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Review Article

The silent crisis: a review on epidemiology of burns and home safety challenges in Eastern India

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ABSTRACT

Burns can represent some of the most severe injuries globally, posing a significant public health issue and sparking widespread health concerns, especially in low- and middle-income nations. This review examines the epidemiology of burns and the related home safety issues in Eastern India, an area characterized by varied socio-economic and cultural factors. Burns rank among the primary causes of illness and death, with a disproportionate impact on women, children, and the elderly. The research investigates the occurrence, risk factors, and socio-cultural influences of burn injuries, emphasizing the shortcomings in preventive strategies and access to healthcare. Living conditions in Eastern India, marked by hazardous cooking methods, cramped spaces, and inadequate fire safety knowledge, significantly increase the incidence of burn injuries. The review additionally examines current policies, health interventions, and community-centered initiatives focused on burn prevention and treatment, identifying critical areas for improvement. Highlighting the importance of a multi-sectoral strategy, this paper promotes improved public health initiatives, such as community awareness, infrastructure enhancements, and reinforced healthcare systems, to address the unnoticed crisis of burns in Eastern India.

Keywords: Burn injury, Home safety, Eastern India, Kitchen setting, Cooking methods

INTRODUCTION

Fire is playfully referred to as a "necessary evil." Burn injuries have historically been regarded as some of the most severe injuries that can impact the human body.[1] Burn injuries have traditionally been viewed as among the most serious injuries that can affect the human body. According to the database of the ministry of health and family welfare of the government of India, approximately 70 lakh people experience moderate to severe burns each year in India. Each year, more than 700,000 burn injuries require hospitalization.[2]

Approximately 80% are women and children. These statistics provide insight into the strain that burn cases place on India's healthcare system. The urgent concern in India is the death rates of young newlywed women caused by dowry demand.[3] The urgent concern in India is the death rates of young newlywed women caused by dowry demands. This decrease in this youthful demographic has led to adverse effects on the nation's development. Burn injuries have recently emerged as a significant global public health emergency.[4,5]

Burns rank as the fourth most frequent type of trauma across the globe.[6] Low to middle-income nations account for 90% of burn cases.[7] The majority of burn injuries happen at home, primarily during cooking.[8] Studies from various regions such as in Bangladesh and Ethiopia, reveal that 80-90% of burns happen at home.[9] Burns among adult females predominantly occur at home, while adult males typically experience them outdoors or at work.[10,11] The elderly are particularly prone to sustaining

burns in the kitchen.[12] Despite the perception of homes as safe environment, accidents frequently occur in this place. Women between the ages of 16 and 35 are disproportionately affected by burn injuries often due to their role in cooking, typically in hazardous kitchen conditions.[13] The global rate of fire-related injuries remains at its peak In the Southeast Asian region. Although the mortality rate from burns has declined recently, the physical and psychological pain experienced by the patients can be distressing for both the victims and their families. Epidemiological studies are crucial concerning risk factors and the high-risk population.

Current research evaluating the factors contributing to burn injuries particularly in LMI nations are very restricted. Additionally, with the exception of a few studies, there is limited focus on evaluating the safety of heating or cooking devices in kitchen environments as potential indicators of burn injuries.

The objective of this review was to identify the predictors of accidental burns in rural regions of eastern India. Injuries arising from burns and scalds are primarily accidental, yet some might also be deliberate (suicidal/ homicidal). The available literature on burns in India, usually relying on retrospective medical records, shows that burn-related deaths and injuries are more prevalent among younger women aged 18-35, often caused by kitchen accidents like kerosene stove explosions, kerosene spills leading to clothing ignitions, or suicides. This is further clarified by the types of garments worn by women in India, like sarees and dupattas.[14-16] Numerous burn and scald injuries result in lasting disabilities and scars that increase future healthcare expenses. Most injuries can be avoided. The particular causes and circumstances in which burns and scald injuries occur among victims of various age and gender groups are typically distinct. Examining the reasons will aid in comprehending the context of burn injuries, facilitate local intervention recommendations, and assist in decreasing the burden of morbidity and mortality associated with burns and scalds. The current review also intends to fill this void by incorporating the viewpoints of women who are mostly affected with burn injuries and their families to comprehend the context of the burn incidents.

Several previous home safety studies have incorporated assessments of knowledge, attitudes, and practices (KAP) in their investigations, but these evaluations have mainly emphasized knowledge and attitudes, with limited attention given to behaviors. Secondly, various aspects of home safety related to burns have not been extensively investigated in previous research. This underscores the necessity of conducting problem-oriented or fire-related home safety evaluations. Previous studies on home safety have typically been wide-ranging or, at best, concentrated on certain target demographics. Moreover, previous research has generally failed to combine environmental assessments with safety-related initiatives.

EPIDEMIOLOGY OF BURN INJURIES IN INDIA

Prevalence and incidence of burn injuries

India experiences significant burn-related morbidity and mortality, with an estimated yearly incidence of 6-7 million burns. This figure, based on data collected from significant hospitals and extended to cover the entire nation, indicates the second-largest type of injuries after road accidents. Nearly 10% of these pose a life threat and require hospitalization. Approximately 50% of the individuals hospitalized succumb to their injuries. Around 100,000 to 150,000 people are disabled annually and require multiple surgeries and prolonged rehabilitation.

Demographics of burn victims

Seventy percent of those suffering from burns are in the most active age group of 15 to 40 years, with many patients hailing from low socioeconomic statuses.[17] Having a low socio-economic status is linked to higher chances of accidental injuries and death.[18-22] Socioeconomic indicators can influence risk by changing human actions or by heightening exposure to environmental dangers.[23] Injury mortality rates have actually increased across different SES levels, despite successful prevention efforts targeting injury risk in low SES populations.[23,24] Burn injuries are more common in vulnerable populations like the poor, mentally ill, and women, regardless of a country's income level. In numerous low- and middle-income countries, women and girls face a higher likelihood of encountering burn hazards.[25] Fire, acids, and chemicals are intentionally employed to injure or disfigure women and girls, serving as a form of gender-based violence alongside unintentional injuries.[26]

RISK FACTORS FOR BURN INJURIES IN INDIAN KITCHENS

A significant portion of these incidents take place within the home or its vicinity, stemming from energy poverty and tasks like food preparation and heating. In the majority of households, the kitchen was the primary area for cooking, followed by the corridor and then the living room. In many low- and middle-income countries, it is common to see dangerous cooking setups (such as cookstoves on the ground or open fires with three stones), the use of unreliable and unregulated liquid petroleum gas (LPG) cookstoves, and people wearing traditional loose clothing that can easily catch fire.[27] For instance, a cluster-randomized study in Ghana found that most households cooked using a ground-level open fire fueled by biomass (such as wood, plant material, dung).[28] A study conducted by Guddatu et al revealed that cooking at ground level poses risks. Individuals who cooked at ground level are more prone to burn injuries.[9] This literature from India shows that age and gender play a crucial role in determining burn injuries. Burns are more common in specific age demographics. Accidental burns

are frequently seen in children due to their lack of awareness about harmful materials and inadequate supervision by parents in unsafe living conditions found in low-resource settings.[29,30] In males, burn injuries are primarily associated with being exposed to dangerous situations that mostly occur outside the home. Women tend to experience burn injuries at home.

A study by Tripathee et al shows higher rates of flame burns were found in females, while males had higher rates of electric burns.[31] Education is another important element in determining burn injury rates and outcomes. Individuals with a lower level of education may be less aware of burn prevention methods such as the appropriate use of cooking equipment and the significance of keeping children away from potentially hazardous areas. Furthermore, education influences health-seeking behaviour; people with greater levels of education are more likely to seek emergency medical attention after a burn injury and follow suggested treatment regimens. Individuals with lower education levels may postpone obtaining care, elevating the risk of consequences and long-term disability.[32]

A study by Kuiri et al reveals many accidents took place in households and kitchens. Kerosene pump stoves are commonly utilized for cooking purposes. The 39.5% of cases involved injuries related to stove incidents. The main causes of these injuries were typically linked to stoves exploding from too much pumping or refilling fuel while the stove was still on. 2.7% of cases involved injuries related to gas ovens. These accidents happen when the cylinder valve is left on, a damaged pipe causes a leak, and a closed kitchen is lit, resulting in an explosion.[33]

SPECIFIC TYPES OF BURNS IN KITCHEN SETTINGS

Oil lamps like 'kupi', candles, hurricane lanterns, and diyas (clay baked earthen oil lamps) were also partially to blame for flame burns in rural India. Injuries were mainly caused by accidental candle falls during evening prayer with diyas inside the mosquito. All accidents occurred as a result of human error. Regardless of the type of fuel or burner used, both a flame and scald injuries occurred in the kitchen. A large number of fire incidents occur when individuals cook while wearing clothing with long, loose ends like aanchal or dupatta. Carrying hot soups with faulty pincers resulted in a number of scalds and burns. Unintentional stumble onto the hot soup-filled containers resulted in scald injuries among children.

Injuries, especially in children and teenagers, resulted from careless handling of fireworks outdoors. Scald injuries in children of rural areas are caused by falling into big tanks used for boiling grains. In winter campfires, the elderly were the main victims of flame injuries. The majority of injuries occurred in the kitchen as a result of hot liquids being spilled.

ASSESSMENT OF BURN SEVERITY IN KITCHEN-RELATED INJURIES

Research conducted by Bailey et al indicates that Flame burns were associated with increased mortality rates and led to longer hospital stays. More than 50% of all fire incidents took place in residential settings. During cooking and meal preparation, women accounted for a third of injuries, while children under age five accounted for another third of injuries sustained at home.[34] Prior research has also shown that adult women commonly experience flame burns while cooking in the kitchen.

In a prospective 1-year research carried out by Rewa et al involving all patients (n=499) admitted to the Burn unit of the dept. of surgery at SGMH, Rewa (M.P.), the results indicate that burn injuries predominantly affect females, with the kitchen being the most common location (67.53%).[35] Suri et al did a retrospective examination of patients who presented to the burn centre at civil hospital Ahmedabad and reported that there were 523 patients hospitalized, 351 of them had kitchen-related burns. There were 264 patients seen on an outpatient basis, with 142 having cooking burns.[36] Research conducted by Saxsena et al revealed that burn injuries occurred more frequently (52.9%) when cooking appliances were malfunctioning compared to when they functioned correctly (46.1%). However, this relationship was not statistically significant ($p=0.457$). Furthermore, individuals who opted to cook at floor level encountered 51.8% more burn injuries compared to those who cooked at a standing height (45.3%). Nevertheless, the association was not statistically significant ($p=0.405$). Individuals who relied solely on chulha (60%) experienced more burn injuries compared to those who exclusively used gas burners (42.7%), but this association was deemed statistically non-significant ($p=0.107$).[3] Women represent approximately 65% of burn fatalities in India, with kitchen incidents, self-immolation, and domestic violence being the primary causes.[37] Some additional significant risk factors include various characteristics, such as age, gender, race and ethnicity, low socioeconomic status, place of living, poverty, education, intent of injury, and comorbidity.[18,38] Every risk factor intermingles and overlaps, exacerbating the problem. The relationship between poverty and burn risk is a major topic thoroughly examined in the literature.[39]

Our evaluations uncovered numerous significant insights that necessitate more focused consideration. First, in this study, an extensive variety of potential home safety measures related to burns was examined, mainly concentrating on kitchen setting, cooking and heating. Numerous hazards associated with the home surroundings, cooking and heating devices, along with safety-related actions, were examined in this context.

Burn injuries and their outcomes such as morbidity, death, and disability, are a significant issue in public health. The most serious injury a person can experience is

burn injuries. In countries such as India, this situation is even more dire. Age and gender are crucial epidemiological factors in all cases of burn injuries. Over half of individuals fell within the 18 to 44 age group which considered productive, aligning with findings in other research conducted in India Jordan and some hospital data also shows up to 70% in the same age group which is similar to our study results with (53.88%, 916/1700) belong to 18-44 age group.[40,41] Most research in India has indicated that the highest occurrence of burns is found in individuals aged 15 to 40 years, characterized by a general dominance of females.[16]

Most of the people participating in the Indian kitchen were women. This happens because of socio-cultural factors, as women are mainly responsible for domestic duties like cooking. In most households, the kitchen acted as the primary space for cooking, with the corridor next and the living room after that. A very similar trend is noted in a study from Iran, in which people mainly utilized a distinct kitchen for cooking, next to the living room.[42]

A study by Bailey et al reveals that one-third of injuries among women involved in cooking and meal preparation were due to burn injuries, a finding that aligns with our study, which reported a rate of (66.66%,56/84).[34] Burns impact men, women, and children; nonetheless, previous studies show that young women often fall victim to accidental burns.[43-45] The majority of burn injuries typically happened while cooking or working in the kitchen, also known as domestic burns.[48,49] Burn injuries are more common among at-risk populations. Populations regardless of their national income level, including disadvantaged, mentally ill, and/or female groups. In numerous LMICs, women and girls frequently face the risks of burn injuries. A significant portion of these incidents happens in and around the home, often linked to energy poverty and tasks like cooking and heating. In many LMIC contexts, high-risk cooking setups (such as ground-level cookstoves and open 3-stone fires), the use of poorly regulated and unsafe LPG cookstoves, and the wearing of traditional, baggy, and often flammable attire are prevalent.[4]

A person's job can make them vulnerable to burns. The majority of victims in our research were homemakers involved in cooking, along with unskilled laborers. The factors contributing to the high rate of burns in housewives included frequent exposure to cooking, lack of knowledge in using high-pressure stoves, excessive work demands causing rushed tasks and accidents, and social pressures increasing their vulnerability to suicidal or homicidal burns. Ambade et al and Sharma et al also noted the elevated occurrence of burns among housewives.[50,51] Our research indicates that burns associated with occupations were prevalent among electricians, welders, and similar professions which were mostly males (32.14%, 27/84).

A study by Lam et al in Vietnam shows a higher prevalence of males experienced injuries from direct contact with electricity and flames/heat.[52]

Biomass fuel/chulha was the most frequently used cooking device by the participants, followed by LPG.A limited number of households were using LPG and chulha for their cooking requirements. It is closely linked to the family's economic and social status. People of high socio-economic status have specialized kitchens with safe, modern cooking equipment, while those with low socio-economic status do not have a distinct cooking space and still rely on open flames for preparing food. Users of open flames, like chulha or kerosene stoves, face a greater danger of burns than those utilizing LPG. Microwave ovens were excluded from our research since they were infrequently utilized in rural regions of Odisha. Various other studies demonstrate a comparable conclusion that using open flames for cooking, particularly at ground level with devices like chulhas and kerosene stoves, presents considerable dangers for burn injuries in developing countries.[53-55] In our current investigation, we additionally found that cooking at ground level carries risks (64.88%). People who cooked food at ground level have a greater occurrence of burn injuries. Further research results reveal that people cooking at ground level face a higher risk of burn injuries.[56-59] For example, a cluster-randomized study in Ghana showed that the majority of households relied on an open fire at floor level using biomass fuels for cooking, including wood, plant materials, and dung. There is a limited amount of statistical data available concerning the risks associated with injuries reported from cooking at chulha or floor level; much of the information that exists is qualitative and anecdotal. This is not surprising because rural households-usually without access to clinics that document injury information-are the primary users of solid fuels for cooking and the heating.[60]

In our research, most of the individuals were dressed in long and loose garments. Regarding the female victims, most were wearing a saree during the burning incident, and it was frequently made of synthetic material. Severity of burn was also more in the victims wearing loose and synthetic saree which is similar to few studies.[21,30] A study by Jhonson et al reveal loose clothing can ignite, leading to serious burns on the legs.[62] Certain risks examined in our research were associated with cooking equipment. This encompassed production safety, deterioration of cooking appliances over time, and user habits. We noted that in instances where cooking devices were malfunctioning, there were increased occurrences of burn injuries. These findings indicate that by properly maintaining their cooking appliances and scheduling regular check-ups by professionals, the occurrence of burn injuries can be minimized. Several additional studies in other developing nations also indicate similar data.

Research conducted in Nepal Bhumistan showed that the use of smokeless chulha for cooking reduced the

incidence of burn injuries in rural regions.[63] Consequently, these initiatives could aid people with low socioeconomic status who still rely on open flames. The initial help or primary treatment for burn injuries differs from one person to another. Many people utilize different home remedies like toothpaste, coconut oil, potato mash, any cold cream, tamarind, and a variety of herbs. A limited quantity were using water and appropriate allopathic treatments, including SOS, silver-x, and burnol. Most people did not know the first aid steps for treating burn injuries. Most individuals usually turn to herbal solutions for suitable care. A research study done in Ethiopia found that only 13.5% utilized cold water, 20% employed oil or Vaseline, whereas the majority turned to home remedies like herbs, mud, or urine.[64]

CONCLUSION

The primary outcome of this research indicated that issues with both cooking and heating appliances significantly contributed to the occurrence of burns. This encompasses safety issues related to appliance product safety and their usage, which includes the location of usage, method of usage, and intended use. In line with the results of this study, the kitchen is identified as the primary location for domestic burns in the majority of hospital-related injuries. Cooking devices like LPG were safe and user-friendly, whereas chulha was hazardous to use. Thus, individuals should be encouraged to utilize safe cooking devices (LPG), or, if that's not feasible, they ought to use alternative safe and affordable appliances. Cooking at floor level posed dangers and led to numerous burn injuries. Contact and scald burns were the primary forms of burn injuries. Often, the pot-holding tool was not utilized correctly.

Understanding of proper first aid has been alarmingly inadequate within the community. Many of the burn injuries could have been avoided, and possessing adequate safety awareness while cooking can lessen this issue. The occurrence of burns was higher among young, married, uneducated, Hindu women. Even though current laws are updated and numerous non-government organizations (NGOs) are addressing this issue, fatalities from burns among females persist. The current examination of burn injury cases underscores that, unlike in Western nations, the burn deaths in India exceed the implications of the term 'accident'. Therefore, burn incidents require a comprehensive inquiry to allow the legal system and medicolegal experts to take essential measures in combating this societal issue.

Our results emphasize the need for more research into gender-related disparities in burn injuries and treatment. This research emphasizes the necessity of continuous injury surveillance programs to both comprehend the morbidity and mortality patterns associated with preventable injuries such as burns and to formulate and assess potential interventions.

Recommendations

To create strategies for burn prevention, it is essential to consider both active and passive approaches. Enhancing product safety via legislation and standardization, alongside promoting better customer conduct and usage habits through safety education, is advised in this context. Due to the scarce information regarding sex- and gender-related disparities in burn injury outcomes in LMIC, only hypotheses exist regarding the underlying causes for these differences. To delve deeper into this idea, we suggest a mix of community-focused, along with region- and national-specific assessments. This will clarify variations in exposure to risks, accessibility of healthcare services, or implicit gender bias among providers, not just to identify the existence of gender-related differences in burn treatment and results, but to explain the root causes of those variations. Carrying out a home safety survey specific to burns in a rural location of India disclosed various aspects of danger related to burn injuries. Nevertheless, further analytical investigations are required to recognize them as genuine risk factors for burn injuries. Home safety studies focused on specific injuries are practical and can yield valuable insights for promoting safety. Education on health and safety, along with safer heating and cooking equipment, could be beneficial. Consistent upkeep of cooking devices and safety measures will greatly help women. Occasionally, it is essential to hold a "domestic burn prevention IEC program" and a "community awareness program" aimed at ladies and teenage girls on a regular basis. Proper health education on first aid should be provided to eliminate detrimental behaviors. In the end, funding for both current and innovative systems will need to address the varied population and significant number of burn injuries that take place in India. Considering the limited availability of current resources, we think that priority should be given to enhancing the quality of care and resource availability in existing centers while also creating innovative solutions to assist those with restricted access to any type of care. Enhancing access to burn treatment is a significant challenge that needs to be tackled methodically to mitigate the severe effects these injuries persistently impose on healthcare systems and economic development in developing countries.

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