



## Injury in Construction Site of Bangladesh - Findings from a Nationwide Cross Sectional Survey

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### Authors' contributions

This work was carried out in collaboration between all authors. Authors FR and AR designed this nationwide cross sectional study. Authors MJH, AU, AB and SRM reviewed the literatures, analyzed survey data and prepared the manuscript. All authors read and approved the final manuscript.

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### ABSTRACT

**Background:** Construction sites are recognized for high rates of injury in all over the world. Construction workers, even non-workers such as pedestrians and children are victim of injury at construction sites. In Bangladesh no reliable statistics is available on injury in construction site, mainly due to lack of well-maintained health information documentation system. In this study, Bangladesh Health and Injury Survey (BHIS) 2005 data was analyzed to describe the incidence, disability, population at risk and costing for the injuries occurred in the construction site.

**Methodology:** A nationwide cross-sectional survey was carried out from January to December in 2003 among 171,366 rural and urban households, with a sample of 819,429 populations.

**Results:** Incidence of injury in construction site was found to be 16.96/100,000 population per year. Of the injured 81.6% (n=114) were working on the construction site during the incidence. Males are more vulnerable with a risk of 12.46 times higher than female. Approximately 84.1% (n=117) of the injured were from the poor socio-economic conditions with a monthly income less than \$100.

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Common injuries include cut by sharp weapon 29.0% (n=40), injury caused by falling objects 22.3% (2=31) and fall injury 21.7% (n=30). Moreover, among the injured 65.0% (n=90) were daily labourers and 1% (N=1) of the casualty continued to have lifelong persistent problems with disabilities.

**Conclusion:** High rates of construction site related injury was found among the populations of Bangladesh. Construction workers as well non workers, children are also victims of injury in construction site. National strategy is needed to be developed and implemented to minimize this public health burden. Therefore, formulation of a national strategy and its appropriate implementation is of crucial importance to minimize this public health burden.

*Keywords: Construction site; injury; cross sectional; Bangladesh.*

## 1. BACKGROUND

The construction industry is recognized as having high accident rates which result in absence from work, loss of productivity, permanent disability and fatalities relative to other industries [1,2]. In developing countries, occupational health and safety hazards among construction workers are ten to twenty times higher than in industrialized countries [2,3]. According to the International Labour Organization (ILO) the global mortality from fatal occupational accidents in 2008 was 321,000 [4]. Centre for diseases Control reported that in 2005 a total of 5,702 deaths among the US population was due to work related injuries [5]. Falls from height at construction sites are a common cause of trauma, leading to high mortality and pose a financial burden on the healthcare system in Qatar [6]. In Singapore, the majority of workplace related injuries patients admitted due to fall from height was 66.0% and falling of heavy objects 21.9% at work with a case fatality of 4.7% [7]. Work related injury is a public health problem resulting in both serious social and economic consequences, which is preventable if appropriate measures are undertaken [8].

Bangladesh is a developing country where construction activities are commonly found in both rural and urban areas. People that are involved in construction sector often do not have professional training and mostly work without taking any safety measures. As construction sites are open and easily accessible, general people including children are easily exposed to hazards in the construction site. In Bangladesh due to lack of systemic data sources, the overall statistics of injury in construction sites are not available. Therefore, to design an effective intervention, it is essential to measure the incidences and potential risk factors of injuries in

construction sites. This paper describes the incidence, disability, population at risk and costing of the injuries in construction site.

## 2. METHODS

### 2.1 Study Design

This was a nationwide population based cross-sectional study.

### 2.2 Study Population

The study was carried out during 2003 (January to December) in 12 randomly selected districts out of 64 districts of Bangladesh. The survey covered populations from both rural and urban areas. Metropolitan City Dhaka was also covered in this survey. A total of 819,429 population was covered in this survey. Method of 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 from Dhaka Metropolitan City. In Bangladesh, each district comprises several upazilas (sub districts). One upazila was randomly selected from each selected district. An upazila comprises a number of unions. A union is the lowest administrative unit comprising, 20,000 population. From each upazila two unions were selected randomly and 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 this survey slum populations were captured from the Dhaka Metropolitan city. In the urban areas, mohallas served as clusters. Mohallas are the lowest unit of the city corporation. About 400–500 households constitute a mohalla. Systematic sampling was conducted to achieve the required number of households.

## **2.3 Case Ascertainment**

Anyone who was injured in construction site and received treatment or could not perform normal daily activities or absence from school for at least 3 days was included as a case of construction site injury.

## **2.4 Data Collection and Interview**

Forty-eight data collectors face to face interviewed to collect data from all respondents. Along with the investigators, six full-time supervisors were employed for the supervision and monitoring of the data collection process. Both the supervisors and data collectors were trained intensively for data collection process. Mothers were preferred as a convenient respondents. However, if the mother was not available then the most knowledgeable members of the household were considered as respondents. Where possible, the head of household and as many household members as possible were present to corroborate or add detail to the respondent's interview answers. Screening forms were used to identify any mortality or morbidity in the household. A household member was defined as someone living in the same house, including domestic helpers or long-term guests who shared meals and participated in the daily activities within the household. In the beginning of the interview the respondents were asked whether there had been any illness or injury at home in the last 6 months. For any identified illnesses/ injuries, the interviewer proceeded with further clarification regarding the injuries. Structured questionnaires were employed if injuries caused the illness. If respondents were unavailable during the first visit then a repeat visits were made to the households. About 2.7% of households could not interviewed in spite of a repeated attempts. Total number of participation was 166,766 households in this study.

## **2.5 Definitions**

### **2.5.1 Injury cases**

An injured person who sought medical care or a 3-day work loss or absence from school.

### **2.5.2 Permanent disability**

Defined as any of the part of the body losing function permanently.

### **2.5.3 Treatment cost**

Treatment cost referred to out-of-pocket expenditures made by the family. The cost of the medical care provided by the government hospital was not included in this calculation.

## **2.6 Statistical Analysis of the Findings**

Descriptive statistics were used to analyze the characteristics of injured patients in construction site. Mean, SD, and proportion were used where appropriate. Construction site injuries were presented by gender, age, and place of residence (rural or urban). Age was categorized in twelve groups. The yearly incidence was calculated from the occurrence of injury morbidity in 6 months multiplied by 2, as morbidity data were collected with a 6-month recall period. Rates were calculated with 95% CIs. Relative risk (RR) was calculated to compare the injury risk in different age groups and gender by using a 2X2 table in openepi.com software. Weighting factors were added where applicable.

## **3. RESULTS**

### **3.1 Incidences**

139 unintentional injuries in construction site were found in this nationwide cross sectional survey, among them 97.5% (n=136) were non-fatal and 2.5% (n=3) were fatal injury. The incidence of injury was 16.96/ 100,000 (95% CI 14.31 to 19.97) populations in a year. Among the cases, 92.6% (n=129) were male and 7.4% (n=10) were female. Male were also found more vulnerable with a risk of 12.46 times than the female (RR; 12.46 95% CI 6.55 to 23.71). The mean age of victims was 29.01 (SD±13.62) years, ranging from 0 to 65 years, of the all incidences 24.7% (n=34) were children. The highest incidence was found in the age group of 30 to 34 years.

### **3.2 Socio Demographic Characteristics**

Most of the victims were from the poor socio economic conditions. Among them, 84.1% (n=117) whose monthly income was less than 100\$. The daily labourers consisted a total of 65.0% (n=90) was the main victims of injury in construction site. Among the victims, 47.7% (n=66) were from rural areas and 52.3% (n=73) were from urban areas. Among the injured, 68.9% (n=96) were the main earner while 17.3% (n=24) were supporting earner for the family.

### 3.3 Time, Place and Type of Injury

Total 81.6% (n=114) of injury were taken place during work followed by playing 5.6 (n=8) at the construction site. Sharp weapon contributed for 29% (n=40) of the total injury followed by falling object 22.3% (n=31) and fall injury 21.7% (n=30). Accidental falling from height level consisted 11.7% (n=16) of all injury in the construction site, of these injury 42.8% were fallen from height more than 5.00 meter, 41.0% from 1-5 meter and 16.3% within 1 meter. Among these victims 75% (n=12) were daily labor. About 91.1% (n=130) were victimized in the day time from 8.00 am to 6.00 pm. A total of 82.9% (n=279) of injuries occurred whilst the causality was working with machinery. The highest number of injuries were found among the people working in an industrial setting 39.3% (n=132) followed by agriculture fields 22.5% (n=76). Approximately 88% (n=297) were injured in the day time between 7.00 am and 7.00 pm. Among the injured cases, 40.5% (n=134) were due to powered machine followed by 33.9% (n=112) factory or industrial machine, 10.2% (n=34) farm machine and 4.2% (n=14) construction machine. Among the injured cases 14% (n=20) were due to machine in the construction site.

### 3.4 Injured Part of the Body

Forty-one percent (n=57) incidence were with leg followed by hand 24.9% (n=35) and among the incidences 61.5% (n=86) had open wounded cutting injury.

### 3.5 Health Seeking Behaviour and Costing

Among the casualties 96.8% (n=135) sought medical treatment in different health facilities, of them 65.1% (n=91) received from hospital or clinics where registered doctors facilities were available, 29.5% (n=41) received from the village doctors or medicine shop keepers. Among the casualties 17.8% (n=25) hospitalized and the average hospital stay was 11.48 days (SD± 7.73). Of all casualties 16.2% (n=23) needed surgical operation. The average costing for treatment was tk. 5,517 (\$ 86).

### 3.6 Work Days Loss and Disabilities

Among the casualties 56.6% (n=79) became both physically and mentally disable for different duration, of the disabled 44.15% (n=34) casualties disabled with leg. About 1% (n=1) casualties continued to have lifelong persistent problems with disabilities, giving an overall rate of permanent disability of 0.12/100,000 population-year. Among 46.4% (n=65) required assistance in their daily activities. The Average number of days help required from others was 14.76 (SD± 15.41) days. Among all casualties 26.9% (n=37) needed support from others more than 1 week and 19.0% (n=28) needed support over 2 weeks. Among the injured 47.7% (n=66) were unable to do regular activities for 1 week or more and 10.5% (n=15) for more than 1 month. Average work days lost was 23.57 (SD± 28.28).

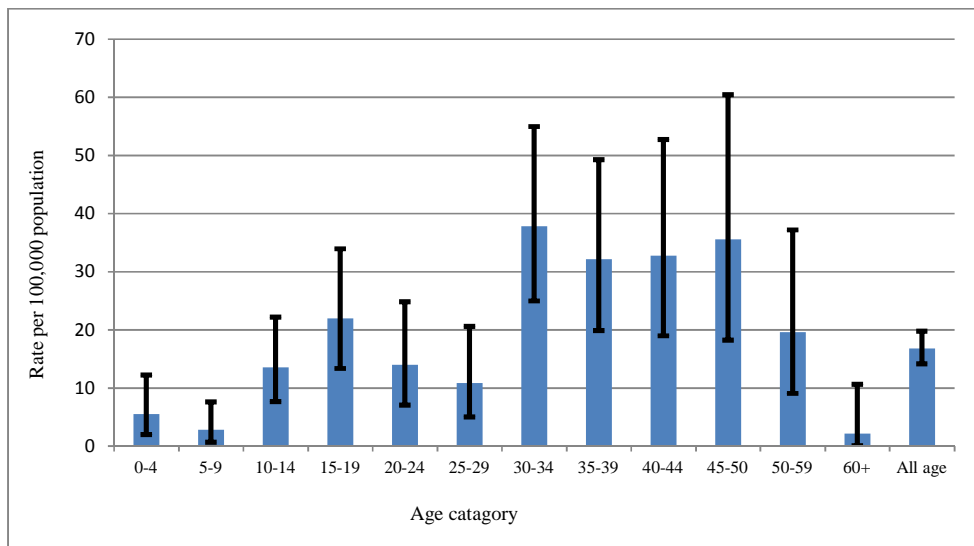


Fig. 1. Distribution of construction site injuries by age (rate/100,000 populations)

**Table 1. Details of injury in Bangladesh**

<b>Injury mechanism</b>	<b>Number</b>	<b>Percent</b>
Cut injury	40	29.0
Falling object	31	22.3
Fall (same or higher level)	30	21.7
Machine	20	14.0
Electrocution	7	4.8
Burn	5	3.2
Others	6	4.92
<b>Activities prior to injury</b>		
Working	114	81.6
Playing (inside/outside)	13	9.0
Traveling/walking	3	1.9
Other	9	7.4
<b>Injured part of the body</b>		
Leg	57	41.0
Hand	35	24.9
Head	15	10.8
Neck	8	5.3
Abdomen	7	4.8
Chest	4	2.7
Face	3	2.3
Others	10	8.2
<b>Occupation</b>		
Daily laborer	90	65.0
Business	11	7.7
Unemployed	9	6.7
Student	7	5.2
Service	5	3.4
Housewife	4	3.0
Others	13	9.1
<b>Sought health care</b>		
Hospital or clinic	60	42.9
Private registered doctor	31	22.1
Village doctor	30	21.6
Herbal medicine practitioner	7	4.9
Medical assistant	3	2
Others	4	3.3
No health care sought	4	3.2

**Table 2. Factors associated with injury in construction site**

<b>Factors</b>	<b>Frequency</b>	<b>Rate per 100,000 population / year</b>	<b>RR with 95% CI</b>	<b>P value</b>
<b>Sex</b>				
Male	129	33.5	14.57 (7.66 to 27.72)	0.00001
Female	10	2.3	1	
<b>Age group</b>				
Children ( 0-17 years)	34	9.66	1	
Productive group (18-49 years)	96	25.21	2.607 (1.763 to 3.854)	0.00001
Older age group( 50+ age)	9	1.07	1.7 ( 0.5134 to 2.232)	0.41

\* Female and children were the reference category

#### 4. DISCUSSION

This population based nationwide cross sectional survey revealed the scenario of injury in construction site in both rural and urban areas of Bangladesh. Annually about 25,000 people suffered from moderate to severe injury in construction site and 512 ended with fatality. In this study, male is found more vulnerable with a risk of 12.46 times higher than the female. Findings were consistent with other studies conducted across Asia, Africa, Europe and USA [2,6,9,10]. Males are at greater risk than female in construction site injuries in Bangladesh largely because men make up the majority of the workforce in construction sites while women are found to be involved in minor activities.

In this study, falls in the same level and falls from the height were found to be one of the leading cause of injury in construction site. Fall in the same level and fall from more than one meter of height is consisted 21.7% (n=30) of all injuries in the construction site. The finding of the present study was relatively consistent with the reports from Ethiopia, Egypt and USA [2,11,12,13]. A hospital trauma registry based study conducted in UAE and Qatar showed 51% of the injury related to workplace was due to fall from height [14,15].

Excluding few exceptions, in Bangladesh unprotected exposed construction site is quite common in highly dense residential and commercial areas even in road sides where movement of general people is very frequent, most construction activities continue without taking proper safety measures. As a result, construction site injury not only affects the workers but also affects the general people including children. Surprisingly among the victims, 24.7% (n=34) were children. Besides, daily laborer, businessmen, students, service holders and housewives were also injured on the construction sites.

#### 5. LIMITATIONS AND STRENGTHS

The results of this study were from the largest community-based cross sectional national injury survey conducted in 2003 in Bangladesh. Similarly to other low income countries, a large number of people in Bangladesh do not attend hospitals or report to the proper department even when suffering from a severe injury. Most of the time hospital, police station or other administrations do not record injury information

properly and even victims found unwilling to report to avoid further complications. As a result, statistics from hospital and other administration are always under-reported. As this is a household survey of over 800,000 populations, findings of this study provides a more accurate scenario of injury in construction site of Bangladesh.

#### 6. CONCLUSIONS AND RECOMMENDATIONS

The rate of construction site related injury is high among the population of Bangladesh. Construction site related injury is a significant cause for mortality, morbidity and disability. It is also a cause for hospitalization, workday loss and prolonged hospital stay. To prevent this public health burden formulation of a national strategy and its appropriate implementation is required.

#### WHAT THIS STUDY ADDS

1. Nationally representative data of injury in construction site covering all ages was studied.
2. Every year about 25,000 people injured in construction site in Bangladesh; among them 17.5% admitted to hospital (total 4300 needed hospitalization)
3. In construction site not only worker but also non worker including children who are not involved in the construction also getting victimized in injury.

#### CONSENT

During conduction of the survey all participants were informed about the objectives and benefits of the study. Consent was also obtained from each of the household head before proceeding the interview.

#### ETHICAL APPROVAL

Ethical clearance was obtained from the Ethical Committee of the Institute of Child and Mother Health, Dhaka.

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## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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