ECONOMIC DISPARITY IN INJURY MORBIDITY AND MORTALITY AMONG ONE-FOUR YEAR CHILDREN- FINDINGS FROM BANGLADESH HEALTH AND INJURY SURVEY: IMPLICATION FOR DEVELOPING COUNTRIES.

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Introduction

In recent decades the overall child mortality rates have decreased globally. Various immunization program and intervention program played important role in reducing the infectious and non-communicable deceased. However, injuries have been emerged as a leading cause of both morbidity and mortality for children[1-3]. It is now a public health issue in both developed and developing world[4-6]. World Health Organization reported that almost 6 million death causes by injury [7]. Studies from Bangladesh revealed that 21% deaths among 1-4 years children cause by injury [3] . It is also a major cause of deaths and illness of children[6, 8]. The problem 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 and half of the hospital surgical beds are occupied by the injury patient [10] .

Data from several populations suggest that socioeconomic disparities are strong predictors of childhood injury mortality[11-15]. Low maternal education, young age, and increased number of other children were strong predictors of injury mortality rate for children 0 through 4 years of age[11]. Although the recent decline in child mortality in Bangladesh is remarkable, death from causes other than infectious diseases and malnutrition remains an important component of child mortality. Death from injury of children can be expected to be a problem in Bangladesh given the geographical features of the country[16].

Globally, poorer bear a disproportionate burden of injury morbidity and mortality. The poor countries suffer more than the rich countries. Within the counties, poor people represented by pedestrians, passengers in buses and trucks, and cyclists suffer a higher burden of morbidity and mortality from traffic injuries.[17] Numerous studies have been demonstrated that lower socioeconomic classes have higher death rates than the upper socioeconomic classes and this difference have increased in the past decades[18-19]. But very few studies focus the equity in child injury mortality and morbidity. The aim of this study is to investigate the socioeconomic inequality in injury related morbidity and mortality among 1- 4 years children.

Materials and Methods

The data for this study were derived from Bangladesh Health and Injury Survey (BHIS) 2003. BHIS conducted by Institute of Child and Mother Health (ICMH) collaborating with Director General of Health Services (DGHS), United Nations Children Fund (UNICEF), and The Alliance for Safe Children (TASC) [20]. The aims of BHIS were to investigate information on cause of death and serious morbidity, pattern and characteristics of injury and overall risk factors and hazards for childhood injury. BHIS also investigated the information environmental risk and hazards around the households. This study conducted in Bangladesh between January and December 2003. BHIS is a large cross sectional data set that comparable across the countries. A

multistage cluster sampling technique was conducted for this survey. Administratively, Bangladesh is divided into 6 divisions. These in turn consist of 64 districts, 12 of them randomly selected. In each district, one upazila (sub-district) out side from district head quarter was randomly selected. Two rural unions (the smallest administrative unit) from each upazila outside from head quarters were randomly selected. Each rural union had roughly 20,000 populations. From district head quarter 12 mahollus (urban smallest administrative unit) was selected randomly for urban sample. A sample of 132000 households from both rural and urban areas in Bangladesh was selected for collecting information.

All women surveyed by the BHIS were asked to provide a complete history of each individual, including age, sex, death occurred preceding two years before survey, and illness occurred before 6 months of the survey. For who died, age and sex were recorded. Verbal autopsy was made for diagnosed the causes of death and illness with a specified structured questionnaire. The collected autopsy form was checked by two independent panels of pediatricians and consensus with the cause of death. To collect information on characteristics of injuries, separate forms were used for each mechanism of injury.

This study used a proxy measure of socioeconomic 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) and ownership of house and cultivable land were assigned a weight or factor score generated through principle component analysis[19]. The resulting scores were distributed normally with mean zero and standard deviation one. Each household was assigned a standard score for each asset. Standard household score were 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 five quintiles to understand health inequality (See Appendix-A).

Results

Table 1 show that the descriptive measures of the households' possession of durable goods. Results of this study show that only 27 percent household own a television, 32 percent own either a radio of a tape recorder, 3 percent had refrigerator.. About one-third (31percent) of the households of the study sample had electricity connection. About 80 percent of households had own homestead. Only 37 percent of the households possessed cultivable land more than or equal 50 decimal. In the BHIS survey, respondents were asked their gross monthly income. Almost 50 percent of the household respondent mentioned that they earned more than 3000 BDT (Bangladeshi Taka) i.e. 50 USD.

Table1: Descriptive Statistics of household asset

	Mean (n=8729)	Std. Deviation	Asset factor score	Asset has	Asset doesn't have
Has television	.27	.44	.277	0.4596	-0.1700
Has radio/tape-recorder	.31	.46	.238	0.3518	-0.1656
Has refrigerator	.03	.18	.151	0.8137	-0.0252
Electric connection	.31	.46	.254	0.3810	-0.1712
Land>=50 decimal	.37	.44	.043	0.0616	-0.0362

Income>3000 BDT	.51	.49	.217	0.2170	-0.2259
Ownership of House	.78	.41	-.197	-0.1057	0.3748
Rent House	.17	.38	.213	0.4652	-0.0953

a For each variable, missing values are replaced with the variable mean; Extraction Method: Principal Component Analysis

Table 2 represents the share of household's asset by each quintile. Almost 90% of the households had the television belongs to the richest and only 2.7% middle class household had the television. Only the 15 % of the rich quintiles' household had ownership of a refrigerator.

Table 2: Percentage of household asset by each quintile

	Poor	**Second**	**Middle**	**Fourth**	**Rich**	**Total**
Possession of television			2.7	46.8	90.5	26.8
Possession of radio/tape-recorder			26.5	56.9	80.4	31.8
Possession refrigerator				0.6	14.9	2.8
Electric connection			22.5	35.9	84.6	27.2
Land>=50 decimal		52.1	54.7	59.6	42.2	39.7
Income>3000 BDT		36.5	55.4	77.0	95.7	51.9
Ownership of House	100.0	92.5	87.5	75.9	41.2	80.4
Rent House			6.4	19.4	56.3	15.5

The ratio of mortality and morbidity proportion by different cause and by each quintile is given in table 3. Due to shortage of space two intermediate (second and fourth) quintiles are not shown in the table. The proportion of mortality for 1-4 year children of first, third and fifth quintiles (referred to low, middle and high economics status) asset index is shown in table 3.

Table 3: Proportion of mortality and morbidity by each quintile

	Mortality				**Morbidity**			
	Q_1	**Q_3**	**Q_5**	**Q_1/Q_5**	**Q_1**	**Q_3**	**Q_5**	**Q_1/Q_5**
Infection	43.8	18.0	7.9	5.6	21.8	17.8	18.3	1.2
NCD	39.3	21.4	7.1	5.5	22.7	21.0	14.3	1.6
Injury	40.0	21.7	6.7	6.0	23.9	22.4	14.0	1.7
Total	**41.8**	**19.8**	**7.3**	**5.7**	**22.5**	**19.3**	**16.8**	**1.3**

Q_1=Poor quintile; Q_3=Middle quintile; Q_5=Rich quintile

The overall mortality of 1-4 year children was consequently highest for those living in the poorest family (first quintile). For example, a poor-rich ratio 5.7 for children implies that mortality rate in the poorest quintile is about 5.7 times the rate of the richest quintile. The results of this study revealed that injury related mortality and morbidity was much more among the most disadvantaged group of Bangladeshi children other than the infectious and non-communicable diseases. The poorest-richest quintiles ratio due to injury mortality was 6.0 and 1.7 whereas this ratio was 5.6 and 5.5 for the infectious and non-communicable diseases. Similarly, the ratio of poorest-richest quintile in terms of illness, cause of injury was the highest ratio. The ratio of injury related illness of 1-4 years children between poor and rich was 1.7 whereas infectious and non-communicable disease was 1.2 and 1.6 respectively.

Table 4: Percentage of household asset by each quintile

		Mortality				Morbidity			
		Q_1	**Q_3**	**Q_5**	**Q_1/Q_5**	**Q_1**	**Q_3**	**Q_5**	**Q_1/Q_5**
Mother's age (Year)									
	<25	34.9	23.3	2.3	15.17	25.0	21.2	13.1	1.91
	>=25	42.9	19.2	8.3	5.17	21.4	18.5	18.3	1.17
Living children									
	1	42.1	15.8	5.3	7.94	19.1	17.5	20.0	0.96
	2	24.1	31.0	10.3	2.34	23.1	19.4	17.2	1.34
	3	42.5	20.0	12.5	3.40	24.4	18.1	18.3	1.33
	4+	44.3	17.9	4.7	9.43	23.4	22.1	11.8	1.98
Birth order									
	1	38.5	17.9	7.7	5.00	20.2	18.6	20.3	1.00
	2	33.3	28.2	7.7	4.32	24.6	17.5	16.0	1.54
	3	43.6	17.9	12.8	3.41	23.3	20.0	17.0	1.37
	4+	44.6	17.6	4.1	10.88	22.6	22.2	11.7	1.93
Mother's education									
	No education	51.2	17.1	4.1	12.49	34.1	20.2	3.5	9.74
	1-5	26.9	26.9	5.8	4.64	23.6	22.0	10.5	2.25
	6-9	23.5	17.6	23.5	1.00	12.2	20.7	25.0	0.49
	10+	16.7	16.7	33.3	0.50	2.4	9.4	55.5	0.04
Father's education									
	No education	54.1	12.8	3.7	14.62	36.1	19.3	3.2	11.28
	1-5	35.7	31.0	4.8	7.44	23.9	23.8	7.1	3.37
	6-9	20.0	25.7	11.4	1.75	13.9	23.9	19.1	0.73
	10+		23.1	38.5	0.00	4.3	11.9	48.4	0.09
Place of residence									
	Rural	43.5	20.4	3.8	11.45	26.1	21.4	9.0	2.90
Total		40.7	20.1	7.5	5.43	22.5	19.3	16.6	1.36

Q_1=Poor quintile; Q_3=Middle quintile; Q_5=Rich quintile

Table 4 presents the equity of childhood injury mortality and morbidity by different socioeconomic and demographic characteristics of their parents. The poor-rich ratio was higher for children with younger age mothers, among higher birth order, illiterate mothers and fathers. Due to the few number in urban cases some quintiles was missing. For this reason urban equity is not shown here.

Bangladesh Health and injury survey found that pneumonia and diarrhoea are the leading cause of death of children between age 1 and 4. The study also found drowning is the third leading cause of childhood death. The mortality inequality was highest for cause due to drowning (table-5). The ratio for diarrhoea and pneumonia was 5 and 6 respectively.

Table 5: Inequality in leading cause of injury mortality and mortality

Cause	Mortality				Morbidity			
	Q_1	Q_3	Q_5	Q_1/Q_5	Q_1	Q_3	Q_5	Q_1/Q_5
Pneumonia	50.0	11.1	8.3	6.0	20.4	20.3	18.8	1.1
Diarrhoea	50.0	10.0	10.0	5.0	29.0	14.5	13.5	2.1
Drowning	39.6	22.6	5.7	7.0	-	-	-	

Among the children, drowning, burn and unintentional poisoning injuries morbidity were 3.8, 3.2 and 1.5 time more for most disadvantaged than the better off (table-6). Diarrhoea and pneumonia were 2.1 and 1.1 times more for the poor than the rich quintiles (table 5). Electrocution was another cause of childhood morbidity as well as mortality.

The odd ratio occurring an injury related morbidity for poorest quintiles than the richest was 1.3 (95% CI=1.04-1.62). However, the odd ratio of occurring an injury related death for poorest quintiles than the richest was 2.58 (95% CI=0.79-8.5).

Table 6: Inequality in external cause of injury morbidity

	Q_1	Q_3	Q_5	Q_1/Q_5
RTA	15.2	20.7	23.9	0.6
Violence	20.0	32.0		
Fall	13.3	19.8	22.8	0.6
Falling object	13.9	22.2	33.3	0.4
Cut Injury	25.0	8.1	16.9	1.5
Burn	29.5	24.5	9.9	3.0
Drowning	31.3	22.7	8.2	3.8
Poison	23.1	23.1	15.4	1.5
Machine	23.1	46.2	7.7	3.0
Electrocution	21.6	29.4	2.0	11.0
Animal Bite	9.8	39.2	13.7	0.7
Others	35.7	21.4	21.4	1.7

Table 7: Estimated regression coefficients from multiple logistic regression model for risk of injury mortality

		B	Exp(B)	95% CI for EXP(B)	
				Lower	Upper
Child age in year		-.13	.88	.68	1.13
Child's Sex	Female	.47*	1.61	.95	2.71
Economic status	Richest		1.00		
	Poorest	.95	2.58	.79	8.46
Mother's age	>=25 yrs	-.10	.90	.40	2.03
Mother's Education	None		1.00		
	10 yr+	-1.40	.24	.02	2.03
No of living children	1		1.00		
	2	.26	1.30	.46	3.68
	3	.45	1.56	.49	5.00
	4+	1.42**	4.14	1.44	11.87
Constant		-5.69			
Model chi-square		41.3			
-2loglikelihood		610.9			

*<.10;**P<.05; ***P<.01

The logistic regression coefficient estimates (beta value) are provided in table 6. Analysis revealed that female children had significant higher probability of injury mortality as compared to male children. The analysis also found that the households with many living children had greater chance of occurring injury deaths. Children with poor had 2.56-times more likely of injury mortality adjusting the other factors but it was not statistically significant. It was also observed that likelihood of morbidity due to injury was 1.3 times higher among children of poor families as compared to the children of rich families (table-8). Control for the other characteristics the occurrence of injury morbidity was increased with the child age. The likelihood of injury morbidity was significantly lower among the females relative to the males. Children with the older age mother had 16 percent less likely to be injury morbidity than the children with younger age (<25 year) mother.

Table 8: Estimated regression coefficients from multiple logistic regression model for risk of injury morbidity

		B	Exp(B)	95% CI for EXP(B)	
				Lower	Upper
Child age in year		.44**	1.56	1.48	1.65
Child's Sex	Female	-.16**	.85	.75	.96
Economic status	Richest		1.00		
	Poorest	.26*	1.30	1.03	1.62
Mother's age	>=25 yrs	-.17*	.84	.72	.98
Mother's Education	None		1.00		
	10 yr+	-.09	.91	.72	1.15
No of living children			1.00		
	2	.09	1.10	.92	1.31
	3	.19	1.21	.99	1.49
	4+	.14	1.15	.94	1.41
Constant		-2.25			
Model chi-square		322.8			
-2loglikelihood		6676.6			

*<.10;**P<.05; ***P<.01

Discussion

This study investigates the inequality in mortality and morbidity for one to four year children especially by cause of injury. In this study, quintile was used to measure the economic status in terms of households goods that developed by World Bank. These goods are indirect indicators of socioeconomic level. The possession of durable goods is not common in Bangladesh, since many families cannot afford them. The physical characteristics of the households have an important effect on environmental exposure to disease and reflect economic conditions. The quintiles show that injury related death was higher among the poor as compare to infectious and non-communicable disease. The children of poorest family suffered more in injury morbidity than the children of rich family. The analysis found that female injury mortality was higher but the illness became lower than males. These might be the cause of gender discrimination. In south Asia however, female mortality at many ages especially during the childhood periods[21]. Excess female mortality at child hood period in Bangladesh and other south Asian countries is believed to result from son preference, which leads to differentials treatment of sons and daughters in terms of foods allocation, prevention of disease and accident, and treatment of illness[22]. In south Asia different studies revealed the evidence of sons preference and discrimination in caring for son and daughters[23]. Due to existing socioeconomic situation in Bangladesh, the poor children are more vulnerable to injury morbidity and mortality the percentage of disabled are much more higher in this group as compare to rich group.

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Appendix A

Cut-off point wealth quintile

Quintile	Cut-off Point
Poorest	Lowest to -0.994068
Second	-0.994068 to -0.518053
Middle	-0.518053 to 0.047871
Fourth	0.0478701 to 1.02969
Richest	1.02969 to Highest