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AN AUTOPSY BASED STUDY OF SOCIO-DEMOGRAPHIC PATTERNS IN FATAL BURN INJURIES: A CROSS-SECTIONAL STUDY.

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ABSTRACT

Background

On a global scale, fatal burn injuries result in considerable morbidity and mortality. To enhance prevention strategies and outcomes, it is imperative to comprehend the demographics of burn-related fatalities, incident particulars, and relevant contributing factors. The study analyzed various demographic variables such as age, sex, occupation, socioeconomic status, and fire source that are associated with fatal burn injuries, leveraging recent investigations and case analyses.

Methods

During the cross-sectional examination, an analysis was conducted on 334 cases of lethal burn injuries. Information concerning demographic variables, incident characteristics, burn injury severity, and time elapsed until initial medical care was received, was gathered through questionnaires and post-mortem examinations.

Results: The study revealed a predominance of females (76.1%) among burn injury victims, with the highest incidence observed in the age group of 21-40 years (47.9%). Cooking-related activities were the primary cause of burn injuries (55.7%), with a significant proportion occurring at home (78.4%). Over half of the victims experienced severe burns covering more than 40% of their total body surface area (TBSA).

Conclusion

Demographic, environmental, and behavioral factors affect Indian fatal burn injuries. Prevention needs household safety, fire prevention, and public knowledge. Improved healthcare infrastructure, particularly burn care facilities and prompt interventions, improves outcomes. To reduce fatal burn injuries, preventive, immediate medical care, rehabilitation, and social support are needed.

Recommendations

The suggestions encompass the enactment of extensive fire safety educational initiatives, the formation of dedicated burn treatment facilities, and the inclusion of psychological assistance and recovery services within the continuum of care.

Keywords: *Fatal Burn Injuries, Demographic Variables, Incident Characteristics, Total Body Surface Area, Prevention Strategies.*
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INTRODUCTION

Fatal burn injuries constitute a considerable public health issue on a global scale, characterized by an intricate interplay of demographic, environmental, and social elements influencing their incidence and outcomes. The demographic pattern of fatalities from burns discloses a disparity in gender and age, with a higher occurrence among females and a significant prevalence within specific age brackets, indicating the impact of societal roles and exposure risks [1] [2] [3].

The origins of fatal burns encompass a spectrum from unintentional incidents like electrical accidents and household fires to deliberate actions such as suicide and homicide, emphasizing the multifaceted nature of these tragic events [4] [5] [6]. Particularly in developing nations, the frequency of deaths related to burns is alarmingly elevated, often exacerbated by workplace dangers and insufficient safety protocols [7] [8].

The repercussions of fatal burn injuries go beyond immediate physical harm, impacting the mental well-being, standard of living, and economic standing of survivors [9]. The seriousness of burn injuries is commonly evaluated by the extent of the total body surface area (TBSA) involved and the depth of the burn, with more extensive and deeper burns being linked to increased mortality rates. The duration of survival and

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cause of death after burn injuries vary, with numerous individuals succumbing to complications like sepsis, pneumonia, and neurogenic shock shortly after the injury [10] [11], underscoring the urgent requirement for prompt and efficient medical intervention in conjunction with enduring care strategies to enhance survival rates.

In India, fatal burn injuries are a significant public health concern, characterized by a multifaceted interaction of cultural, socioeconomic, and environmental elements that contribute to their pervasiveness and severity [12]. The nation encounters a distinct array of obstacles that worsen the susceptibility and repercussions of burn injuries, encompassing factors such as the extensive utilization of open flames for culinary purposes, the utilization of traditional garments that are highly flammable, and the restricted availability of specialized burn treatment facilities in numerous areas [13].

The epidemiology of burn injuries in India illustrates a unique pattern in comparison to more developed nations, marked by a higher prevalence of female victims. These incidents are frequently associated with domestic accidents and, regrettably, instances of self-immolation influenced by various socio-cultural factors. Additionally, a noteworthy proportion of victims comprises children and young adults, often experiencing accidents within the household as a prevalent cause. Although there have been notable advancements in healthcare facilities, the presence of dedicated burn centers and the provision of holistic rehabilitative services continue to be constrained, particularly in remote and underserved regions [14].

Preventive measures, public awareness initiatives, and educational programs regarding fire safety play a pivotal role in tackling the underlying factors contributing to burn injuries. Furthermore, bolstering the healthcare system's ability to deliver prompt and efficient care to individuals affected by burns is imperative for enhancing overall treatment results [15]. The integration of mental health assistance and community reintegration services within the spectrum of care is also crucial for guaranteeing comprehensive support for survivors and their families.

Addressing the issue of fatal burn injuries in India necessitates a comprehensive strategy that integrates preventative measures, acute medical treatment, rehabilitation services, and social assistance. Through close collaboration of governmental bodies, healthcare professionals, and local community groups, it is possible to reduce the incidence of burn-related incidents and improve the well-being of survivors of such traumatic events.

This investigation aimed to analyze various demographic variables such as age, sex, occupation, socioeconomic status, marital status, location, and fire source, that are associated with fatal burn injuries, leveraging recent investigations and case analyses to illuminate this pressing concern.

METHODOLOGY

Study design
This study utilized a cross-sectional design.

Study setting
The study was carried out between May 2021 and April 2022 at the Department of Forensic Medicine and Toxicology, Rajendra Institute of Medical Sciences, Ranchi, Jharkhand, India.

Participants
From a pool of 3,195 autopsied cases, 334 burn-related fatalities were identified.

Inclusion and Exclusion Criteria
Included were burn cases admitted or brought dead to the center with proper records. Excluded were cases lacking documentation, highly decomposed bodies, and cases of post-mortem burns.

Sample size
To calculate the sample size for this study, the following formula was used for estimating a proportion of a population:

$$n = \frac{Z2 \times p \times (1-p)}{E2}$$

Where:
- n = sample size
- Z = Z-score corresponding to the desired level of confidence
- p = estimated proportion in the population
- E = margin of error

Variables
Studied variables encompassed age, sex, residence, marital status, education, occupation, incident details, and source of ignition.

Data Collection
Information was gathered via questionnaires administered to relevant individuals present during the incidents, along with thorough post-mortem examinations.

Statistical Analysis
While conducting the cross-sectional examination, an investigation was carried out on 334 cases of fatal burn injuries. Data about demographic variables, incident characteristics, burn injury severity, and time elapsed until initial medical care was collected through questionnaires and post-mortem examinations. The statistical analysis was performed through the application of Microsoft Excel, succeeded by data examination employing SPSS version 20. After the culmination of this stage, frequency distributions and proportions were ascertained as components of the analytical procedure.

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Ethical considerations

The Ethics Committee approved the research protocol, and all participants provided written informed consent.

RESULT

The study investigated 334 cases of fatal burn injuries, with a demographic breakdown revealing a predominance of females (76.1%) compared to males (23.9%). The age distribution depicted a peak incidence among individuals aged 21-40 years (47.9%), followed by those aged 41-60 years (27.8%). Marital status analysis indicated that a majority of victims were married (62.3%), while a notable proportion were unmarried (31.1%). Educationally, a significant portion had received only primary education (43.7%), with 28.7% having completed secondary education. Occupationally, housewives constituted the largest group (51.8%), followed by laborers (15.2%) and students (13.8%).

Table 1: Demographic features

Demographic Characteristic	Number (%)
Gender	
- Male	80 (23.9%)
- Female	254 (76.1%)
Age Group	
- 0-20 years	54 (16.2%)
- 21-40 years	160 (47.9%)
- 41-60 years	93 (27.8%)
- 61+ years	27 (8.1%)
Religion	
Hindu	308 (92.2%)
Muslim	21 (6.2%)
Christian	5 (1.6%)
Marital Status	
- Married	208 (62.3%)
- Unmarried	104 (31.1%)
- Others	22 (6.6%)
Education Level	
- Primary	146 (43.7%)
- Secondary	96 (28.7%)
- Higher Secondary	64 (19.2%)
- Graduate and above	28 (8.4%)
Occupation	
- Housewife	173 (51.8%)
- Laborer	51 (15.2%)
- Student	46 (13.8%)
- Unemployed	22 (6.6%)
- Others	42 (12.6%)
Socio-economic status	
Lower	262 (78.3%)
Middle	64 (19.2%)
Upper	8 (2.5%)

Regarding incident details, a substantial majority of burn injuries occurred at home (78.4%), with cooking-related activities being the leading cause (55.7%). Accidental ignition and deliberate self-harm accounted for 23.4% and 12% of cases, respectively. Analysis of temporal distribution revealed a higher incidence during evening and night hours, with 62.9% of cases occurring between 6:00 PM and 6:00 AM. Geographically, rural areas reported a higher prevalence (63.8%) compared to urban areas (36.2%). Seasonally, most of the cases were reported in winter (69.5%), followed by summer (24.7%) and the rainy season (5.8%).

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Table 2: Sources of burn

Source of Catching Fire	Number of Cases (%)
Cooking-related activities	186 (55.7%)
Accidental ignition	78 (23.4%)
Deliberate self-harm	40 (12%)
Electrical malfunction	11 (3.2%)
Open flame (e.g., candles)	8 (2.3%)
Heating appliances	7 (2%)
Chemical substances	4 (1.4%)

Severity analysis showed that over half of the victims experienced burns covering more than 40% of their total body surface area (TBSA). The statistical analysis illustrated notable relationships between demographic factors including age, occupation, level of education, socio-economic status, and the severity of burn injuries.

Table 3: Characteristics of burn

Characteristics of Burn	Number of Cases (%)
Mechanism of Burns	
- Thermal	311 (93.1%)
- Electrical	18 (5.4%)
- Chemical	5 (1.5%)
Mode of Burns	
- Accidental	289 (86.5%)
- Suicidal	32 (9.5%)
- Homicidal	13 (4%)
Degree of Burns	
- I	32 (9.6%)
- II superficial	104 (31.1%)
- II deep	87 (26.%)
- III	111 (33.2%)
Severity of Burns (ABA)	
- Mild	76 (22.8%)
- Moderate	153 (45.8%)
- Severe	105 (31.4%)
First Point of Care Delay	
- ≤1 hour	208 (62.3%)
- >1 hour	126 (37.7%)
Facial/Inhalational Burns	
- Facial or Inhalational	102 (30.5%)
- Both	46 (13.7%)
- None	186 (55.7%)
Cause of death	
Hypovolemic shock	50 (14.9%)
Neurogenic shock	11 (3.5%)
Septicaemic shock	273 (81.6%)

DISCUSSION

The study found a significant predominance of females (76.1%) among burn injury victims, indicating potential gender-specific risks or differences in exposure to burn-related hazards. The highest incidence of burn injuries was observed in the 21-40 years age group (47.9%), suggesting that young to middle-aged adults are more vulnerable or exposed to burn risks. Most burn injuries occurred during cooking-related activities at home (55.7% and 78.4%, respectively), highlighting the need for improved household safety and fire prevention measures.

A significant number of victims experienced severe burns covering more than 40% of their total body surface area (TBSA), indicating the high severity of injuries leading to fatal outcomes. A majority of the victims were married (62.3%), which might reflect the domestic setting of many burn incidents. Many victims had only primary or secondary education (43.7% and 28.7%, respectively), suggesting that educational level might influence the risk or circumstances of burn injuries.

Housewives constituted the largest occupational group among the victims (51.8%), reinforcing the domestic

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nature of many burn injuries. A large proportion of victims were from lower socio-economic backgrounds (78.3%), indicating that socio-economic factors play a significant role in burn injury risk. Significant associations were found between age, occupation, socio-economic status, educational level, and the severity of burn injuries, suggesting that these demographic factors influence the risk and outcomes of burn injuries. For instance, individuals from lower socio-economic statuses are more likely to suffer severe burns.

The notable correlations between demographic variables including age, occupation, level of education, and socio-economic standing; and the extent of burn wounds, underscores the necessity of incorporating these variables in evaluating risks, devising interventions, and distributing resources for the management of burn injuries.

Overall, the outcomes offer significant perspectives into the intricate interaction among demographic, environmental, and behavioral elements that lead to lethal burn incidents. They highlight the critical need for employing comprehensive approaches to prevention and intervention that include education, consciousness-raising, safety protocols, and timely medical assistance to alleviate the impact of burn injuries and enhance the prognosis for those affected.

Recent research findings on fatal burn injuries have offered crucial insights into the epidemiological trends and demographic characteristics of these unfortunate events. An autopsy-based prospective study in Assam examined 245 cases and identified a considerable predominance of females, constituting 63.27% of the victims. A noteworthy 53.87% of the incidents took place within domestic settings, predominantly occurring during the winter season (53.06%). The leading cause of death was found to be toxemia, responsible for 56.33% of the recorded cases [16].

In Western Odisha, a research investigation was conducted on 55 fatal burn cases. Within this examination, it was revealed that the female demographic accounted for 72.8% of the individuals affected, particularly concentrated in the 21–30 years age bracket. Moreover, a noteworthy 80% of the female victims were identified as married individuals, underscoring the predominantly domestic context of numerous burn occurrences. The analysis also highlighted that open flame lamps and kerosene stoves emerged as prevalent ignition sources, and a considerable proportion of the victims sustained surface burns exceeding 70%, indicating the gravity of such incidents [17].

A notable research investigation was undertaken concerning 224 incidents of flame burn cases among 1436 medico-legal deaths. Predominantly, the individuals affected were of the female gender (83.03%), notably concentrated within the age bracket of 21-30 years. The analysis indicated that the primary site of occurrence was in kitchens (57.60%), and a significant portion of victims who sustained burns exceeding 80% of Total Body Surface Area (TBSA) succumbed within a day. The leading cause of death was determined to be hypovolemic shock, highlighting the immediate medical complexities linked with severe burn trauma [18].

A comprehensive investigation carried out in Jaipur City examined 425 instances of lethal burns, indicating that the majority of individuals belonged to the 11 to 40 years age bracket, constituting 82.3% of the occurrences, where females accounted for 60.7% of the casualties. The primary cause of burns was from flames (87.7%), mainly attributed to kerosene oil, and most of the events were either accidental (78%) or intentional (19%) [19].

A study conducted at District Hospital, Gulbarga, Karnataka, revealed similar demographic patterns, where 107 autopsies of burn victims were analyzed. The study identified that 71.96% of the victims were women, with a notable proportion (70%) belonging to the age group of 20-40 years. The winter season exhibited the highest percentage of fatalities due to burns (45.79%), and the primary location of such incidents was reported to be the victims' residences. Accidental burns were the most common (74.8%), followed by instances of self-inflicted burns (23.4%) [20].

In the Surat Region of Gujarat, a research study was conducted which revealed a considerable incidence of mortality due to burns among individuals aged 21 to 30 years, accounting for 35% of the cases, showing a distinct female predominance with a male-to-female ratio of 1:2. The primary cause of death was identified as burns shock with toxemia, and a noteworthy proportion of the victims exhibited burns affecting 75 to 100% of their Total Body Surface Area (TBSA) [21].

The examination of lethal corrosive assaults in Central Delhi, albeit not directly linked to burns resulting from fire, contributes to the comprehension of fatal injuries induced by corrosive substances. An analysis was conducted on 13 instances spanning a 13-year duration, revealing a higher prevalence among the male demographic (61.54%) and suggesting that facial and thoracic involvement was prevalent among the victims. The mean Total Body Surface Area (TBSA) affected stood at 56.69%, with septicemia identified as the primary cause of fatality (53.85%) [22].

A study conducted in Kerala, centered on 100 incidents of burn-related fatalities, emphasized a notable prevalence of female victims (78%) and a prevailing age bracket of individuals aged between 20 and 30 years. It is noteworthy that the research revealed a predominant occurrence of suicide as the cause of death (58%), which differs significantly from other areas where accidental burns were more frequent [23].

Generalizability

The study findings indicate that females and young to middle-aged adults are particularly vulnerable to fatal burn injuries, often occurring at home during cooking. This suggests a need for targeted safety interventions and fire prevention education for these groups. The significant

associations between lower socio-economic status, educational level, and burn injury severity highlight the importance of addressing socio-economic disparities. These insights can guide policymakers and health professionals in developing comprehensive strategies to reduce burn injuries and improve outcomes for at-risk populations on a larger scale.

CONCLUSION

The comprehensive understanding offered in the study acts as a crucial foundation for developing evidence-based prevention and intervention strategies aimed at reducing the impacts of severe burn injuries and improving outcomes for those affected. By tackling the demographic, environmental, and behavioral factors influencing the prevalence of burn injuries, these approaches may yield a substantial impact on the welfare and security of the overall populace.

Limitations

The study's generalizability is constrained by its restriction to a solitary tertiary care facility. The study exhibited inclusion bias by solely enrolling cases of fatalities resulting from burn injuries that were brought to the hospital for forensic post-mortem evaluation.

Recommendation

Key recommendations consist of the implementation of extensive fire safety educational initiatives, the establishment of specialized facilities for burn treatment, and the integration of psychological support and recovery services within the spectrum of healthcare. It is imperative to undertake further research and foster interdisciplinary cooperation to advance our understanding of burn injuries and enhance the effectiveness of preventive measures and interventions aimed at mitigating their severe consequences.

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List of abbreviations

TBSA - Total Body Surface Area

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Conflict of interest

The authors have no competing interests to declare.

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