

An Analysis of Hospitalized Burn Injuries in a Burn Care Unit of Northern Bangladesh

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Abstract

Introduction: Burn injuries remain a significant public health issue, especially in low- and middle-income countries where comprehensive data is scarce. This study provides a detailed analysis of burn injuries in Northern Bangladesh, focusing on epidemiological characteristics and factors influencing burn severity and incidents. **Methods:** This retrospective study analyzed 477 cases of acute, unintentional burns recorded between January 2022 and December 2022 at the Rangpur Medical College Hospital's Burn and Plastic Surgery unit. Data on demographics, burn types, etiology, and severity were collected from hospital registers. Statistical analysis, including chi-square tests and logistic regression, was used to identify predictors of burn severity. **Result:** Of the 477 documented cases, females represented 62.05% (296 cases) and males 37.95% (181 cases). Flame burns predominated, comprising 70% of incidents, significantly impacting females engaged in cooking activities. The data revealed a distinct seasonal trend with a significant peak in January, where 40% (191 cases) of annual burn incidents occurred due to campfire exposure. The analysis further demonstrated that burns covering more than 30% of total body surface area (TBSA) were significantly associated with higher morbidity and mortality, with third-degree burns occurring in 92.9% of females compared to 55.8% of males. Logistic regression identified age (OR = 1.28, CI [1.13-2.71]), gender (OR = 1.75, CI [1.11-1.47]), and the cause of ignition (OR = 0.56, CI [0.41-0.76]) as significant predictors of burn severity. **Conclusion:** The findings emphasize the need for targeted interventions to address the high incidence of burns among young to middle-aged women, particularly through safer cooking practices and awareness campaigns. Additionally, public health strategies should consider seasonal risks and promote safer heating methods during colder months. This study underlines critical areas for intervention and highlights the importance of culturally tailored public health strategies to reduce burn injuries in Northern Bangladesh.

Keywords: Burn Injuries, Epidemiology, Bangladesh, Public Health, Gender Disparities, Seasonal Patterns.

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INTRODUCTION

Burns are among the most devastating event of injuries and recognized as a major global public health burden. The global number of deaths due to fire alone records as 265000 in each year, of which, almost 96% occur in low- and middle-income countries (WHO, 2016). Beside large death toll, burns cause million more with disabilities and disfigurements, for which global data remains incomplete or unavailable. Since national

surveillance data and large survey data on injuries are not available in most low-income (LICs) and lower middle-income countries (LMICs), hospitalized data have been found to be a valuable source of information for identifying the epidemiological characteristics of burn injuries [1, 2]. In general, most burn injuries, especially the minor ones, are taken care of by the patients or person closed to the patients, with the advice from pharmacists or local religious healers while many more are treated by the health professionals in a non-

hospital settings (REF). Those who seek support to hospital cares often have serious burn injuries, are the small fraction of the total burn victims. However, the epidemiological data of the hospitalized burns can provide insight into the pattern of injury, which appears to be important for burn prevention and care in low-income countries [3]. Despite the lack of reliable national data, the majority of published studies on burns indicate higher burn injuries in Asian countries [1, 4, 5]. According to the WHO statistics on burns, more than a million people are either moderately or severely burnt in India and over 173000 children (<18 year) suffer from such injuries in Bangladesh (WHO, Key facts). A global study by Burd and Yuen (2005) reported that among the hospitalized pediatric burns, Asian countries bear more than half of the global pediatric burn population [6]. In Bangladesh, a few studies that have reported on the epidemiology of burns come from studies focusing on pediatric burns (scalds and flames) using household surveys [7]. These studies have identified burns as a major cause of illness including permanent disability among children in Bangladesh. These studies also report demographic variability in burn injuries, i.e. young and female children, and children residing rural area were more likely to have higher risk of burn injuries. With a predominance of female fire burns from cooking and heating, gender differences appear to be significant factor in the risk of fire burns in LICs and LMICs [8]. In a study among hospitalized burn patients in Pakistan, the burns were predominantly higher among young female adult, often clothed in loose attire [9]. In a global burn study, socioeconomic factor, race, ethnicity, place of residence and factors pertaining to region are found to be key determinants of burn injuries in lower income countries [10]. Besides demographic variabilities in burn epidemiology, culture and clothing play important roles as determining burn risks. Bangladesh sees burns as a major medical and social challenges as the country lack adequate medical facilities especially specialized personnel for burn treatments, public safety measures and emergency services. Also little has been published in literature about the distribution of burn trauma in Bangladesh, which restricts to understand the etiology of burn patients and epidemiological characteristics of the problem. The current hospital-based study aims to assess the epidemiological characteristics of fatal and non-fatal burns, resulting from unintentional causes by using hospital registration data in Bangladesh.

METHODS

This study was conducted at the Burn and Plastic Surgery unit of Rangpur Medical College Hospital (RpMCH), one of the largest burn care facilities in Bangladesh. Data for this study were extracted from a prospectively maintained hospital register that documents cases of burn injuries admitted to the hospital. The burn registry of RpMCH, which is

part of regular hospital record-keeping, includes detailed information on all types of burn injuries such as scalds, electrical burns, and fire burns. The current study encompasses data of a total of 477 cases collected from January 2022 to December 2022, including all cases of acute, unintentional burns treated in both the indoor and outdoor services of the hospital. Recorded data include patient demographics (age, sex), occupational information, burn mechanisms (e.g., scald, flame, inhalation, electric), locations of the injuries, etiologies, extent and depth of burns (total body surface area, TBSA), affected body regions, and the month of occurrence. Cases involving post-burn complications like contractures, hypertrophic scars, keloids, Marjolin's ulcers, hypopigmentation, as well as sunburn radiation injuries, were excluded. Additionally, injuries associated with violence, including self-inflicted and interpersonal violence, were omitted due to medico-legal constraints. Data compilation was initially performed in a comprehensive table format. Statistical analysis was conducted using Microsoft Excel. Descriptive statistics such as means, medians, and standard deviations were calculated as applicable. The Chi-square test was employed to determine statistical significance, with a p-value of less than .05 considered statistically significant. Ethical considerations for this study were meticulously followed with site-level approvals obtained from the Ethical Committee of Rangpur Medical College. Given that no individual identifiers or household locations were included in the analysis, no additional ethical approvals were required for the secondary use of the pooled data.

RESULTS

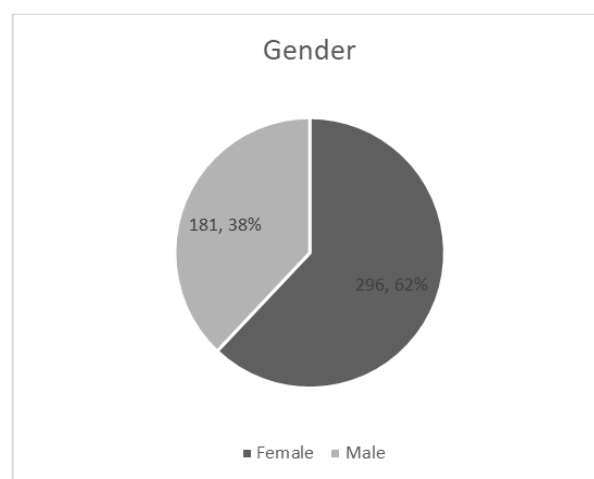


Figure 1: Gender distribution of the participants (N=477)

The study found a notable gender disparity in burn injuries, with females constituting 62.05% (296 individuals) and males 37.95% (181 individuals) of the total 477 cases examined.

Table 1: Characteristics of the hospitalized burns by gender (N=477)

Type and etiology of burns		Females, (n=296) n (%)	Males, (n=181) n (%)	p-value
Age (years) (n=477)	<5	25(8.4)	31(17.1)	<0.01
	5-9	9(3.0)	28(15.5)	
	10-14	9(3.0)	14(7.7)	
	15-24	110(37.2)	29(16.0)	
	25-44	110(37.2)	43(23.8)	
	45-54	22(7.4)	27(14.9)	
	>54	11(3.7)	9(5.0)	
Types of burns (n=477)	Flame burn	257(86.8)	70(38.7)	<0.01
	Scald	30(10.1)	51(28.2)	
	Electric burn	3(1)	39(21.5)	
	Contact burn	5 (1.7)	17(9.4)	
	Chemical burn	1(0.3)	2(1.1)	
	Friction burn	0	1(0.6)	
	Heating material	0	1(0.6)	
Place of burns (n=477)	Home, living, bed, dining, and wash room	218(73.6)	123(68.0)	<0.01
	Kitchen	74(25.0)	5(2.8)	
	Electric and dish lines	2(0.7)	33(18.2)	
	Boiler industry mine rice mill workshop	1(0.3)	13(7.2)	
	Outdoor, motor car, road, field	1(0.3)	7(3.9)	
Occupation of burn victims (n=477)	Housewife	205(69.3)	1(0.6)	<0.01
	Student	46(15.5)	57(31.5)	
	Unknown	31(10.5)	36(19.9)	
	Other	13(4.4)	41(22.7)	
	Farmer	0	30(16.6)	
	Electric worker	1(0.3)	16(8.8)	
Etiology of Flame and Fires (n=327)	Fire camp	164 (63.8)	39 (55.7)	<0.01
	Cooking with wood, wood	75 (29.2)	4 (5.7)	
	Textile	2 (0.8)	7 (10.0)	
	Fire with candle, kerosene lamp	3 (1.2)	8 (11.4)	
	Gas cylinder burst, gas	7 (2.7)	4 (5.7)	
	Others (play with fire)	6 (2.3)	8 (11.4)	
Etiology of Scalds (n=81)	Hot water	20 (66.7)	30 (58.8)	0.214
	Hot curry	6 (20)	14 (27.5)	
	Hot oil	4 (13.)	2 (3.9)	
	Others (ash, combustible)	0	5 (9.8)	
Clothing in flame and fires (n=327)	Yes	239(92.9%)	46(65.7%)	<0.001
	No	18(7.1%)	24(34.3%)	

The age group most affected by burns among females was 15-44 years, with each of these age brackets accounting for 37.2% of female patients, compared to significantly lower percentages in males. In terms of burn types, 86.8% of females suffered from flame burns, which is much higher compared to 38.7% in males. Scalds and electrical burns were more common in males, with 28.2% and 21.5%, respectively, against 10.1% and 1% in females. Regarding the location of burns, a large majority of injuries among both genders occurred at home (73.6% for females and 68% for males). However, burns occurring in the kitchen were predominantly in females (25%), while burns related to electrical and dish lines (18.2%) and boiler industry settings (7.2%) were more common among males. Occupationally, 69.3% of female burn victims were housewives, a stark contrast to males

where only 0.6% were in this category. Among males, students, farmers, and electric workers represented significant proportions (31.5%, 16.6%, and 8.8%, respectively). In terms of etiology of flame and fire burns, a high percentage of females (63.8%) were affected by fire camp incidents, and 29.2% by cooking with wood or wood. In contrast, males were more likely to suffer from burns caused by textiles, candles, kerosene lamps, and other fire-related play (ranging from 5.7% to 11.4% across these categories). Furthermore, the study found that a large majority of females (92.9%) who experienced flame and fire burns were wearing clothing that could catch fire, compared to 65.7% of males. This difference was statistically significant, indicating a higher risk associated with female clothing in burn incidents.

Table 2: Characteristics of the severity of hospitalized burns by gender (N=477)

Characteristics	Level of burns	Females, (n=296) n (%)	Males, (n=181) n (%)	p-value
Total body surface area (TBSA)	0-15%	72 (24,3)	81 (44,8)	<0.01
	16%-30%	132 (44,6)	63 (34,8)	
	31%-45%	50 (16,9)	26 (14,4)	
	46%-60%	29 (9,8)	7 (3,9)	
	61%-75%	9 (3,0)	1 (0,6)	
	>75%	4 (1,4)	3 (1,7)	
Thickness of wound	2nd degree	17 (5,7)	48 (26,5)	<0.01
	3rd degree	275 (92,9)	101 (55,8)	
	4th degree	4 (1,4)	32 (17,7)	

The analysis of burn severity in hospitalized patients by gender showed significant differences in the total body surface area (TBSA) affected and the thickness of wounds. Females generally experienced more severe burns in terms of TBSA compared to males. Specifically, 44.6% of females suffered burns affecting 16%-30% TBSA, and 16.9% had burns covering 31%-45% TBSA, which were both higher than the percentages seen in males (34.8% and 14.4%, respectively). Moreover, only 3.9% of males experienced burns affecting 46%-60% TBSA,

compared to 9.8% of females. Extremely severe burns covering more than 60% TBSA were rare in both genders but slightly more common in females. In terms of wound thickness, the data reveal a markedly higher prevalence of third-degree burns among females, with 92.9% suffering from this severity, compared to only 55.8% of males. Males, however, had a higher incidence of both second-degree burns (26.5% versus 5.7% in females) and fourth-degree burns (17.7% versus 1.4% in females).

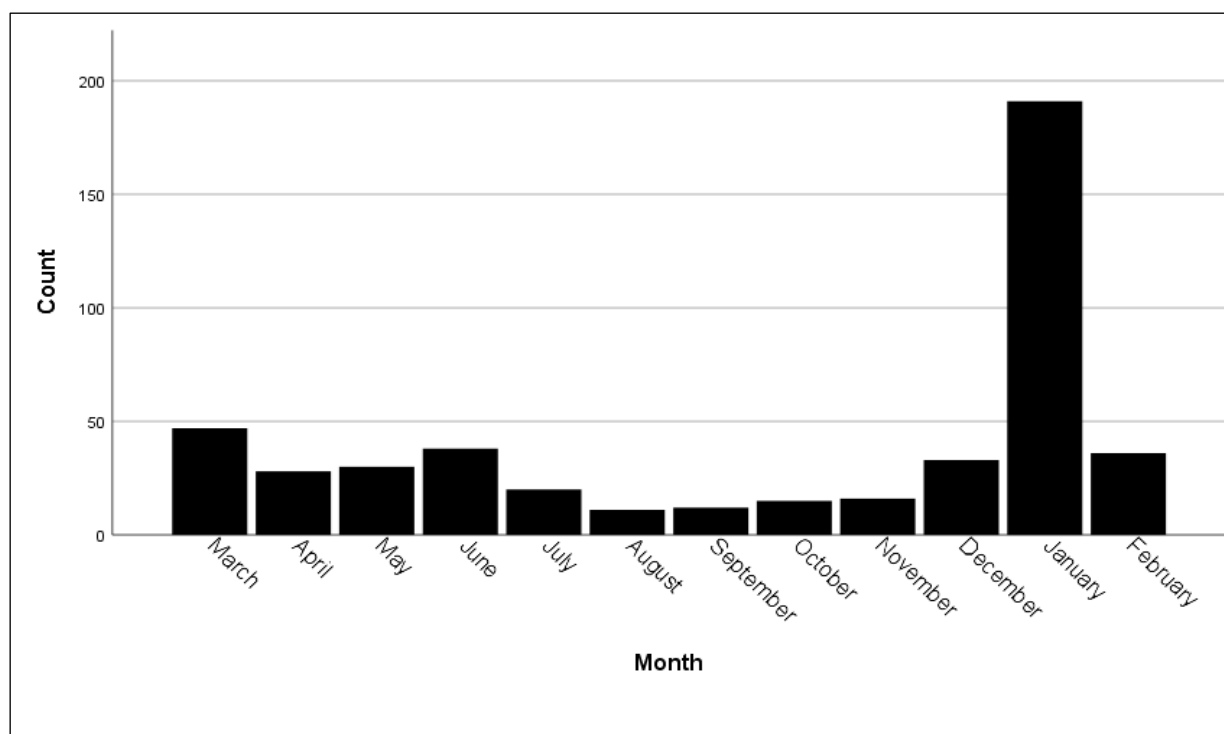


Figure 2: Seasonal pattern of the hospitalized burns, during 2017-2018 (N=477)

The seasonal distribution of hospitalized burn cases shows a pronounced peak during January, with approximately 40% of the annual burn incidents (191 cases) occurring in this single month. This is a significant spike compared to other months, with March

and June recording lower incidences at 9.9% and 8% of cases, respectively. The least number of cases were observed in August and September, each accounting for only about 2% of the yearly total.

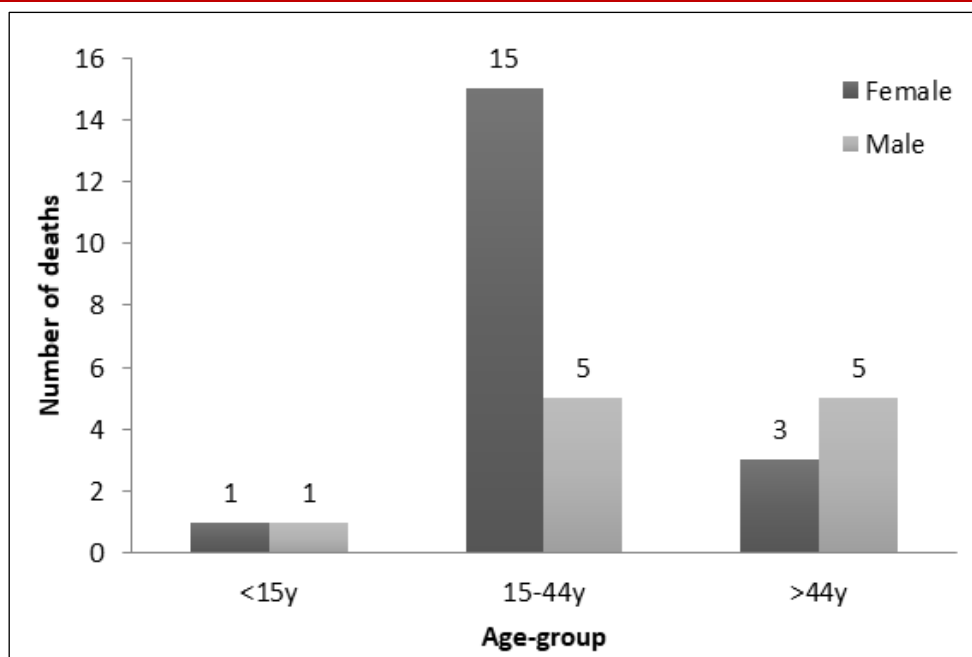


Figure 3: Distribution of burn deaths by age and gender (N=30)

30 out of the 477 (0.63%) had died due to burn injuries. Among the mortality cases, 19 were female (63.33%) and 11 were male (36.67%). Analyzing by age group, the 15-44 age range had the highest number of deaths, with all 15 fatalities in this group being females, accounting for 100% of the deaths in this age bracket and 79% of all female deaths. For those under 15 years of age, there was one death for each gender,

representing about 5% of deaths in each gender category. In the over 44 age group, females also saw a higher number of deaths, with 5 female deaths (26% of female deaths) compared to 3 male deaths (27% of male deaths). This data underlines the pronounced vulnerability among adult females, particularly those aged 15-44, to fatal burn injuries.

Table 3: Univariate logistic regression analysis of factors predicting severity of hospitalized burns (0-30% TBSA vs 31% TBSA and above), (N=477)

Predictor variables	OR (CIs)	p-value
Age	1,28 (1.13-2.71)	<0.01
Sex	1,75 (1.11-1.47)	0,012
Place of burns	0,76 (0,53-1.09)	0,149
Occupations	0,98 (0,98-,98)	<0,01
Causes of ignition	0,56 (0.41-0.76)	<0.01
Seasons	1,06 (1,01-1.12)	0,018

The univariate logistic regression analysis conducted on a sample of 477 patients investigated the impact of various factors on the severity of hospitalized burns, specifically comparing burns covering 0-30% of total body surface area (TBSA) to those covering 31% TBSA and above. The results indicated that age is a significant predictor, with each increase in age raising the odds of more severe burns by 28% (OR = 1.28, 95% CI [1.13-2.71], $p < 0.01$). Sex also plays a crucial role; being male increases the odds of experiencing more severe burns by 75% (OR = 1.75, 95% CI [1.11-1.47], $p = 0.012$). Conversely, the place of burns did not significantly predict burn severity, with an OR of 0.76 (95% CI [0.53-1.09], $p = 0.149$). Occupation showed no significant impact on burn severity with an OR of 0.98 (95% CI [0.98-0.98], $p < 0.01$). However, the causes of ignition were found to significantly decrease the odds

of severe burns by 44% (OR = 0.56, 95% CI [0.41-0.76], $p < 0.01$). Additionally, seasonal variations slightly increased the odds of more severe burns by 6% per season (OR = 1.06, 95% CI [1.01-1.12], $p = 0.018$).

DISCUSSION

The current epidemiological study conducted at the burn care unit of Rangpur Medical College Hospital in Northern Bangladesh provided a comprehensive analysis of 477 registered burn cases over the period from January 2022 to December 2022. This study, crucial in regions where national patient data are scarce, sheds light on demographic, etiological, and locational patterns of burn injuries, which are essential for crafting targeted prevention and policy initiatives [1, 11]. A significant finding of the study is the high prevalence of burns among young to middle-

aged adults (15-44 years) and females, indicating a specific vulnerability in this demographic segment. Notably, 71% of non-fatal burn injuries involved females, a statistic that aligns with findings from other South Asian studies and contrasts with data from regions like Afghanistan and Pakistan where males are more frequently affected [1, 4, 12-15]. This demographic trend underscores the role of socio-economic and cultural factors in burn injuries, particularly the involvement of women in household cooking, which increases their risk exposure [16, 17]. The study identified flame and fire burns as the most common types of injuries, constituting nearly 70% of all cases, with scalds and electrical burns following in frequency. A marked gender disparity was observed in the incidence of these burns. Flame burns were particularly prevalent among females, who often are engaged in domestic tasks such as cooking or managing potentially hazardous materials like kerosene stoves. This gender-specific trend aligns with findings from similar studies across South Asia, underscoring an urgent need for enhanced safety protocols and awareness initiatives in these activities [1]. Targeted interventions, such as the promotion of safer cooking technologies and practices, could mitigate risks associated with these types of burns. Additionally, the data revealed a notable seasonal pattern in burn incidents, with a significant uptick in campfire burns during the colder months of December and January. This seasonal increase is attributed to gatherings around campfires for warmth, a common practice in the region during winter. Such trends, also noted in other studies from Bangladesh and India, highlight a behaviorally induced risk that public health campaigns could effectively address by promoting safer methods of heating and public education about the risks of open fires [18, 19]. Analysis of the total body surface area (TBSA) affected by burns revealed that more severe burns, affecting over 30% TBSA, were comparatively rarer but were associated with substantial morbidity and mortality. The study's logistic regression analysis pinpointed age, sex, and the causes of ignition as significant predictors of burn severity, indicating strategic areas for intervention. Implementing community-based safety workshops and regulatory measures to manage and mitigate the use of open flames and unsafe electrical setups could significantly reduce the occurrence and severity of burns. The role of clothing in exacerbating burn injuries was particularly emphasized. The analysis found a high incidence of severe burns among females who were wearing loose and highly flammable clothing at the time of the incident. This critical issue necessitates a comprehensive review of clothing safety, particularly in environments where open flames are used. Public health initiatives could greatly benefit from incorporating strategies that promote the use of non-flammable fabrics and safer clothing designs in the kitchen and other high-risk areas. By addressing these factors through robust community engagement and

educational programs, it is possible to enhance overall safety and reduce the incidence of severe burn injuries. These interventions should be culturally sensitive and tailored to the specific needs and habits of the local population, ensuring higher effectiveness and community acceptance. In conclusion, this study has provided crucial insights into the epidemiological characteristics of burn injuries in a specific region of Bangladesh, emphasizing the need for targeted preventive strategies. These should include educational campaigns focusing on safe cooking practices, the use of safer cooking appliances, and public awareness about the risks of wearing flammable clothing near open flames. Moreover, enhancing structural safety in homes and public spaces, particularly in rural and underserved areas, could reduce the prevalence and severity of burns. Finally, addressing these factors through community-based interventions could lead to a substantial decrease in burn injuries, improving overall public health outcomes in the region.

Limitations of The Study

Hospital register is not representative of a given population since it often includes episodic- or event-based data. Secondly, this data is lacking the representation for the conditions as the cases are not well defined nor do have effective treatments in the case of severity. Other limitations that the hospital data suffer from the heterogeneity of the access to health care services and differences in health seeking behavior within a population and uneven quality of routinely collected data through the health care services. Some burns cases might miss out as homicide and suicide cases and were not included in the current analysis due to medico-legal reasons. Finally, this is a cross-sectional study in nature, therefore, could not establish any causal relationship between independent variables and dependent variable such as burns.

CONCLUSION

In conclusion, the epidemiological study conducted at the Rangpur Medical College Hospital has provided pivotal insights into the patterns and determinants of burn injuries in Northern Bangladesh. Highlighting the prevalence of burn injuries among young to middle-aged women, particularly due to their involvement in cooking and household activities, the study underlines the critical intersections of gender, socio-economic, and cultural dynamics in burn incidents. The predominant incidence of flame and fire burns necessitates targeted interventions to enhance safety measures and raise awareness about potential hazards. Furthermore, the seasonal surge in campfire burns during the colder months points to the necessity of educating the public about safer heating practices to mitigate risks associated with such gatherings. The findings emphasize the significance of implementing comprehensive public health strategies that include promoting safer kitchen technologies, non-flammable clothing, and structured community awareness

programs tailored to local cultural contexts. Additionally, the study advocates for the improvement of home and public space safety infrastructures, particularly in rural and underserved communities, to prevent severe burn injuries. By addressing these critical areas through proactive and culturally sensitive interventions, there is a substantial opportunity to decrease the incidence and severity of burns, thereby enhancing the overall public health and safety of the population in the region. This approach not only targets the immediate risk factors but also builds a foundation for sustained prevention, contributing to the long-term health and well-being of the community.

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