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Consequences of childhood burn: Findings from the largest community-based injury survey in Bangladesh

S.R. Mashreky [a,b,*], A. Rahman [a], S.M. Chowdhury [a], S. Giashuddin [a], L. Svanström [b], M. Linnan [c], S. Shafinaz [d], I.J. Uhaa [d], F. Rahman [a,b]

[a] Centre for Injury Prevention and Research Bangladesh (CIPRB), Bangladesh
[b] Department of Public Health Science, Karolinska Institute, Sweden
[c] The Alliance for Safe Children, Thailand
[d] UNICEF, Bangladesh

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ABSTRACT

In terms of morbidity and disability, burn is a major public health problem throughout the world, especially in low-income countries. It causes long-term disability and remains as a health, social and economic burden. A population-based survey was conducted in Bangladesh between January and December 2003. Nationally representative data were collected from 171,366 rural and urban households comprising of a total 819,429 population, which included 351,651 children under 18 years of age. Mothers/head of households were interviewed with a structured instrument. The objective of this paper is to determine the consequences of childhood burn at social and economic levels in Bangladesh.

In the survey, 1013 children were found with different degrees of burn in the preceding 1 year. Among them 20 children were permanently disabled. The rate of permanent disability was found to be 5.7 per 100,000. The average loss of school days was found to be about 21 days. More than two-thirds of the burn victims required assistance in their daily activities for different durations of time. More than 7% of the children required hospitalisation for their burns. The rate of hospitalisation was 21.9 per 100,000; the average duration of hospital stay was 13.4 days. The highest duration (40 days) of hospital stay was found among girls 10–14 years old. The highest expenditure for the treatment was also found in this age group. The average direct expenditure incurred by a family for treatment of severe burn was determined to be $462. In this study it was found that more than 61% of the families earn less than $50 a month.

Burn is a devastating injury among all childhood injuries with significant additional economic consequences beyond the medical, pain, and suffering issues. Developing a national prevention program should be an immediate public health priority.

1. Introduction and background

In terms of morbidity and long-term disability, burn is a major public health issue throughout the world, especially in developing countries [1]. Annually 238,000 deaths occurred globally due to fire-related burns, and the great majority (95%) of these occurred in low and middle-income countries [2]. Even in developed countries injuries from burns represent the

* *Corresponding author at*: Centre for Injury Prevention and Research Bangladesh (CIPRB), House 226, Lake Road 15, New DOHS Mohakhali, Dhaka 1206, Bangladesh. Fax: +880 28861499.
E-mail address: mashreky@yahoo.com (S.R. Mashreky).
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leading cause of unintentional injury mortality and morbidity [3–6].

Children are the most vulnerable group of burn victims because they have less perception about dangerous situations and limited ability to react promptly and properly [7]. Burn was found as the most devastating cause of all childhood injuries [8,9]. It has an effect on mental functions, self-care, mobility, domestic life, relationships, and education and work status [10]. Long-term impairment and disability due to scaring is common in burn [11], and psychological impairment like anxiety, post-traumatic stress disorder (PTSD), self-confessed depression and juvenile delinquency are not uncommon [11,12]. The economic consequence is also a major issue in burns. In a developed country like the United States, a ''cost of burns'' model suggests a dollar value of societal losses from childhood burn deaths and injuries at approximately $3.5 billion a year [13].

Although childhood burn is one of the major public health problems in Bangladesh [14], the policy planners like many other developing countries do not properly recognize it, which is mainly due to unavailability of convincing data.

In a recent publication the magnitude and characteristics of childhood burn in Bangladesh was reported by the same authors and it was estimated that about 173,000 children suffered moderate to severe burn every year [14]. This paper was intended to assess the physical, social and economic consequences of childhood burns. Both the papers were prepared from the same population-based survey conducted in Bangladesh.

2. Methods

2.1. Study design

Cross-sectional study.

2.2. Study population

The study was carried out during 2003 (January to December) in 12 randomly selected districts of Bangladesh and in Dhaka Metropolitan City. This encompassed a population of 819,429 including 351,651 children under 18 years of age.

Multi-stage cluster sampling was used to choose a total sample size of 171,366 households; 88,380 from rural areas, 45,183 from district towns (urban areas) and 37,803 households from Dhaka Metropolitan City. Twelve out of 64 districts were randomly selected for the survey. In each district, to represent the rural community, one upazila (sub-district) was randomly chosen, and in each upazila, two unions (administrative lowest units composed of ~20,000 population) were selected randomly. Each union was considered a cluster. All households in the union were included in the survey. The district headquarters of the 12 selected districts and Dhaka Metropolitan City constituted the urban areas. In the urban areas, mohallas served as clusters. Mohallas are the lowest unit of City Corporation, about 400–500 household constitute a mohalla. Systematic sampling was done to achieve the required number of households.

2.3. Case ascertainment

Anyone under 18 years of age was considered as a child, meeting the UN definition of ''a child''. Children were identified as burn patients when s/he received any treatment or could not perform normal activities for at least 3 days for burn.

2.4. Data collection and interview

Forty-eight data collectors collected data from respondents using face-to-face interviews. Along with the researchers, six fulltime supervisors were employed for the supervision and monitoring of the data collection process. Mothers were primarily preferred as respondents. However, if the mother was not available, the most knowledgeable members of the household were considered as respondents. Where possible, it was the head of household, and as many members of the household were present as possible to corroborate or add detail to the respondents' interview answers. Screening forms were used to identify any mortality or morbidity in the household. A household member was defined as a member living in the same house, including domestic helpers, long-term guest, etc., sharing meal and information.

The respondents were first asked whether any deaths had taken place in the household in the last 2 and 3 years in National and Dhaka metropolitan surveys, respectively, or experienced an illness in the last 6 months. If any deaths or illnesses were identified, the interviewer proceeded with further clarification regarding the death or illness. Structured questionnaires were employed if burn injuries caused the death or illness. Repeat visits were made to the household where respondents were unavailable on the first visit. In spite of repeated attempts, 2.7% household could not be interviewed. A total of 166,766 households participated in the study.

In the sampled households 351,651 children 0–17 years of age were identified. Among them 178,285 were male and 173,366 were female children. 155,934 children were from urban areas, and 195,717 were from rural areas.

2.4.1. Definition of severity

Non-fatal burns were separated in different degrees of severity. They were classified into severe, serious, major and moderate. The definitions are:

Moderate: Sought medical care, but not admitted to hospital; or had a 3-day work loss, or absence from school, but had no permanent disability. Three days was set as the minimum number following extensive discussions with social scientists and epidemiologists familiar with Bangladeshi cultural norms.
Major: Hospitalised, for a period of less than 10 days but no permanent disability.
Serious: Hospitalised for 10 days or more, but no permanent disability.
Severe: Permanently disabled (loss of vision, hearing, handling, ambulation, or mental retardation) regardless of whether hospitalisation occurred.

Permanent disability was defined as any of the part of the body that losses its functional ability permanently.

2.4.2. *Definition of cost of treatment*

Treatment cost was calculated by only the expenditure made by the family. Cost of the service by the government hospital was not included in this cost calculation.

2.4.3. *Statistical analysis*

Proportions of different levels of severity were calculated. Temporary disabilities were categorized according to the duration of disability. Proportions were calculated according to duration of school absence. Mean duration of hospital stay was calculated according to severity, age and gender. Cost of the treatment was calculated according to severity of burns. Yearly incidence rate of permanent disability was calculated from the number of occurrence of permanent disability in 6 months multiplied by two, as data were collected considering a 6 months recall period. Like the rate of permanent disability, the rate of hospitalisation was also calculated in this study. Rates were calculated by using EPI6 software, and all of the analyses were carried out by using SPSS 11.5 software.

3. Results

A total of 1013 children were found to have suffered from burns. Two children had died due to burns. The rates of fatal and non-fatal burns in children were 0.6 per 100,000 children-year and 288.1 per 100,000 children-year, respectively. Among the total children with non-fatal burns 56.7% were boys and 43.3% were girls. The median age of having non-fatal burn was 3 years, and mean age was 4.75 (S.D. ±3.94) years. The highest proportion (57%) of non-fatal burn was found among children 1–4 years old.

It was found that majority of the burn victims belonged to poor families. The average monthly family income of the burn victims in this study was found to be US $67. The monthly family income was found to be less than US $50 a month, among more than 61% of the families.

3.1. *Social consequences*

It was found that 2% of the burns were severe in nature that caused permanent disability. More than 92% of the burns were moderate in nature, that is, the child required medication or could not perform his/her normal activities for at least 3 days, but required no hospitalisation. About 4% of the victims had major burns, which required hospitalisation. About 2% of the burns were characterized as serious, that is, the victims needed to stay in hospital for more than 10 days.

A total of 517 patients reported temporary disability of different duration. The majority (59.8%) of temporary disabilities lasted for 1 week to 1 month's duration. About 20% were disabled for 1–3 months time. A very small proportion (1.5%) of the children suffered from temporary disability for more than 3 months.

It was found that many of the children required assistance in their daily activities after completing his/her treatment. About 55% of the burn patients required assistance in their activities of daily life for a period of more than 1 week but less than a month. More than 16% mentioned that they required assistance for 1–3 months time. The mean duration of assistance needed for the burnt children was found to be 16.1 days (S.D. ±16.8), ranging from 1 to 159 days.

Table 1 – Distribution of social consequences of childhood burn

	Frequency	Percent
Severity of burn (*N* = 1013)		
Permanent disability (severe)	20	2.0
Temporary disability		
Serious	18	1.8
Major	38	3.8
Moderate	937	92.5
Duration of temporary disability (*N* = 517)		
<1 week	97	18.8
>1 week but <1 month	309	59.8
1–3 months	103	19.9
>3 months	8	1.5
Assistance required for daily activities during temporary disability (*N* = 696)		
<1 week	193	27.7
>1 week but <1 month	379	54.5
1–3 months	115	16.5
>3 months	9	1.3
Loss of school days (*N* = 202)		
<1 week	37	18.3
>1 week but <1 month	100	49.5
1–3 months	60	29.7
more than 3 months	6	3.0
Work day loss (*N* = 69)		
<1 week	26	38.2
1 week to <1 month	27	38.8
1–3 months	12	18.2
>3 months	3	4.9

It was found that out of total 1013 burned children, only 214 were students. Among them, 202 children had to be absent from school for various durations due to their injury. About half of them could not go to school for a week to a month's duration. About 30% of them could not go to school for 1–3 months duration. It was observed that mean duration of school loss among burn victims was 21.13 days (S.D. ±19.13), ranging from 1 to 90 days. When only hospitalised children were considered, the mean duration of school loss was found to be 48.28 days (S.D. ±14.73).

Among the 1013 burn victims, 90 were found to be working children. The majority (76%) of the working children had to be absent from their work due to their injury. Among them, 38% were absent from work for less than a week; 39% were absent for 1 week to 1 month; more than 18% of the children could not work for 1–3 months. About 5% of the children were absent from their work place for more than 3 months. Mean duration of work loss of the working children was found to be 25.97 days (S.D. ±52.48), ranging from 1 to 245 days (Table 1).

The highest rate of permanent disability was found among infant girls at 38.1 per 100,000 children per year. In this age group no boy was found with permanent disability. The second highest permanent disability was found among the girls of 10–14 years. Their rate was 13.6 per 100,000 children per year. Among 5–9-year olds, the rate of permanent disability was 11 per 100,000 children per year. In this age group no girl was found with permanent disability (Fig. 1).

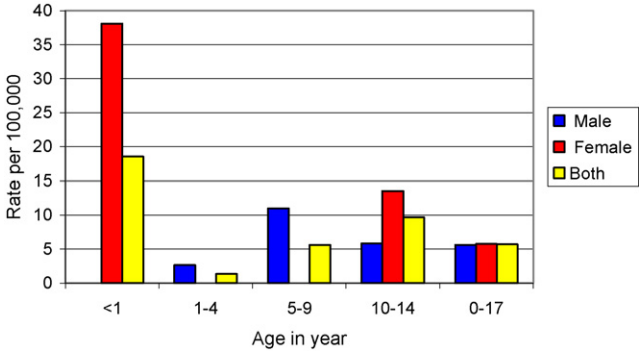

Fig. 1 – Distribution of permanent disability by age and sex (rate per 100,000).

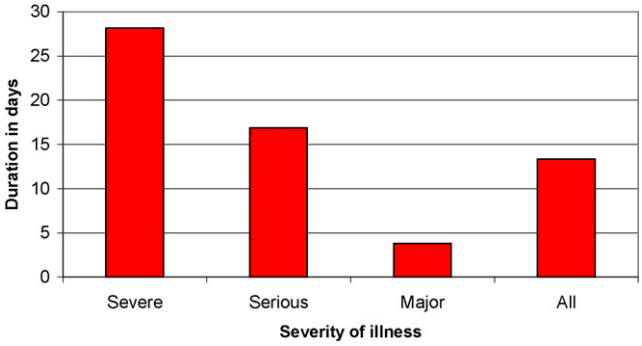

Fig. 3 – Duration of hospital stay by severity.

When considering the body part affected, it was found that most frequently the leg or thigh was burnt. About 50% of the burn victims had burnt their leg or thigh. Following this were the arms or hands that were burnt in 25% of the burn victims. The third most frequent part of the body getting burnt was the abdomen or pelvic region, which occurred in 12% of the cases.

Regarding permanent disabilities, about 65% of these were found due to burnt arms and hands. Scars in the head and neck regions and on the back were other common areas, which made permanent disabilities. Each of theses body parts constituted 15% of the total permanent disabilities.

3.2. *Economic burden*

It was found that of the 1013 burned children, 77 (7.6%) were admitted to hospitals. The majority (58%) of the admitted patients were 4 years of age or less. About three-quarters of the admitted burn cases were from rural areas. More than 50% of the total admitted children with burn were from very poor families having an average monthly family income of less than US $50.

The overall rate of hospitalisation due to childhood burn was found to be 21.9 per 100,000 population per year. The highest hospitalisation rate (67.9 per 100,000 population per year) was found among the infants. Male infants were hospitalised more (84.2 per 100,000) than the female (50.8 per 100,000). The second highest hospitalisation rate (17.8 per 100,000) was found among the children of 1–4 years; it was 44.5 per 100,000 populations per year. Hospitalisation rate was found lower among the female of all age groups (Fig. 2).

The average duration of stay in hospital due to childhood burn was 13.35 days (S.D. ±14.84) ranging from 1 to 60 days. The duration of stay varied with the severity of burn. In case of severe burn, the average duration of hospital stay was 28.14 days (S.D. ±15.13) ranging from 15 to 60 days. The duration of hospital stay was 16.87 (S.D. ±1.62) and 3.82 (S.D. ±2.43) days in serious and major burns, respectively. A longer duration of hospital stay was found among boys in age groups of 1–4, 4–9 and 15–17 years and among the girls of infant and the 10–14 years age groups. Mean duration was found highest 40 days (S.D. ±21.68) ranging from 20 to 60 days, among the girls 10–14 years of age (Fig. 3).

Considering the treatment cost of all of the burns, the average expenditure of a family for a child was found $23. The cost of treatment increased with the severity of burn. The average cost for serious and major burns was $191 and $58 per child, respectively. It was found that for the treatment of a severe burn, a family needed to spend $462 for each victim (Fig. 4).

4. Discussion

Childhood burn was found as a major cause of loss of school days, loss of workdays, physical impairments, hospitalisation

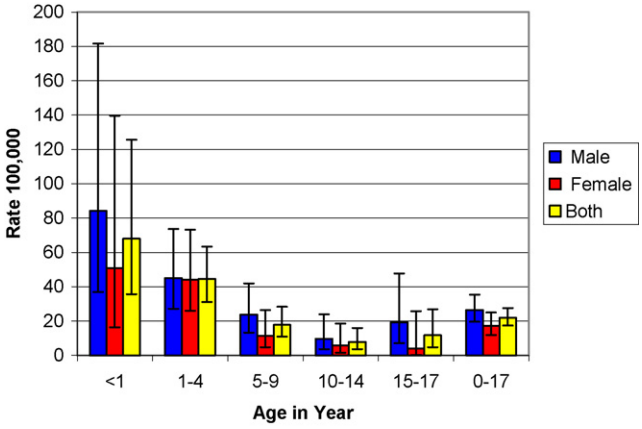

Fig. 2 – Distribution of hospitalisation rate by age and sex.

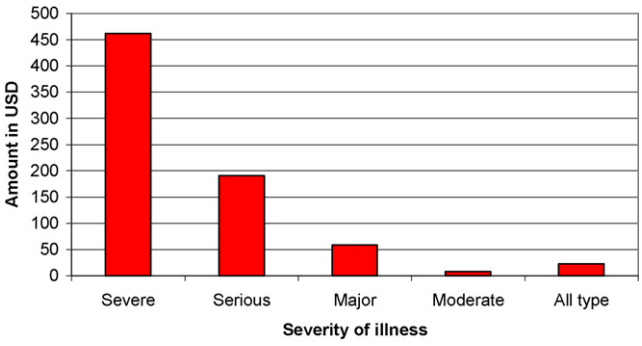

Fig. 4 – Cost burn management by severity of injury.

and medical expenses in Bangladesh. Disfigurements associated with burns of young children will have major effects on their lives as adults, especially when it occurs to young girls. This study found childhood burn to be a major cause of permanent disabilities. It was estimated that 3400 children become permanently disabled every year in Bangladesh. Higher rates of permanent disabilities were found among infant and adolescent girls. Due to burn adolescent girls (10–14 years age) were also found to be the most sufferers in terms of longer duration of hospital stay and higher management costs.

In this study the majority of the hospitalised adolescent girls who were admitted due to burn were burnt from flame. Adolescent girls like many other low-income countries help their mother in cooking or cook by themselves for their family, which make them more expose to flame in comparison to adolescent boy. Overexposure to flame may be the reason higher rate of severe burn among adolescent girl. Bangladeshi girls normally wear loose (sari, dupatta, etc.) clothes, which are very much at risk contacting with flame during cooking. Cookers are very traditional (choola) which create open flames. All of these factors could be the reason for severe burns among adolescent girls, and, consequently, longer duration of hospital stays, higher treatment cost and higher rate of disabilities. Similar patterns can be found in African countries, as traditionally females are involved in the cooking for the family and therefore have higher incidence of domestic burn and its consequences [26–28]. When designing a burn prevention program for Bangladesh, special attention needs to be given to adolescent girls.

In Bangladesh among the childhood burn victims, more than two third children suffered from different degrees of physical impairments and required assistance in their activities of daily life ranging from 1 week to 6 months duration. A relatively lower proportion of physical impairment was found in Ghana overall, it was only about 17% [29]. Higher physical impairment in Bangladesh may be due to the health seeking behaviours of the parents/caregivers, parents of the rural community normally seek service from medicine shopkeeper, traditional healer other unqualified service provider beside this service facilities is very much inadequate in rural Bangladesh. Average loss of school days was found to be 21 days in this study, which is consistent with the findings of other studies [16,17]. However, the school days loss was found much higher (48.28 days) in Bangladesh when we only considered hospitalised burn cases. Among working children, the average duration of work loss was found 25.5 days (S.D. $\pm$52.48), which was much lower than the findings in the USA [25]. The findings of this study were much lower than the findings in the USA, but this was a community-based study, which included the entire range of moderate to sever burn. While the USA study only considered victims who were seen at health care facilities. More than 7% of the children with burn injury needed to be hospitalised in this study. The rate of hospitalisation was found 21.9 per 100,000 children per year. The rate was found higher (67.9 per 100,000 children per year) among the infant group. In Israel, the rate of hospitalisation among infant and toddlers was found to be a little higher (103 and 23 per 100,000 children per year). However hospitalisation rate of elder children due to burn in Israel was found almost similar to the result of this study [19].

The average length of hospital stay found in this study was 13.35 days. Similar duration of hospital stay for burns was found in Turkey [18]. However a shorter duration was found in Iran, which was 10.6 days [23]. The duration of hospital stay was found to be much higher in severe burn, which is consistent with results of other studies [21,30].

We made an effort to compare the costs of treating burns in Bangladesh with costs in other countries. We recognized that because the level of care is different, a straight comparison is not entirely valid, but a look at ''average'' costs is still revealing. Acute burn care is a costly service [15]. In the United States the medical cost of primary health care for one inpatient with burn ranges from $3000 to $5000 a day [20]. In UK average cost of an admitted burn patient was calculated about $3800 [24]. In New Zealand in the case of a major burn, the average cost of each patient was calculated to be $647 per day [21]. The cost of each burn management in India was found to be about $12 per day [22]. In this study total cost of burn management could not be calculated exactly. Only the average expenditures by the family for the treatment of burn cases were calculated. A case of severe burn treatment was calculated to be approximately $462 per patient. In case of hospitalised burn injury, average length of hospital stay was found more than 13 days, in this case at least one of the adult member of the family need to stay with the burnt children and the person need to be absent from his/her workplace. Majority of the poor people in rural Bangladesh earn on a daily basis. For the treatment of burnt child family need to spend extra money, conversely has to be absent from workplace to look after the child, which ultimately create a double burden of economic pressure on the family. Although in Bangladesh the treatment cost of burns was found much lower than that of the USA or the UK, this cost becomes unbearable for a Bangladeshi family since more than 50% of the families in this study earned less than $50 per month.

In a low-income country like Bangladesh it is difficult to continue regular life if the breadwinners have to stay in the hospital or need to spend extra money for treatment cost. Like many other low-income countries, Bangladesh does not have any comprehensive health insurance policy. To get proper treatment at health facilities, individuals need to pay for the treatment directly. When patients stay in a hospital the family needs to spend money for transport and accommodation. If a patient is treated in a government hospital, treatment cost is less for the family, as government health service is free of cost; they may only need to buy the medicine if it is not available in the hospital. During the period of hospital stay a working person cannot earn their normal wage, and moreover the family may need to spend extra money for the treatment.

Burn is an injury, which may need more than one intervention for reducing disabilities, and permanent deformities, and these sequels also, increases the cost of management. In a country like Bangladesh, proper management facilities for burn cases are generally inadequate. There is only one burn centre in the capital city for the whole country with a population of over 140 million. Kimmoa of Finland found that the performance of the burn patient is good, even after a long hospitalisation. He also claimed that the modern multidisciplinary burn team helps patients to return to society and a normal life [31]. Inadequate service facilities and lack of

trained manpower in burn management may be the reason of the high incidence of impairments and disabilities among burn survivors in Bangladesh.

4.1. *Strengths and limitations*

This is the largest community-based injury survey undertaken in Bangladesh. The study findings represent the most comprehensive national statistics for the country. In developing countries, including Bangladesh, a large proportion of injured people do not attend hospitals for treatment. Moreover the hospital recording system is not comprehensive enough to record and collate the information; as a result hospital statistics are very much under reported. Much higher number of cases were captured in this study, as it was conducted at household and community level.

In this study psychological impairments were not explored. Moreover, no structured instruments were used for measuring the physical impairment. Patients or their parent's subjective judgement was considered in measuring physical impairment, which is a relatively weak method of measurement. During data collection, the recall period was considered for 6 months for non-fatal burn, so some of the moderate injuries may not have been captured, and some information about impairment may not be that exact because of the long recall period.

4.2. *Conclusion and recommendations*

This study has effectively characterized the human and, to an extent, the economic costs of burn injury to Bangladeshi children. Childhood burn was found as a major cause of morbidity and disability in Bangladesh. It causes a high rate of hospital admissions and extended hospital stays. During illness or hospitalisation, parents need to stay with their children and be absent from their jobs, which reduces family income during the period when the family needs to spend extra money for treatment. Even the child who is the victim may be a wage-earning member of the family, thus creating additional economic loss. Accordingly, a burn injury creates a huge economic burden for the family.

Childhood burn can be considered a devastating injury for the children and also for their parents. Inexpensive, well-targeted burn prevention interventions can be developed and initiated which can rapidly change the burn injury picture in Bangladesh. Results from this study suggest female children; both adolescents and pre-adolescents who routinely help with preparation of family meals would be an excellent target group for initial interventions. Policy makers need to be aware about the problem and must be motivated to address the issue. To reduce this huge economic and social burden of individuals, families, society and the nation it is very important to develop a burn prevention strategy and prevention program for the country.

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