usually goes unreported to avoid social embarrassment. The management of such type of cases includes multi-disciplinary approach involving Radiologist, Surgeon, Psychiatrist and Forensic Medicine experts. It should be extracted by the operative procedure only when all attempts to remove it have been failed. After the treatment, patient should be counselled by the Psychiatrist and if any underlying mental illness is detected then it should be looked into.

To prevent homophobia or sexual prejudice against homosexuals in today's scenario is a tough task, so for this a positive approach towards their sexual orientation and addressing their problems linked to their homosexuality is the need of hour.

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*Letter to Editor*

# Ethical Leadership- How Deeply We Care?

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**Abstract**

Moral leadership has become the most vital ingredient for successful organizations in the present world. However, enabling such a deeply ethical attitude towards leading others is becoming increasingly difficult due to the short term outlook of business leaders and their incapacity to build a culture of trust and transparency within teams. This article explores the various challenges associated with developing moral leadership within organizations. Highlighting cases where immoral leaders have caused huge financial and reputational loss for their organizations, this article suggests techniques of "organizational development" as a tool for developing moral leadership within organizations. Authors highlights useful aspects of organization development which, when effectively utilized, can create a culture of mutual trust, transparency and ethical collaboration among teams within organization.

## 1. Introduction:

Moral leadership is perhaps the most vital aspect of humanity in present times that defines a great leader. Moral leaders are the people who make the people see a common purpose, develop a sense of shared identity in them and include them to act towards achieving those common goals. In present times, when we are seeing the world getting divided into factions of extremes, cultural supremacists trying to justify their culture over others, moral leadership permits us to see different sections of society with a humanistic lens. Such leaders respect the diversity among people and build bridges that can help others navigate the complexities without deviating from the "path of morality".

Ensuring morality in society is quite a challenging task as often people develop their moral sense based on their cultural upbringing, socio-political environment, and the perception of what defines a "success" for their life. A study conducted by Duke University recently found that 56% of students in the United States pursuing a master's degree in business administration admit to cheating—the highest rate of cheating among graduate student groups.[1] When everyone around us is cheating and yet getting the desired results, it reinforces the image that cheating is a price that all students have to pay to be successful. Such cases form a wrong sense of morality early in our lives.

Unethical attitudes are rampant across various sections of corporate world as well. It would be relevant to bring forth the example of Ford Pinto here.[2] Ford Pinto was a car that had become notorious for its faulty mechanism that led to collisions leading to causalities and death for many. Investigation into the design revealed that, due to the intense competition from Volkswagen, company rushed into production even though internal engineers had discovered a potential danger of ruptured fuel tanks in preproduction crash-test stage itself. A deeper level analysis revealed how these managers were thinking when they were making the decision. Apparently, because they thought of it as purely a business decision rather than an ethical one, they conducted

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traditional cost-benefit analysis, estimated cost for a redesign, potential lawsuits, and even compensation for casualties and ultimately concluded that it would be cheaper to pay for lawsuits than go for a design overhaul. They viewed it entirely from a business case scenario and failed to view it from a moral lens which gave rise to a disastrous unethical behavior.

**2. Ethical Leadership**

Several types of biases also lead to lack of moral leadership in organizations.[3] When people overlook the outcome of a bad decision thereby falling prey to self-serving bias, it leads to group-think which can hinder an ethical issue from becoming a prominent agenda of discussion in meetings. Overemphasis on "know it all" attitude and "authoritative" forms of leadership has damaged the fabric of organizations and created individuals who are more competitive than collaborative. It has perpetuated a culture where self-censorship prevails in groups and psychological safety is missing for inclusive participation. Such cultural underpinnings form a crooked foundation for ethical leadership and makes it tougher for such leaders to take centre-stage in organizations.

But you may wonder that our organizations have also developed better control mechanism to counter such unethical behavior. Most of the organizations, nowadays, have a code of conduct in place along with mechanisms like corporate governance scrutiny, ombudsman etc. Despite that, they often lack the zeal while implementing such practices. The need of the hour is for leaders to enact a system that integrates ethical and moral practices in their culture. But how should leaders enable such an integration?

Leader's personal commitment is their strongest moral force where they "lead by example" and "live by" such ethical values themselves. It is evident in practice when CEOs set example by regulating their own salaries to ensure an equitable pay-culture within organizations. It makes employees trust them and gives rise to an equitable and trustful culture. It is also needed that they have a high "Say-Do" ratio, otherwise it reduces the credibility of leaders, and gives an impression of hypocritical attitude towards culture. While they attempt to live by such values, leaders have to be conscious to explore their own assumptions and assess its potential pitfalls. They must recognize that, in present times, directive and commanding style of leadership does not influence people and hence they should pursue coaching as a technique to allow others to visualize their best self and get intrinsically motivated to achieve it.

Great organizations are created when leaders bring in ethically motivated individuals to carry the baton of moral leadership. Hence it becomes pertinent that they must be vigilant of the kind of people entering their organizations. As Prof. Adam Grant mentions in his book "Give and Take", leaders should not only encourage "givers" (those who prioritize team's goals over their personal ones) but more importantly, weed out the "takers" (those who are self-centered just on their own goals) from their organizations.[4] Such "takers" are self-centered, tend to be unethically motivated and they can rapidly spread a toxic culture when they occupy senior managerial positions.

The primary characteristic of an ethical leader should be the spirit of service: "one who serves the community" rather than the "one who controls the community". They have to be accessible, approachable, and accountable to their employees. They should leverage their influencing skills to create a free-space within organizations that fosters psychological safety and encourages employees at all levels to speak up their mind. When leaders adopt such humility, it creates a chain reaction of followers who are truly inspired by such ethical values.

We need leaders who emphasize on planned, systemic wide changes, where they use the group collaborative processes to build teams and transform organizational culture. But they have to be careful that they are not just focused on ends but also adopt an ethical path as means to achieve those ends. It helps them to overcome their pre-conceived notions of leadership, encourages openness to feedback, and surfaces any bias or blind spots present among individuals. It is highly relevant as it enables to develop a morality centric organization where ethics lays the foundation for a just and humane organization.

As our way forward, we should remember what Jonathan Sacks, chief rabbi of United Kingdom, once said "*When everything that matters can be bought and sold, when commitments can be broken because they are no longer to our advantage, when shopping becomes salvation and advertising slogans become our litany, when our worth is measured by*

*how much we earn and spend, then the market is destroying the very virtues on which in the long run it depends."*

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