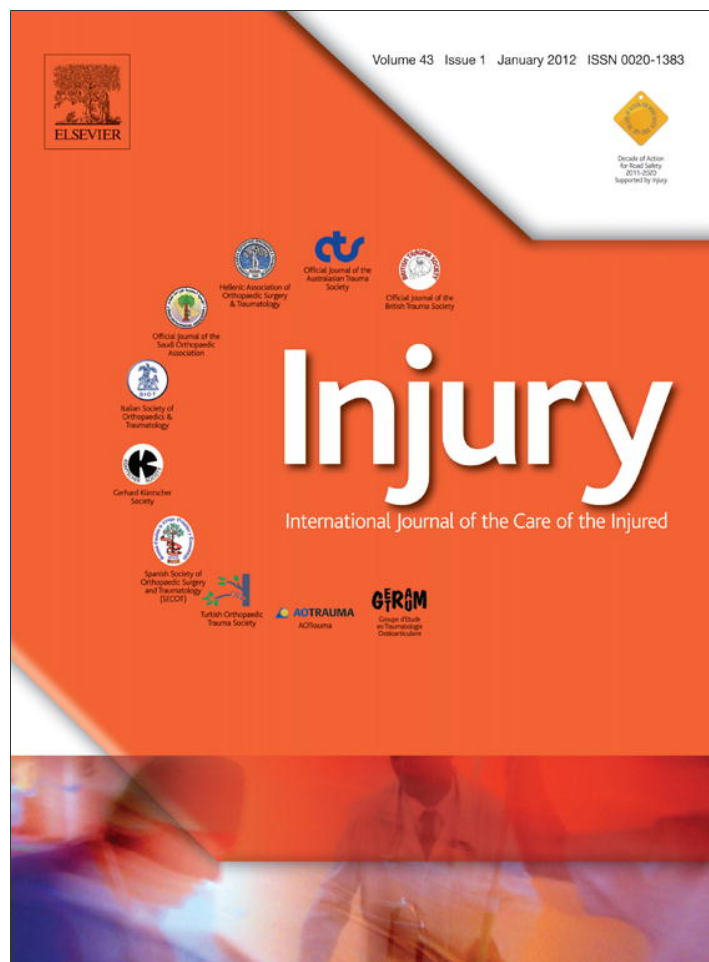


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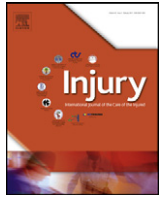
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## Consequences of non-fatal electrical injury: Findings of community-based national survey in Bangladesh

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### ABSTRACT

This study was designed to document the consequences of electrical injury in Bangladesh. A community-based cross-sectional survey was conducted from January to December 2003. Nationally representative data were collected from 171,366 rural and urban households, comprising a total of 819,429 population. Face-to-face interview was chosen as a data collection method.

The overall rate of electrical injury was 73.7 per 100,000 population-year. The rate of permanent disability due to electrical injury in Bangladesh was 0.366 per 100,000 population-year. Among the total 604 non-fatal electrical injuries in the survey, 282 (46.7%) had suffered from temporary disabilities for different durations. A total of 172 students were injured from electrical injury and among them 139 (80.8%) missed school for different durations due to their illness. Mean duration of absence from school was 9.72 days ( $SD \pm 10.98$ ), ranging from 1 to 45 days. Among the working people average duration of work loss was 10.56 days ( $SD \pm 14.98$ ), ranging from 1 to 90 days. About 39% of the total patients with electrical injury were contributors to their family income. For each family the expenditure for each seriously injured patient due to electrical injury was USD 271.

Electrical Injury is a major cause of morbidity in Bangladesh. It is responsible for significant loss of school days and work days and creating serious health and economic hardship for the inflicted families. A nationwide prevention program needs to be developed to address this problem.

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### Introduction

Along with the high income countries electrical injuries are becoming a growing concern of low income countries too.<sup>10</sup> These injuries vary from superficial burns of the skin to complex multi-organ involvement and death. Individuals exposed to an electrical injury develop a variety of complications, several of which are recognized years after the initial electrical shock.<sup>2</sup> Electrical injury is a relatively infrequent but potentially devastating injury. There is no specific therapy for electrical injury, and the management is symptomatic. With the advancement in the intensive care unit, especially in burn care, outcome of electrical injury has improved a lot, however prevention remains the best way to minimize the prevalence and severity of electrical injury.<sup>5</sup>

In order to increase agricultural production, small business and industries rapid expansion of electrical supply was made. Considerable proportions of the population in rural areas now

have opportunities to use electricity in their household. With the expansion of access to electricity more people are becoming exposed to the risk of electrical injury. However, people are not much aware about the safety issues regarding using electricity.

In Bangladesh, like many other low income countries, we do not have adequate data to understand the present scenario of the health burden due to electrical injury. This study was designed to explore the social and economic impact of electrical injury. The information of this study will help policy planners to understand the problem and be motivated to address this health issue appropriately.

### Methodology

#### Study design

Cross-sectional study.

#### 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.

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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 (district urban areas) and 37,803 households from Dhaka Metropolitan City.

Twelve districts were chosen from the six divisions of Bangladesh. Bangladesh is divided into 64 districts under 6 divisions. Districts have both urban and rural area. Two districts were selected randomly from each of the six divisions. One sub-district was randomly selected from each selected district. A sub-district comprises a number of unions. Two Unions (lowest administrative unit comprising of ~20,000 population) were then randomly selected from each of the sub-districts. All households in the union were included in the survey for rural population. The district headquarters of the 12 selected districts and Dhaka Metropolitan City were selected for the urban population. In the urban areas, mohallas served as clusters. Mohallas are the lowest unit of City Corporation. About 400–500 households constitute a mohalla. Systematic random sampling was done to achieve the required number of households in urban areas.

#### Case ascertainment

Anyone who had been injured by electrical injury and took any treatment or could not perform normal activities for at least 3 days was included as a case of non-fatal electrical injury.

#### 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 preceding 1 year of the date of interview or 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 in first visit. In spite of repeated attempts, 2.7% of households could not be interviewed. A total of 166,766 households participated in the study.

#### Definition of severity

Non-fatal electrocutions 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 or could not perform normal activities for 3 days, 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:* Hospitalized, for a period of less than 10 days but no permanent disability.

*Serious:* Hospitalized for 10 days or more, but no permanent disability.

*Severe:* Permanently disabled (loss of vision, hearing, handling, ambulation, or mental retardation) regardless of whether hospitalization occurred.

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

#### Definition of cost of treatment

Treatment cost was calculated by only the expenditure made by the family. It included cost of medicine and accommodation for the attendance but did not include loss of income due to illness. In government hospitals cost of the services provided by the government was not included in this cost calculation.

#### Adjustment of data

The stratified, multi-stage sampling scheme generated a national sample that required weighting to allow for proper representation. Weighting factors were calculated for Dhaka Metropolitan City (DMC) and for districts other than DMC. Weighting factors for DMC were calculated for slum, non-slum and peri-urban populations. For other districts, weighting factors were calculated for rural and urban populations in each district. For the national estimation, the proportional size of the population of DMC and other districts was taken into consideration in calculating final weighting factors.

#### Statistical analysis

Standard descriptive statistics were used to analyse the characteristics of patients with electrical injuries. Mean, standard deviation (SD) and proportion were used where appropriate. Yearly incidence rate of electrical injury was calculated from the number of occurrences of electrical injury morbidity in 6 months multiplied by two, as data were collected considering 6 months recall period. Rates were calculated with 95% confidence intervals (CI).

#### Results

A total of 604 cases of non-fatal electrical injuries were found in the survey. Among the total, 45% were in age group less than 18 years and 55% were in age group 18 years and above. The overall rate of electrical injuries was 73.7 per 100,000 population-year. Among age less than 18 it was 77.6 per 100,000 population-year and in age group 18 years and above it was 70.76 per 100,000 population-year. In this study three persons were found with permanent disability due to electrical injury. They were male and in 18 years or above age group. All three persons were the major bread earner for their family. The incidence rate of permanent disability in Bangladesh was 0.366 per 100,000 population-year.

More than 53% electrical injury took place at home and about 43% occurred from the household source of electricity. Majority of the victims of electrical injury were found to be economically poor. About 60% of the victims' monthly family income was \$50 or less (Table 1).

Majority (95%) of the electrical injuries were moderate in nature. Only 2.5% was major and 1.6% was serious in nature. Only three (0.5%) cases were found permanently disabled due to electrical injury. Rate of permanent disability was 0.366 per 100,000 population-year.

**Table 1**  
Social consequence due to electrocution.

	Frequency	Percentage
<b>Severity of illness</b>		
Moderate	576	95.5
Major	15	2.5
Serious	10	1.6
Severe (permanent disability)	3	0.5
<b>Total</b>	<b>604</b>	
<b>Duration of temporary Disability (N=282)</b>		
Less than a week	177	62.8
1 week to less than a month	82	29.1
1 month to 3 months	20	7.1
More than 3 months	3	1.1
<b>Length of school day loss (N= 139)</b>		
Less than a week	92	66.2
1 week to less than a month	39	28.1
1 month to 3 months	8	5.8
<b>Length work day loss (N= 165)</b>		
Less than a week	117	70.9
1 week to less than a month	37	22.4
1 month to 3 months	10	6.1
More than 3 months	1	0.6

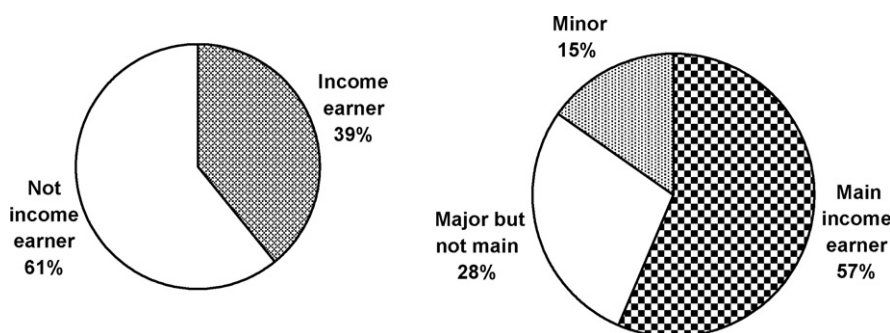
Among the total 604 non-fatal electrical injury patients 282 (46.7%) had suffered from temporary disabilities for different durations. Among the 282 patients, about 63% suffered from temporary disability for less than a week, about 29% suffered for more than week to a month. About 7% suffered for 1–3 months duration and about 1% suffered for more than 3 months duration.

Among the total non-fatal electrical injuries 172 were students. Among 172 students 139 (80.8%) missed their school for different durations due to illness caused by electrical injury. More than two thirds of them were absent from school for less than a week. About 28% could not go to school for more than a week to 1 month duration. About 6% of them were absent from their school for 1–3 months duration. Mean duration of absence from school was 9.72 days (SD ± 10.98), ranging from 1 to 45 days.

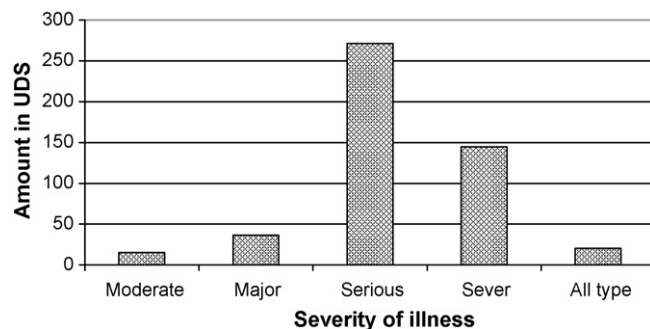
**Economic impact**

Out of total 604 non-fatal electrical injuries, after excluding students, unemployed and children not yet going to school, 318 had different occupations. Among them about 71% could not work for less than a week. About 22% could not work for 1 week to 1 month. About 6% could not work for 1–3 months duration. Average duration of work loss was 10.56 days (SD ± 14.98), ranging from 1 to 90 days (Fig. 1).

About 39% of the cases of electrical injuries were contributing to their family income. About 57% of them were the main income



**Fig. 1.** Impact of electrical injury on family income.



**Fig. 2.** Amount of money spent by family for a patient of electrical injury.

earner of the family, 28% were not main income earners but contributed a lot to the family income and 15% contributed in family income to some extent.

**Hospital admission and cost of treatment**

Among the total 604 patients of electrical injuries 27 needed to be hospitalized for their treatment. Rate of hospitalization was 3.29 per 100,000 population-year. Average duration of stay in hospital was 8.55 days (SD± 8.03), ranging from 1 to 30 days. Average expenditure of a family for a patient of electrocution was about \$20 and it increased with severity of illness. The expenditure was \$271 for a family for each patient with serious electrical injuries (Fig. 2).

**Discussion**

In terms of morbidity, health expenditure and temporary disabilities electrical injury is a major health problem in Bangladesh. Every year about 500 people become permanently disabled and about 5000 people need to be hospitalized due to electrical injuries. The severity of the electrical injury depends on the intensity of the electrical current passing through the victim's body, and the duration of contact with the source of the current.<sup>2</sup> Duration of hospital stay was found 4.5, 22, 11.5 and 18.9 days in four different studies.<sup>1,3,4,9</sup> Our study shows average duration of 8.55 days hospital stay. This variation is because of the variation in the intensity of electrical current causing the injury. As majority of the electrical injuries in this study were caused from low voltage electrical units used for household activities, severity found was also less. However, electrical injury caused considerable amount of school day and workday loss. Mean duration of absence from school was 9.72 days (SD ±10.98), ranging from 1 to 45 days and average duration of work loss was 10.56 days (SD ±14.98), ranging from 1 to 90 days. Electrical injury had a great impact on economic condition of a family. A significant proportion of the patients with

electrical injury were the main income earner for the families and due to this illness they had to be absent from their workplace. Along with this each of the families had to spend money for the treatment of the injured member which doubled the economic burden for the families. Average expenditure of a family for a patient of electrical injury was \$20 which was about \$271 for a patient with serious electrical injury. Sixty percent of the families in this population earned \$50 or less in a month. Average expenditure of a family for each burn patient other than electrical injury was found \$22 USD amounting up to \$462 in case of severe burns in Bangladesh.<sup>7</sup> Average expenditure for hospitalized Road Traffic Injury was found \$86 per patient per family.<sup>8</sup>

#### *Strength and limitation of study*

Major strength of this study is the sample size and the sampling procedure. Findings of the study are representative of national statistics. Method of data collection is also strength of this study. In a country like Bangladesh record keeping system is so poor that hospital information is always seriously under-representative. Very low proportions of people seek health care from hospital,<sup>6</sup> so a large portion of any illness remains undocumented anyway. Household survey and face-to-face interview minimize this problem. One weakness of this study is the long recall period. Many of the mild to moderate electrical injuries could not be captured due to 6-month recall period and these cases might be underestimated in this study.

#### *Conclusion*

Electrical injury is considerable cause of morbidity in Bangladesh. It is responsible for substantial cause of loss of school days and work days. It creates serious health and economic hardship for the inflicted families. Considering all these factors electrical injuries should be considered as a public health problem and a national strategy for prevention needs to be developed. Since home was found to be the most common source and place for electrical injuries, improving the household environment and the knowledge of household occupants would significantly reduce electrical injuries. Education at household level could be a potential approach in prevention of electrical injury in Bangladesh.

#### **Competing interests**

None declared.

#### **Ethical issues**

Ethical clearance was obtained from the Ethical committee of Institute of Child and Mother Health Dhaka. Participants were informed about the benefits and objectives of the study. Verbal consent was obtained from each head of household before proceeding with the interviews.

#### **Acknowledgement**

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