

Burn Patterns in a Rural Community of Bangladesh: Findings from Surveillance Data of January to June 2015

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Abstract

Background: Burn is a major cause of injury morbidity in Bangladesh with prevalence of 9.89/1000 population in 2016. This study aims to describe distribution and existing patterns of burns in a rural community where an active community-based injury surveillance had been ongoing since 2005.

Methods: We analyzed surveillance data of January-June 2015 descriptively and compared burn events between genders and age-groups using z-test, two-sample t-test, Fisher's exact test, Wilcoxon rank sum tests, ANOVA, and Kruskal-Wallis test with 95% CI.

Results: There were 114 burns yielding burn-rate of 1.5/1000 population/year, lower than in 2016 ($p < 0.01$), with no mortality, mainly caused by hot-liquids (46%). Most burns occurred in kitchens (59%) and while playing near fire (41%). Females had higher rates (1.8/1000), higher median (IQR) age at burn (28.4, 4.6-44.4), longer duration of illness (13.4 days, SD 8), and more hot-liquid burns (56%) than males ($p < 0.05$ for all). One-to-four-year-olds had highest rate (5.1/1000) ($p < 0.01$) and infants suffered longer (22.3 days, SD 15.0). Prior to burns, for all children < 10 years, playing near fire was most common activity (78.8%, 41/52), but for ≥ 10 years, these were cooking for females (63.8%, 30/47) and workplaces for males (35.7%, 5/14).

Conclusion: Reported burn-rate was low, high-risk groups matched previous findings, and longer sufferings in females might be from gender-biased health-seeking behaviour. Activities prior to burns matched behaviors typical for high-risk groups. We recommend a country-wide study to identify activities prior to burn in high-risk groups and to consider those by policy makers for designing targeted interventions.

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Introduction

Burn is a type of injury affecting mainly skin or other organic tissue of the body predominantly by heat or due to cold, radiation, radioactivity, electricity, friction or contact with chemicals.¹ An estimated **180,000** annual **deaths** result from burns, rendering it a major global public health problem, and nearly two-thirds of burn mortality occur in **WHO African and South-East Asia Regions**, where prevention, acute care, and rehabilitation services are limited.^{2,3} Besides mortality, burns are major causes of disability-adjusted life-years (DALYs) lost in Low- and Middle-Income countries (LMICs) because of its substantial contribution to morbidity, long-term disability, and economic loss, particularly among children and women.³ In Bangladesh, burn mortality raised from 3.5 to 5.7 per 100,000 population/year as obtained from two national surveys conducted in 2003 and 2016 respectively;⁴ the most contributing cause to deaths were flames and electrocution.^{4,5} The change in morbidity rate was also notable, from 166.3 in 2003 to 989.3 per 100,000 populations for all ages in 2016.^{6,7}

Children <5 years of age and females are at higher risk of getting burned, which often take places in kitchens while cooking where unsafe cooking practices, use of open fires, kerosene stoves, overcrowded housing, and limited supervision of children increase exposure risk.^{2,3, 8,10} Seasonal variation has been observed in occurrence of burn events, with higher incidence during winter months, likely related to increased fire use for heating and crowding, a pattern consistent across Bangladesh and other countries.^{8,11}

Despite substantial burden of burn events, community-level data on its patterns, activities preceding injury and their demographic risks remained limited in Bangladesh till 2005, underscoring the

importance of conducting surveillance to inform targeted prevention strategies. Centre for Injury Prevention and Research Bangladesh (CIPRB) launched the only Injury Surveillance System (ISS) in this country since 2005 and operated in three unions (Dhangora, Bramoghacha and Chandikona) of Raiganj upazilla, Sirajganj since 2011 with objectives to track trends of injuries, including burns, over time and to evaluate effectiveness of child injury prevention programs implemented in the surveillance area. Though the cohort was not well representative of injury situation of the whole country, the system was simple, flexible, acceptable to all stakeholders and relatively stable. Surveillance data quality was good. The background characteristics of the surveillance sites showed slight female predominance, Muslim and farmer majority. Married females were mostly housewives and involved in cooking twice a day using traditional utensils, child-rearing, household works and also in part of occupational works done at home. There were some 'day-care' homes named "Anchal" at one union, providing morning care of 25 children by each.

Objective

By nature, a surveillance provides with ongoing data from the population under surveillance often more accurately reflecting a continuous scenario, rather than a snap-shot situations from surveys. Therefore, analysis of surveillance data always revealed a better picture of the health-event under consideration. With this view in mind, we aimed to analyze burn data of ISS to describe the distribution and current patterns in the rural community setting in 2015 focusing on genders and age-groups.

Methods

This study was based on analysis of secondary data obtained from the ISS for the period of January-June 2015 with approval from the CIPRB authority. With help of pre-coded questionnaires surveillance data collectors (SDC) collect data from every household of each of the three unions regarding each person on demographic, health, socio-economic, participation in injury prevention, and relevant information were updated as needed. All illnesses are recorded by SDCs in two categories- injury illness and illness due to other causes for all age groups, which occurred in the previous six months. If any illness occurs due to injury, they conduct detail interview for that injury and a verbal autopsy for any injury-related death. Apart from socio-demographic, illness, and injury related information, data were collected on burn-related variables (mortality, cause of burn, source of flame, type of hot liquid, type of hot object, cause of explosive use, type of chemical, and type of activities/positions while got burned).

Persons were defined as having an illness when they “required medical attention or one-day work loss or could not perform normal activities for one day or unable to attend school for one day”. An injury was defined as ‘physical damage due to the transfer of energy, which could be mechanical, thermal, chemical, electrical, radical or absence of essentials such as oxygen or heat.’ And a ‘Burn’ was ‘exposure to flames, heat or chemical that leads to tissue damage of the skin, or places deeper in the body’.

Descriptive analysis of data was done by calculating rate per 1,000 population per year (by dividing number of burn events in a group of people by number of mid-population between January-June 2015 in that group

which was obtained from the surveillance authority, and multiplying the rate by two), frequency distribution, mean, median, standard deviation, range, and percentages as applicable. Though the data were collected from all people residing at surveillance sites, we considered those sites as sample population for whole population of the country and compared burn events between genders and age-groups using z-test, two-sample t-test, Fisher’s exact test, Wilcoxon rank sum tests, ANOVA, and Kruskal-Wallis test with 95% CI at the significance level of 0.05. Stata version 14.2 was used for analysis.

Results

The total number of reported burn events was 114. There were no burn related deaths. Burns were observed in all age groups had cases except 15-17 years of age. Mean age of the burned persons was 22.9 (SD 22.2) years. Male and female cases were 43 (38%) and 70 (62%) respectively. Among the 61 cases (aged >6 years), mean years of schooling was 3.0 (SD 3.7). Nearly two-thirds (58.4%) of the burns occurred at kitchen and around noon (mean 12.2 hours, SD 3.4). Hot liquids (46%) and hot objects (37.2%) caused majority of burns. Mean duration of illness was 12.4 days (SD 6.8) and median (IQR) of treatment cost was 250 (150-300) BDT (Table I).

In 2015, rate of burns at Raiganj sub-district was 1.5 per 1000 population/year, which was significantly lower than rate in 2016 (9.89 per 1000 population/year) in Bangladesh ($p < 0.01$). Rates in male vs female (1.1 vs 1.8), their median (IQR) ages in years (5.3, IQR 2.2-23.2 vs 28.4, IQR 4.6-44.4), mean (SD) days of illness (10.5, SD 3.8 vs 13.4, SD 8.0), places of occurrence of the burn, and type of burns sustained differed significantly ($p < 0.05$ for all) (Table I).

Table I: Distribution of burn events between male and female population residing at the surveillance sites of Raiganj sub-district, 2015

Burn Events	Total	Male	Female	p value
Rate (per 1000 in 2015)	1.5	1.1	1.8	<0.05
Age at burn (years), Median (IQR)	13.0 (3.9-39.4)	5.3 (2.2-23.2)	28.4 (4.6-44.4)	<0.001
Years of schooling, Median (IQR)	1 (0-5)	1 (0-4)	1 (0-5)	0.64
Place of occurrence, f (%)	Kitchen	66 (58.4)	51 (72.9)	<0.001
	Yard	29 (25.7)	13 (18.6)	
	Bedroom	11 (9.7)	5 (7.1)	
	Others	7 (6.2)	1 (1.4)	
Type, f (%)	Hot liquid	52 (46.0)	39 (55.7)	0.04
	Hot object	42 (37.2)	21 (30.0)	
	Flame	16 (14.2)	9 (12.9)	
	Others	3 (2.7)	1 (1.4)	
Time of occurrence (24-hours), Mean (SD)	12.2 (3.4)	11.7 (2.8)	12.5 (3.7)	0.22
Duration of illness (days), Mean (SD)	12.4 (6.8)	10.5 (3.8)	13.4 (8.0)	0.03
Work-loss days, Mean (SD)	3.5 (2.6)	3.7 (2.0)	3.2 (2.6)	0.4
Treatment cost (BDT), Median (IQR)	250 (150-300)	250 (150-300)	200 (150-400)	0.8

We compared burn events between populations of different age groups. Children aged between 1-4 years had the highest burn rate in 2015, which was 5.1 per 1000 population per year, and was significantly different from the other two age groups ($p < 0.05$ for both). Mean duration of illness was higher in infants (22.3 days, SD 15.0) and the duration varied significantly between the three groups ($p = 0.01$) (Table II).

Burn rate among male and female varied by age group (Figure 1). For both genders, the rates were highest in 1-4 years of age group, 5.5 for male and 4.8 for female per 1,000 population in 2015. The lowest rates were observed in infants for both male (0.2/1000/year) and female (0.3/1000/year). At early ages (< 10 years) rates of burn are higher among males than females and rates in female are higher after 10 years of age.

Table II: Distribution of burn events between population of different age groups residing at the surveillance sites of Raiganj sub-district, 2015

Burn Events		<1 year age (n=3, 2.6%)	1-4-year age (n= 36, 31.6%)	≥5-year age (n=75, 65.8%)	p value
Rate (per 1000 in 2015)		0.2	5.1	1.3	<0.05 for both (1-4-year compared with others)
Place of occurrence, f (%)	Kitchen	2 (66.7)	21 (58.3)	44 (58.7)	0.25
	Yard	0	12 (33.3)	17 (22.7)	
	Bedroom	1 (33.3)	3 (8.3)	7 (9.3)	
	Others	0	0	7 (9.3)	
Type, f (%)	Hot liquid	1 (33.3)	13 (36.1)	38 (50.7)	0.54
	Hot object	1 (33.3)	17 (47.2)	24 (32.0)	
	Flame	1 (33.3)	5 (13.9)	11 (14.7)	
	Others	0	1 (2.8)	2 (2.7)	
Time of occurrence (hours), Mean (SD)		14.0 (4)	11.8 (3.3)	12.3 (3.4)	0.48
Duration of illness in days, Mean (SD)		22.3 (15.0)	13.6 (8.7) ¹	11.4 (5.0)	0.01
Work-loss days, Mean (SD)		4.5 (3.5)	4.2 (2.6)	3.2 (2.5)	0.29
Treatment cost (BDT), Median (IQR)		100 (100-4000)	225 (15-300)	250 (150-300)	0.86

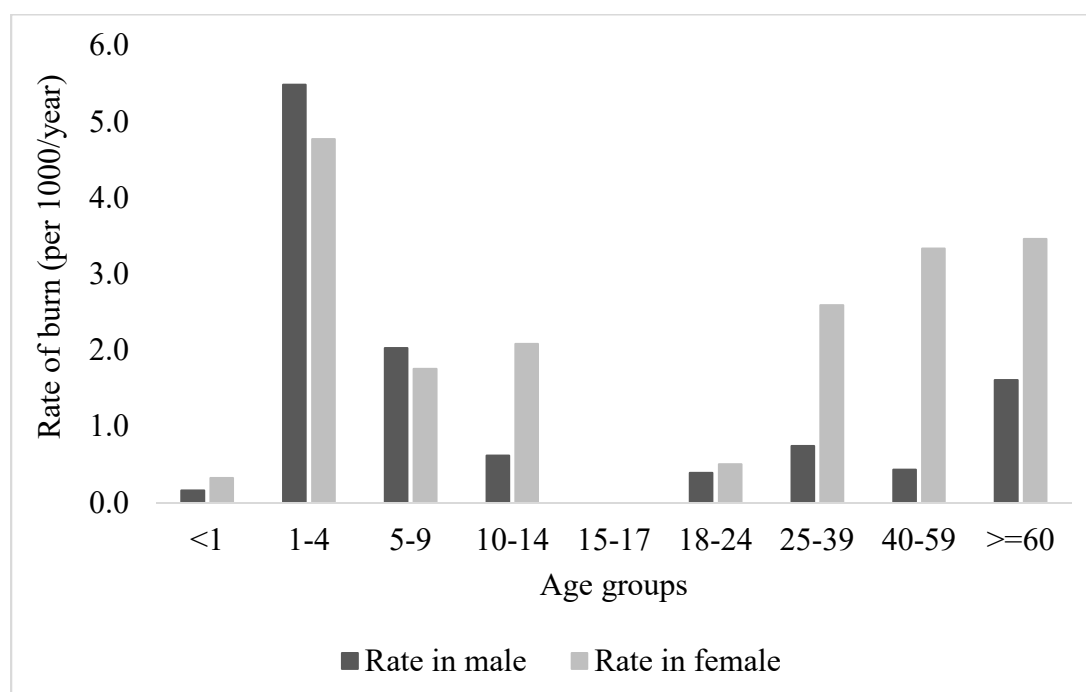


Figure 1. Rate of burn events per 1,000 population in 2015 in males and females of different age groups at Raiganj, 2015 (n=113)

Analysis of prior burn activities/positions showed that playing near the fire was the commonest activity (41/52, 78.8%) for both male and female children <10 years of age. However, activities were different from 10 years of age onwards; 63.8% female were involved in cooking before burns and 35.7% males in works outside home (Table III).

Table III: Activities/position of people of different age groups of both genders prior to burn events at Raiganj sub-district, 2015

Age group (years)	Male (n=43, 38%)		Female (n=70, 62%)	
	Total (%)	Activity/position prior to burn (%)	Total (%)	Activity/position prior to burn (%)
< 1	1 (2.3)	Playing near fire (100)	2 (2.9)	Playing near fire (50) Cooking (50)
1-4	20 (46.5)	Playing near fire (80) Playing with hot object (10) Others (10)	16 (22.9)	Playing near fire (100)
5-9	8 (18.6)	Playing near fire (50) Playing with hot object (37.5) Cooking (12.5)	5 (7.1)	Playing near fire (80) Cooking (20)
10-14	2 (4.7)	Playing near fire (100)	4 (5.7)	Cooking (75) Playing near fire (25)
15-17	0	-	0	-
18-24	2 (4.7)	Playing with hot object (50) Others (50)	4 (5.7)	Cooking (75) Working outside home (25)
25-39	6 (14.0)	Working outside home (66.7) Playing near fire (16.7) Others (16.7)	20 (28.6)	Cooking (75) Working outside home (15.0) Playing near fire (5.0) Others (5.0)
40-59	2 (4.7)	Working outside home (50) Others (50)	14 (20.0)	Cooking (57.1) Working outside home (14.3) Others (28.6)
≥ 60	2 (4.7)	Cooking (50) Others (50)	5 (7.1)	Working outside home (40) Cooking (20) Others (40)

Discussion

Burns, among all injury events, cause significant mortality and morbidity, nationally and globally. Though several surveys are conducted at different times, this surveillance-based secondary data analysis from a rural sub-district, Raiganj in Bangladesh provides a real-time characterization of burn patterns with probable effects of prevention programs, and highlights important demographic and behavioral risk characteristics, that strengthen survey findings. We found a lower burn rate compared with 2016 national estimates, with no burn-related deaths, and identified distinct

epidemiologic patterns across gender and age groups. Burns were predominantly caused by hot liquids and hot objects, occurred mainly in kitchens, and involved females and children aged 1–4 years as the highest-risk groups. Activities preceding burns were strongly linked to age- and gender-specific behaviors.

Differences in overall burn rate and burn-related mortality from a national survey done in 2016 and another survey in 2013 were observed from the analysis.^{5, 6} The probable reasons of the difference might be comparison

of a single sub-district surveillance data to surveys encompassing larger areas, absence of other months of cold seasons in the dataset, and presence of ongoing injury prevention program including a type of 'day-care' named "Anchal" in some areas (i.e., Dhangora) which prevent children from being injured and also from burns while mothers remain busy at work. The 'zero' mortality might also be due to predominance of hot liquid and hot object burns, which generally have lower fatality risk than flame injuries.¹²

Significant difference in occurrence of burn events was found when compared between genders. Females accounted for 62% of all burns, and had a significantly higher burn rate than males, similar to other studies (5, 7, 13). This pattern aligns with gendered household roles in LMICs, where women's responsibilities for cooking heighten exposure to burn-related hazards.^{5, 13} Type of burn and place of occurrence of burns differed significantly between genders with females having higher hot liquid burns and sustaining burns more at kitchens, which are also evident in earlier studies^{5, 13} and reflect female predominance in domestic work environments. The significantly longer duration of illness among females may be related to delayed care-seeking factors as previously reported in studies of health-seeking differences between genders,¹⁴ injury location, or deeper tissue involvement.

Age emerged as one of the strongest determinants of burn risk when age groups were compared. Children aged 1–4 years had the highest burn rate (5.1 per 1,000), which was significantly higher than other groups ($p < 0.05$), consistent with global and national evidence that toddlers are the most vulnerable.^{5, 13, 15} The present 2015 scenario of this risk group was no different from 2003, demanding especial preventive efforts for them.¹⁶ The probable reason for their

vulnerability can be due to curiosity and limited motor control,¹⁷ and frequent proximity to kitchens or cooking areas as their mothers work over there. This is supported by the result that most of the burns in this age group occurred at kitchens and by hot objects. Infants (<1 year) experienced prolonged illness duration, likely due to thinner skin, greater surface-area involvement, and more complex wound care needs.

Bivariate analysis revealed higher burn rates in younger males (< 10 years), but in females aged ≥ 10 years. Probably, the in-born nature of a male-child puts them at more risk, as also supported by previous findings.¹⁸ When immediate burn-prior events were analyzed, children <10 years were burned mainly while playing near fire. The finding reinforces the behavioral nature of this risk profile as such events usually result from unsafe cooking practices in open places, open fires in yard in winter, lack of supervision, as well as childhood characteristics, and are often preventable.^{8, 13} For girls over 10 years and more, cooking was the most common activity before getting burned, reflecting placement of young girls in household roles such as cooking.¹³ The predominant activities before burn for adult females was cooking, for elderly females (≥ 60 years) and adult males was work-place related, which indicate consistency with age and gender specific daily involvements.¹³

The major limitation of the data includes its short duration leading to calculation of probable yearly rates, partial depiction of seasonality, and inability to identify long term burn-associated disability. Other limitations were exclusion of medically untreated burns and burns hampering activities for less than a day in the dataset as defined by the surveillance case definition and poor representativeness of surveillance in respect to the whole country.

Conclusion

Burns are a global public health problem, but these are on most occasions preventable. This study, an analysis of burn data of January-June 2015 from an active community-based surveillance, provided gender and age-group stratified picture of burn patterns in a rural community, a testament of consistency of demographic risks (female sex and 1-4-year) of this specific injury despite already known facts for years and preventive approaches; nevertheless, the overall rates revealed improvements. It also identified activities prior to burn in high-risk groups. Given these findings, we recommend nationally representative survey to identify major prior burn activities and based on that to prioritize targeted **age-specific and gender-responsive interventions, to promote** behavior-focused safety initiatives tailored to domestic cooking environment through community health workers.

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Conflict of interest

The authors declare that they do not have any conflict of interests.

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