Injury Surveillance System in Bangladesh: a new approach

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Abstract

The objective of the Injury Surveillance System (ISS) is to identify groups at risk for injury-related deaths, illnesses, hospitalization and cost due to injury. Three sub-districts are chosen for the ISS. The data collector collects data every month from each household on a fixed schedule 60-70 households on their assigned block. The surveillance system comprises a total of 133913 households with 621320 populations. The overall crude birth rate and death rate is about 22.2 and 6.0 per thousand populations. Injury accounted for 8.6 percent of all deaths under 18 years. Among 1-4 years children, 27.7% death accounted for injury and the rate was 69.3 per 100000 children. Drowning, road traffic accident, violence and burn are the main causes of injury death after infancy. Almost 27% of ill patient were injured who admitted to hospital. The proportion of hospital admission had increased due to injury after first year of life.

Background

Injury emerged as a leading cause of both morbidity and mortality for children. Studies from Bangladesh revealed that 21% deaths occurred among 1-4 year's children due to injury [1-3]. In infancy, the main causes of death were low birth weight, pneumonia and birth asphyxia, whereas after the infancy, the leading cause of child death is injury [1]. It is now a public health issue in both the developed and developing world [4-5]. The World Health Organization reported almost 6 million deaths due to injury [6]. It is also a major cause of disabilities and deaths of children [7-8]. The problems of road traffic accident, drowning, fall, and burn have been an unnoticed public health disaster. It is expected that injury will be the rival of communicable disease as a cause of ill health and death by the first decade of the new millennium [9]. Non-fatal injuries are the frequent cause of hospital admission and disabilities center admissions, and half of the hospital surgical beds are occupied by injury patients [10]. Within developing countries, poor people represented by pedestrians, passengers in buses and trucks, and cyclists suffer a higher burden of morbidity and mortality from traffic injuries [11]. Low maternal education, young age, and increased number of children were strong predictors of injury mortality rate for children 0 to 4 years of age [12]. Although the recent decline in child mortality in Bangladesh is remarkable, death from different causes other than infectious diseases and malnutrition remains an important component of child mortality.

Many different information systems are now used to monitor fatal and non-fatal injuries in developed countries, but much less is known about the extent of these injuries in developing countries. Historically, the majority of information regarding injury is derived from mortality and hospitalization data. This information does not reflect the full extent of the injury problem because most people who are injured do not die from their injuries or receive treatment in hospitals. Adequate data about types of injuries and their causes is vital to understand injury problems. Community based injury surveillance, while normally difficult to sustain, is a way to more accurately characterize the magnitude of injury problems in middle and low-income countries. To address the magnitude and determinants of injury, the Centre for Injury Prevention and Research Bangladesh, (CIPRB), collaborating with UNICEF Bangladesh, Director General of Health Services (DGHS), The Alliance for Safe Children, (TASC), is conducting a community based Injury Surveillance System under their PRECISE project.

The aim of this study was to assess the incidence and types of injury mortality and hospitalization. This study was also investigated how the risk factors associated with injury morbidity and mortality among the children of rural community in Bangladesh.

Materials and Methods

Data

Three upazilas (sub-district) from three different districts were chosen for this study. These upazilas are Raiganj from Sirajganj district, Sherpur sadar from Sherpur district, Monohardi from Narshindi district. The selection criteria of these three upazilas were firstly; geographically they are nationally represented except the hilly areas. Secondly, previous study found mortality due to injury were similar extent in these upazilas and consistent with the national. And lastly, the socio-economic and demographic characteristics of the population in these upazilas were similar and also consistent with the national.

This study is based on the information available from September 2007 to August 2008 from the three intervention area of CIPRB (Raiganj, Sherpur and Monohardi). Information regarding illness includes those of stayed at least one night in hospital; higher severity includes any disability or death from injury during this period. The study shows the occurrence of fatal and non-fatal injury by age and sex in the three regions. Detailed information regarding population and household composition is found in the appendices.

Mapping and numbering

To fulfill the requirement of the needed 200,000 populations from Raiganj upazila, 5 unions are chosen for the surveillance system out of 9 unions. In the Sherpur and Manohordi upazila, 7 unions and 8 unions are chosen out of 14 unions and 11 unions respectively. Each upazila was divided into thirty blocks. Data collectors assigned a unique number for each of the households. The household numbering was provided on the basis of each block of the surveillance area.

Data collection and store

The baseline census of the population conducted during October -December 2005. The data collector collects data every month from each household on a fixed schedule 60-70 households on their assigned block. The aim of this regular visit is 1) to identify all demographic (birth,

death, marriage, migration), and health (illness and injuries) events occurring in the surveillance area; 2) to record all population movements to ensure accurate denominators for the surveillance data; and 3) to collect information on health status, health knowledge and behaviour and responses of the community people in the injury prevention programme. A verbal autopsy is done when an injury death occurs, and a detailed interview is done for any serious injury event. Two types of quality control bodies have been formed to maintain the quality of surveillance data. One is central, and the other is local. Data is entered into a custom SQL relational database using Visual Basic software.

Statistical analysis

This study used a proxy measure of economic status of each household in terms of assets or wealth, (Poorest, Second, Middle, Fourth, Richest), rather than in terms of income or consumption. Information regarding the household items (i.e. television, radio, electricity, refrigerator or car), ownership of house, household's income (price of all commodities produce in a year from agriculture and other sources plus salaries of household's members if applicable) and cultivable land were assigned a weight or factor score generated through principle component analysis [14]. Principal component is a technique for extracting from a set of variables those few orthogonal linear combinations of the variables that capture the most common information successfully. Intuitively the first principal component of a set of variables is the linear index of all the variables that capture the largest amount of information that common to all of the variables. The resulting scores distributed normally with mean zero and standard deviation one. Each household was assigned a standard score for each asset. Standard household score was added up for each household, and each child was assigned the total household asset score for its household. Children were ranked according to their total scores and divided into five quintiles to understand health inequality. Simple descriptive measures such as rates and proportion were used with bi-variate analysis.

Results

This result is based on the information available from September 2007 to August 2008 of the three areas. Total households and population of the surveillance area were 133913 and 621320 respectively. The average household size is 4.6. Sex ratio is 104.

Birth rate and Death rate

Respondent of the area were asked whether there was an event (i.e. birth, death, illness or injury, marriage and migration) occurred last one month. Last one-years 3517 deaths and 13044 births and 4361 hospital admitted ill cases were recorded in the surveiallance areas. The overall crude birth rate was about 22.2/1000 population, which is almost similar to the national (20.8/1000) average found in sample vital registration system 2003 (SVRS). Crude birth rate is also similar in all the three area (Table-1). The overall death rate was 6.0 per 1000 populations, which is almost similar as compare to national (5.9). Infant mortality and was 52.0 per thousand live births. Infant mortality rate is slightly lower as compared to national 57 per 1000 live birth (BDHS 2007) [1].

Table 1: Demographic indicators of surveillance area

	Raiganj	Sherpur	Monohardi	Total
CBR	20.6	22.4	19.6	22.2
CDR	5.3	5.5	6.1	6.0
Neonate	41.7	37.3	39.4	37.8
Post-neonate	16.4	12.2	13.9	14.2
Infant	58.1	49.4	53.3	52.0

Injury mortality

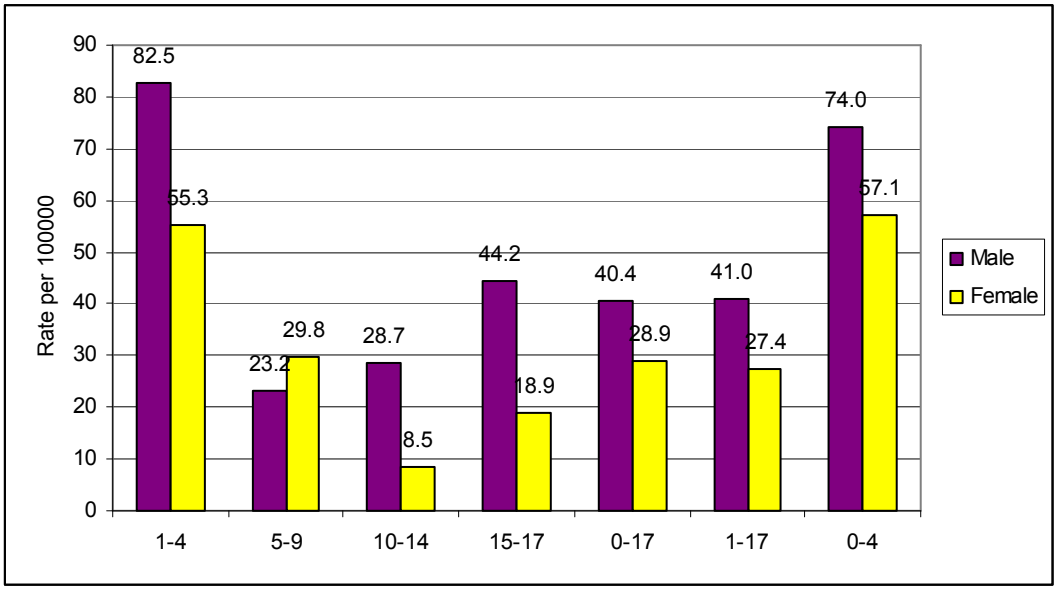
Injury accounted for 8.6 percent of all deaths among children under 18 years. The proportion of injury related death was higher among the children 5-9 years ages. It is observed that more than 27.7 percent of death was due to injury among 1-17 year's children. Among 1-4 years children, 26.3% death accounted for injury and the rate was 69.3 per 100000 children (table- 2). The injury mortality rate in all children (0-17 years) was found 34.8 per 100,000 children per year. However, the rate was 65.7 per 100,000 populations per year among under five children. Causes of injury deaths were drowning, road traffic accident (RTA), electrocution, burn, animal bite and suicide. Drowning is the main killer of children (53.9/100000) after infancy. The result clearly reveals that different types of injury were prevailing in different ages i.e. suffocation was leading in infancy, drowning was leading in 1-9 years, road traffic accident and suicide were leading in 10-14 years and 15-17 years.

Table: 2 Age specific death rate per 100000 populations

	n	Percent	Rate per 100000							
			Suicide	RTA	Burn	Drowning	Suffocation	Machine	Animal bite	Total
<1	4	0.6	0.0	0.0	0.0	11.3	22.5	0.0	0.0	45.1
1-4	36	26.3	0.0	7.7	1.9	53.9	0.0	1.9	3.8	69.3
5-9	20	29.9	0.0	5.3	1.3	13.2	0.0	0.0	5.3	26.4
10-14	14	26.4	5.4	5.4	0.0	1.4	0.0	0.0	1.4	19.1
15-17	11	31.4	23.5	2.9	0.0	0.0	0.0	0.0	0.0	32.4
0-17	85	8.6	4.9	5.3	0.8	16.4	0.8	0.4	2.9	34.8
1-17	81	27.7	5.1	5.5	0.9	16.6	0.0	0.4	3.0	34.5
0-4	40	4.8	0.0	6.6	1.6	47.7	3.3	1.6	3.3	65.7

Gender differential in injury mortality are shown in Figure-1. It is observed that death due to injury was higher among males in all age groups except age 5 to 9 years. Death due to injury was 40.4 per 100000 among male's children (0-17 years) whereas the rate was more than double i.e 82.5 per 100000 among children age 1-4 years. Also under five mortality were lower for the female children than the male children.

Figure:1 Age specific injury death rate per 100000 populations by sex



Mother's level of education is inversely related to her child's risk of dying. Higher levels of educational attainment are generally associated with lower mortality risks, since education exposes mothers to information about better health care during childhood illness and nutrition. The results show that both under five and under eighteen mortality decline sharply with increase levels of mother's education (Table 3). The injury rate was 42 percent lower for children whose

mothers had at least secondary education, compared with children whose mothers had no education. Among the three regions there were no significance differences in child mortality.

Table: 3 Mortality rate per 100000 by background characteristics

Characteristics		0-4 years		0-17 years	
		Injury death	All causes	Injury death	All causes
Highest educational level					
	No Education	62.2	1435.2	33.1	410.9
	Primary	79.1	1084.2	32.6	325.6
	Secondary	35.9	694.7	27.2	265.0
	Higher secondary +	0.0	212.1	28.8	86.4
		P>.10	P<.001	P>.10	P<0.001
Surveillance region					
	Raigonj	77.9	1333.9	33.4	407.3
	Sherpur	53.2	1298.0	32.7	381.9
	Manohardi	38.6	1205.5	31.5	365.5
	Total	65.7	1279.5	34.8	384.4

Hospitalization due to injury

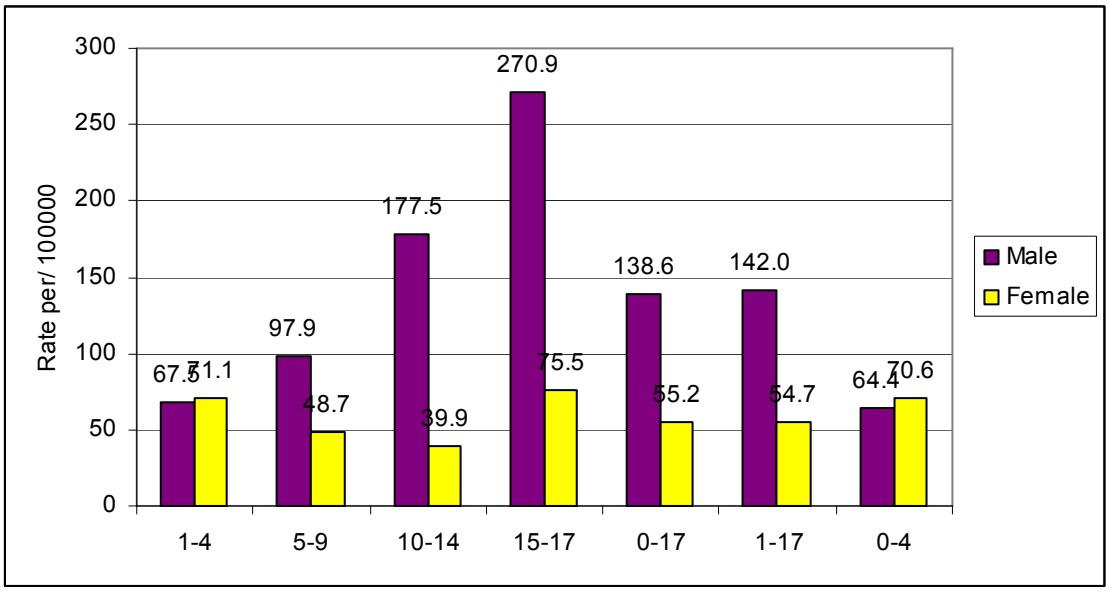
In children age 1-17 years, 27 percent of total hospitalization (admitted to hospital or clinic and stayed at least one night) was due to injury. The hospitalization rate due to injury including infants was 98.4 per 100,000 populations. There was an increasing trend of hospitalization due to injury with age. The highest hospitalization rate was observed in children 15-17 years with a rate of 179.5 per 100,000 children (Table-4). Hospitalization rate due to injury increased with age of the children. The main cause of hospitalization due to injury was road traffic accident (24.7/100000) among children 1-17 years. The next leading cause was violence (18.7/100000) that was followed by fall (18.3/100000). Besides, these cut, burn, poisoning, animal bite and electrocution were common injuries in the surveillance area (table-4). There were small portion of other injury causes not shown here.

Table: 4 Age specific hospitalization rate per 100000 populations

	Injury	Percent	Rate per 100000							
			RTA	Violence	Fall	Cut	Burn	Poisoning	Animal bite	Total
<1	5	1.5	11.3	0.0	11.3	11.3	0.0	11.3	0.0	56.3
1-4	36	14.1	9.6	1.9	9.6	3.8	19.2	5.8	3.8	69.3
5-9	56	26.2	19.8	6.6	14.5	9.2	7.9	1.3	9.2	73.9
10-14	82	35.7	32.7	23.2	27.2	5.4	1.4	1.4	2.7	111.7
15-17	61	35.9	41.2	61.8	20.6	5.9	2.9	0.0	2.9	179.5
0-17	240	19.8	24.2	18.0	18.0	6.6	7.4	2.5	4.9	98.4
1-17	235	27.0	24.7	18.7	18.3	6.4	7.7	2.1	5.1	99.9
0-4	41	6.9	9.9	1.6	9.9	4.9	16.4	6.6	3.3	67.4

Hospitalization due to injury illness was higher among male children than female children within surveillance areas (Figure-2). Among the male children the occurrence of injury morbidity was increasing with their ages. Highest rate of hospitalization was 270.9 per 100000 children was observed among the children of age 15-19 years. Road traffic accident and violence were the main causes of hospital admission beyond age 5 years.

Figure: 2 Hospitalization rate per 100000 by age and sex



Socioeconomic status and incidence of injury occurrence

The risk of dying of a child also associated with the economic status of the household. The ratio of mortality and morbidity rate by different causes and by each quintile is given in table 5. The first, third and fifth quintiles of assets index referred as low, middle and high economics status. The overall mortality of 0-17 year children was consequently highest for those living in the poorest families (first quintile). For example, a poor-rich ratio 1.7 for children implies that child mortality in the poorest quintile was about 1.7 times more than that of the richest quintile. The results of this study revealed that injury related mortality and morbidity were much more among the most disadvantaged group of Bangladeshi children than non-injury causes. The poorest-richest quintiles ratio due to injury mortality was 1.7 whereas this ratio was 1.6 for the non-injury causes. Similarly, the ratio of poorest-richest quintile in terms of illness (hospitalization) had the highest injury ratio. The ratio of injury related hospital admission among children between poor and rich was 0.7 which was opposite to injury mortality.

Table 5: Inequality in causes of mortality and morbidity by quintiles

Quintiles	Injury (Rate/100000)		Non-injury (Rate/100000)		Total (Rate/100000)	
	Death	Hospitalization	Death	Hospitalization	Death	Hospitalization
Poorest	46.3	80.0	442.0	275.7	488.3	355.7
Poorer	25.2	85.3	372.2	356.7	397.4	441.9
Middle	34.6	86.4	354.2	357.7	388.8	444.1
Richer	36.2	108.5	331.5	425.9	367.6	534.4
Richest	26.5	119.1	280.0	522.6	306.5	641.6
Total	33.7	95.2	356.6	385.1	390.3	480.3
Poorest/Richest	1.7	0.7	1.6	0.5	1.6	0.6

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Conclusion and Discussion

The findings are from the first large-scale injury surveillance system being implemented in a developing country. In many ways, it is the equivalent of the Matlab Demographic Surveillance System, but focusing primarily on injury. More than 8 percent of deaths causes by injury among the under 18 years old. The rate of injury mortality was 35/100000 among children aged 1-17 years. Death due to injury was higher among 1-4 years age. The main causes of death due to injury were drowning and transport injuries. One-fifth of the total hospitalization was due to injury among the children in the surveillance area. The analysis found that about one in every 1000 children was admitted to hospital due to injuries.

This study investigated the mortality and morbidity children, especially by cause of injury, among socio-economic groups. In this study, quintiles were used to measure disparities in mortality by the economic status in terms of household's goods that were developed by World Bank [14]. The study confirmed that risk of injury related death increased with age of children. At different age different types of injury categories of injuries appeared. The study found that inequalities also appeared in mortality. The children of poorest families suffered more in injury mortality than the children of rich families but it was not statistically significant. The reason could be small number cases in the upper quintile. Greater portion exists in drowning related injuries among 1-4 year old children. Male injury mortality and hospitalization was higher than female. In most population, male mortality is higher than female mortality at almost all ages.

The association of childhood death and maternal education were statistically significant in the bivariate analysis. It is known as the main determinant of child survival in developing countries [20-23]. There have been suggestions that the weak relation between maternal education and

child injury mortality may be related to weaker health infrastructure in South Asian countries may in some way inhibit the ability of more educated women to take advantage of their human capital in the health environment. The results of this study revealed significant association between socioeconomic inequality and incidence of injuries among children. The study also stated that wealth distribution affected almost similar pattern on child mortality due to injury and other causes of deaths and illnesses. This analysis demonstrated that after infancy age is an important mediator of the occurrences of injury mortality and morbidity.

Although there has been a decline among both infant and under five mortality, they are still considered to be very high compared to many developing countries. Due to decreased infant mortality, the under-five mortality had decreased but child mortality remained constant since 1997. However, the third leading cause of under-five mortality and first leading cause of child mortality is drowning [1, 16].

Findings from the other studies confirm that causes of injuries and the pattern of incidence by age and sex are more or less similar in developing countries and most of the injury incidence (i.e. cut, burn, falls, poisoning and drowning) of younger ages took places at the premises of home [17-19]. This study goes part of way towards highlighting the extent of ill health due to injury among children in developing countries. Based on the findings of this study, a direction of further research on childhood injury and their risk factors can be drawn.

Due to existing socioeconomic situation in Bangladesh, the children of rural area were more vulnerable to injury occurrence. Injury causes an extra burden to the poorest family as it results more disabilities than other diseases. It is also important to reduce child injury instantly specially among children to achieve MDG 4 by 2015.

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