Inequity and Child Survival in Bangladesh

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Abstract

In Bangladesh under-five mortality has dropped appreciably after 1975s, although decline has been faster since 1980s. There is a gap between rich and poor in declining under-five mortality. The aim of this study is to examine the socioeconomic causes of inequalities in The aim of this study is to examine the socioeconomic causes of inequalities in child survival between poor and better-off children. Bangladesh Demographic and Health Survey (BDHS) data are used for the study. In this study quintiles were calculated on the basis of household assets and wealth score by use of principle component analysis. The poorest-richest ratio of infant mortality was 1.3 in 1993-4 whereas this ratio was 1.6 in 2004 BDHS indicating that gap between the poor and the rich had widened. This is also supported by the values of Concentration Index (CI). All are significantly different from zero of conventional levels. The absolute value of CI inequalities in child survival increased over time. Multivariate regression analysis confirmed that infants and child mortality of poorest quintile had significantly higher risk of childhood death than the richest quintile. Due to existing socioeconomic differentials in Bangladesh, i. e. the poor children are more vulnerable to mortality.

Key words: Inequity, Child survival and Bangladesh

Introduction

In recent decades overall child mortality rates have decreased globally. In Bangladesh, infant mortality declined by 25 percent from 89 deaths per 1,000 live births to 65 deaths per 1,000 live births between the periods 1989-2004. Child and under five mortality declined 52 and 34 percent respectively over the same period. In the last five years, child mortality declined only 20 percent (BDHS, 2004). Data from several populations suggest that socioeconomic disparities are strong predictors of childhood mortality (Wagstaff, 2000, Hosseinpoor, 2005). Low maternal education, young age, and increased number of children were strong predictors of mortality rate for children 0 to 4 years of age (Mosley and Chen 1984). Globally, poorer countries bear a disproportionate burden of injury morbidity and mortality. Numerous studies have demonstrated that lower socioeconomic classes have higher death rates than upper socioeconomic classes, and this difference has increased in the past decades (Wagstaff, 2002, Gwatkin et al, 2000). Recently, the differences in health status between the poor and the rich has led to more research on the health of different groups in developing countries (Gwatkin, 2001).

However, very few studies have focused on the inequity in child mortality and morbidity. This may be due to the fact that social stratification takes other forms and that it may be difficult to measure socio-economic position in the developing countries. However, parental education as one measure of socio-economic position has been shown to be important to child survival in developing countries, (Caldwell, 1979; Durkin et al, 1994; Bicego & Ahmad, 1996; Sullivan et al 1994). In studies in Western countries occupation has been the most important indicator employed (Smith et al., 1998). A study on inequalities in child mortality in nine developing countries using consumption levels as a measure found that countries with a more unequal consumption distribution in the population were the ones who tended to have

greater inequalities in child mortality than those with a more equal consumption distribution (Wagstaff, 2000).

The aim of this study was to investigate how the socioeconomic position associated with mortality among under five children. Further, the aim was to explore what extent the risk factors could explain some of the socioeconomic inequity in mortality of the children. We hypothesized mother's age, mother's education, place of residence, sex of child and household's assets to represent different aspects of socioeconomic position and, therefore, to have an association with experiencing mortality.

Data and Methods

Data used in this study derived from two Bangladesh Demographic and Health Surveys (i.e. BDHS 1994 and BDHS 2005). A two-stage sampling technique was conducted for these surveys. The two surveys contributed total of 32744 births and 33830 births respectively. For the purposes of this study analyses were restricted to all births from five years preceding the survey. First, the quality of the birth history information for recent births should be better, i.e. have less recall error, than for more distant births. Second, the assumption of a static risk profile using retrospective data is least violated when using recent births.

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 types of house, sources of drinking water and cultivable land etc.) was assigned a weight or factor score generated through principle component analysis (Gwatkin et

al, 2000). 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. Inequalities by income in mortality and morbidity thereof are measured here using a concentration index and concentration curve. To measure income related inequality in health we plot the concentration curve, which graphs the cumulative proportion of health against the cumulative proportion of population ranked by economic status (see Figure-4). It plots the cumulative proportion of deaths (on the *y*-axis) against the cumulative proportion of children at risk (on the *x*-axis), ranked by economic status, beginning with the most disadvantaged child. If the curve coincides with the diagonal, all children, irrespective of their household income, enjoy the same mortality rates. The convention is that the index takes a negative value when the curve lies above the line of equality, indicating disproportionate concentration of the mortality among the poor, and a positive value when it lies below the line of equality. The further the curve lays from the diagonal, the greater the degree of inequality in mortality across quintiles of economic status. Concentration index is a generalization of the Gini coefficient. The numerical measure of inequality in mortality is measured by the *concentration index* denoted as C defined as twice the area between the concentration curve and the diagonal. The lowest value that C can take -1: this occurs when all the population's health is concentrated in the hands of most disadvantaged person. The maximum value of the index can take +1: this occurs when all the

population's health is concentrated in the hands of least disadvantaged person. The concentration index estimates reported in the study are calculated from grouped data using the following equation:

$$C= 2/\mu(\Sigma f_t \mu_t R_t)-1 \qquad (1)$$

Where, μ represents the mean of the particular health indicator μ_t and f_t respectively represent the value of health indicator and population share for the t^{th} socio-economic group. R_t is the relative rank of the t^{th} socio-economic group, defined as $R_t = \sum_{y=1}^{t-1} f_y + .5 f_t$, which indicates the cumulative proportion of population up to midpoint of each interval group. (Kakwani et al, 1997). In the analysis, adjustment was made for linearity of the quintiles.

Analysis of the effects of socio-economic and demographic factors on infant and child mortality was based on the estimation of regression model. The model examined the effects of maternal and other socio-demographic characteristics on the likelihood of the child being died. In the analysis of the model, death measured as dichotomous variable coded 1 if the child died prior to the date of interview and 0 otherwise. Logistic regression model used for the analysis to examine the wealth effect on the infant mortality. The coefficient in the analysis represented increase or decrease in the log odds of being occurrence of event (versus not occurrence) associated with a unit or category change in an independent variable. Cox's proportional regression model (Cox, 1972) used for survival prospect beyond infants and the results were expressed as relative risk with 95% Confidence Interval.

Results

Infant mortality rates by different quintiles for two surveys are presented in Table-1 for the five-year period preceding the surveys. Comparing estimates of two inter surveys results; it is observed over last decade infant mortality has significantly declined. The lowest-highest quintiles ratio of infant and under-five mortality were 1.3 and 1.5 during the period 1989-1993 and since then it has widened. The quintiles ratio of infant and under-five mortality

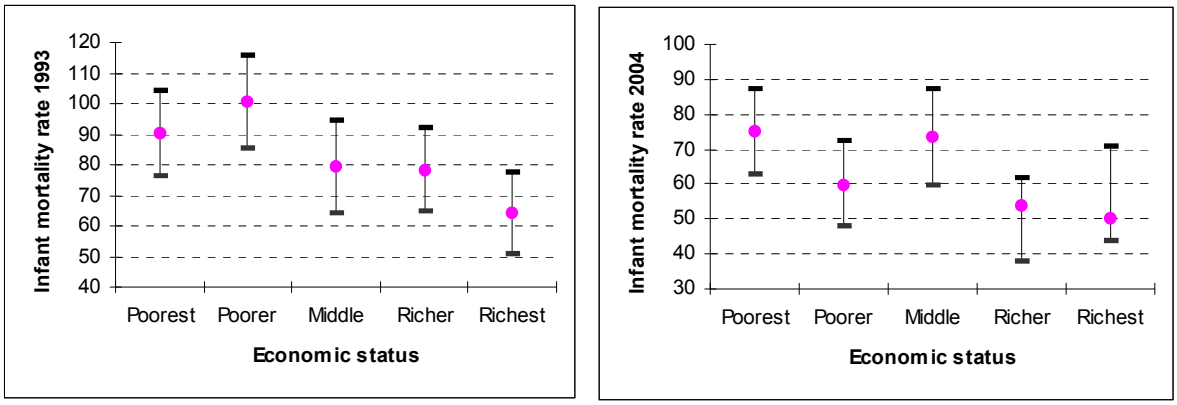
increased to 1.6 and 1.8 times during period 1999-2003, suggesting that the inequities in infant and under-five mortality had increased since 1989-93. These findings also supported by the values of Concentration Index (CI). The CI for infant and under-five mortality were –0.0604, –0.0594 in 1993-94 and –0.0703, -.1060 in 2004 respectively. All are significantly different from zero of conventional level. The absolute values of the indices indicated that inequities increased despite overall decline in under-five mortality. The negative value of concentration indices indicated inequity in both infant and under-five mortality favor the better off and its corresponding t-value reveal that there were significant inequalities among the richest and poorest quintile groups.

Table: 1 Infant and under five mortality rates by economic status

Economic status	Infant		Under five	
	BDHS 1993-4	BDHS 2004	BDHS 1993-4	BDHS 2004
Poorest	94.3	81.8	133.7	104.1
Poorer	104.1	60.3	132.9	73.8
Middle	90.3	78.7	134.6	96.8
Richer	81.9	53.7	125.0	64.6
Richest	71.7	50.2	91.4	58.2
Total	88.6	65.2	123.5	80.3
Poor-rich ratio	1.3	1.6	1.5	1.8
Concentration index (CI)	-0.0604	-0.0703	-0.0594	-0.1060
St. Error (CI)	0.0208	0.0338	0.0348	0.0364
t-test(CI)	-2.91	-2.08	-1.71	-2.91

In the figure-1, it is observed that there were declined trend in infant mortality rate, from the bottom quintile to the top in both the surveys.

Figure-1: Infant mortality rate and its 95% confidence interval by economic status



Gender differential in infant, child and under-five mortality are shown in Figure-2. Both infant and under five mortality were lower for the female children than the male children while child mortality was higher for female children than the male children.

Figure: 2 Infants, U5 and child mortality by sex

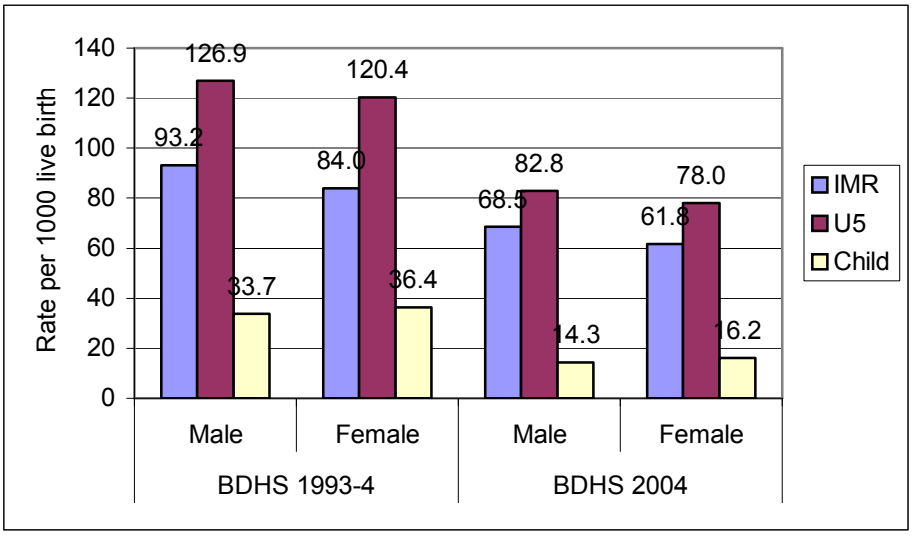


Figure 3 reveals that infant morality inequity odd ratio by division. It is observed that in two inter-survey periods Khulna division had low infant mortality and low inequity. It is also shows that Rajshahi division had lower mortality but high inequity. Sylhet division had high infant mortality and high inequity. For the medium average mortality division Dhaka, Chittagong and Barisal division, the inequity increased between the two survey periods.

Figure: 3 Infant mortality rate, inequity by division

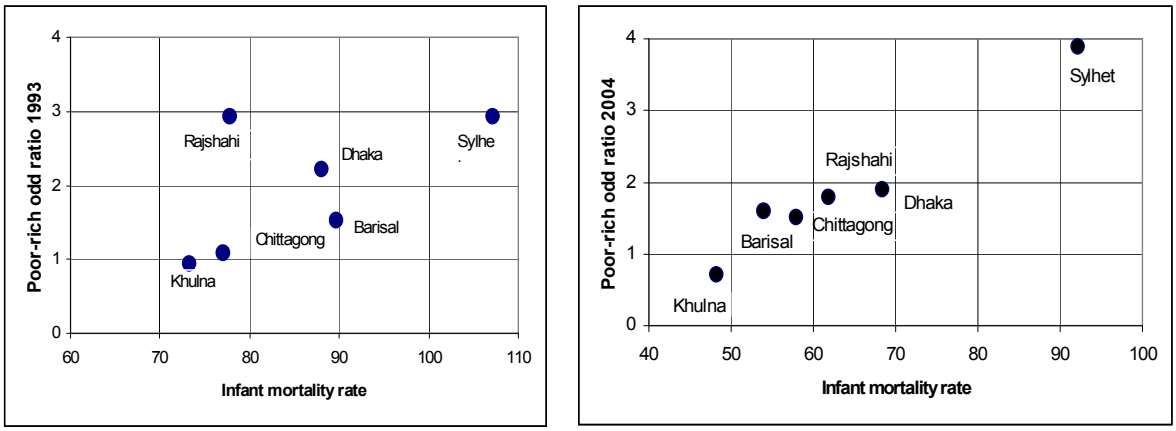
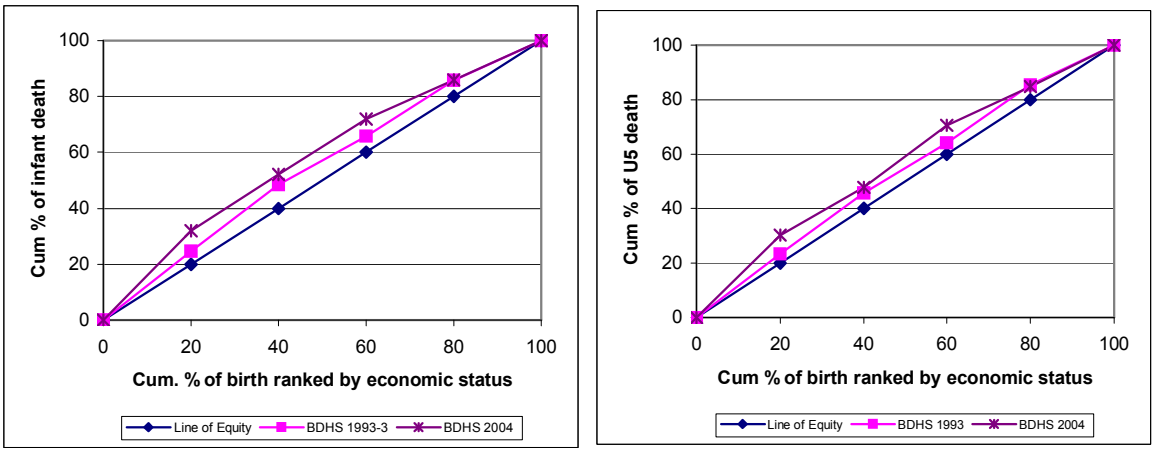


Figure 4 shows the concentration curve on infant mortality. The diagonal line indicates the line of equality. Curve above the diagonal indicates that infant mortality favors the poor. The farther the curve is above the equality line, the more concentration in infant mortality amongst the poor. All curves in different surveys clearly indicate the infant mortality concentrated among the poor. The curve of BDHS 2004 is farther away from other curve, which indicates greater degree of inequality in infant mortality between the poor and the rich in 2004 compared to the earlier surveys.

Figure 4: Concentration curve of infant mortality and under-five mortality by surveys



Similarly, Figure 4 also shows that inequality in under-five mortality between poor and rich had been increasing over time. Detailed analyses all the BDHSs data demonstrate that children of poorest family suffered more in mortality than the children of rich family. The analysis indicates that there was a gap in infant and under-five mortality among the poor and the rich. If the gap can be narrowed down between the poor and the non-poor, there will be more improvement in the overall health status of the population.

Multivariate analysis of infant and under-five mortality

Table 2 presents the estimate of the logit analysis of the infant mortality. The demographic variable mother's age at child's birth was associated with infant mortality. The analysis shows that children of young (15-19 years) mothers had a risk of dying 1.37 (95 % CI 1.17-

1.60) before their first birthday. Mother's education had significant impact on infant mortality. Children of mothers with no education had 1.85 (95 % CI 1.54-2.21) times risk of dying before completing one year than children of mothers have at least secondary education. Previous birth interval had significant association with infant mortality. Increasing the birth interval has negative effect on the risk of dying. Children in rural areas had 1.23 (95 % CI 1.02-1.5) times more likelihood of dying in infancy compare to the children in urban areas. The infants of poor families were 1.38 (95 % CI 1.12-1.69) times more likelihood to had death as compared to infants of better off families.

Table 2: Infant and child mortality determinants: Logistic regression and Cox's regression analysis

Variables		Infant mortality		Child mortality	
		Odd ratio	95% CI	Risk ratio	95% CI
Mother's age at birth	<=20	1.37	1.17-1.60	0.82	0.57-1.17
	21-25	1.00		1.00	
	>25	1.15	0.97-1.36	1.19	0.85-1.66
Mother's education	No education	1.85	1.54-2.21	1.68	1.13-2.53
	Primary	1.36	1.11-1.66	0.92	0.57-1.48
	Secondary and Higher	1.00		1.00	
Multiple birth		6.66	5.05-8.78	-	-
Birth interval	First birth	1.00		1.00	
	0-18	1.63	1.31-2.03	2.59	1.64-4.09
	19-30	0.98	0.83-1.17	1.77	1.19-2.64
	31-42	0.59	0.48-0.72	1.27	0.82-2.00
	43 and above	0.50	0.42-0.61	0.59	0.35-0.99
Sex of the child	Male	1.00		1.00	
	Female	0.91	0.80-1.03	1.16	0.88-1.53
Place of residence	Urban	1.00		1.00	
	Rural	1.24	1.02-1.50	1.39	1.00-2.02
Survey period	Survey 1993-4	1.00		1.00	
	Survey 2004	0.73	0.64-0.83	0.52	0.39-0.71
Economic status	Poorest	1.38	1.12-1.69	2.48	1.43-4.30
	Second	1.27	1.03-1.57	2.42	1.39-4.24
	Middle	1.27	1.02-1.58	2.67	1.52-4.70
	Fourth	1.08	0.86-1.35	2.57	1.48-4.49
	Richest	1.00		1.00	

The table 2 also presents multivariate analysis of child mortality using Cox's proportional hazards regression. The model stratified by poverty status, allowing the baseline hazard to differ between poor and non-poor. The most significant factors explaining differentials in child mortality are economic status, maternal education, highest birth interval and the place of residence. Mother's age was not significantly associated with child mortality. Household's incomes, as presented in this paper by wealth, exert a significant effect on child survival, particularly in infancy when income contributed the most to reducing mortality over time.

Discussion

In developing countries, it is still difficult to measure the income level of the population that may reflect their position in those societies. This study developed a proxy measures of income to assess the inequity of childhood death in Bangladesh, which calculated as the rescaled weighted sum of household' ownership durables and indicators of housing quality. This study confirms that inequity was still appeared between poor and better-off children although there was rapid declined in overall under-five mortality (BDHS 2004). The analysis provides some indication that the improvement in survival status had been achieved among both poor and better off. Previous study found that reduction in mortality over time had been largely due to the reduction in mortality among the poor (World bank, 2005). The concentration indices confirmed that death was higher among the poor children as compared to rich children. The study found that inequalities in mortality also appeared among the spatial distribution. The findings are consistent with results obtained from other studies in different part of the world (Hosseinpoor 2005, Wagstaff, 2000).

The regression analysis indicates that mother's socioeconomic and demographic factors affect on child survival. The demographic factors associated with higher infant mortality

include mother's age at birth, short preceding interval and multiple births. The study revealed that younger and old-aged mothers had large number of child deaths. This indicates mother's age had a convex (U-shaped) effect on mortality risk; the coefficient suggests that the mothers' optimal age for childbirth is during her late 20s (Mosley and Chen 1984). While these factors are likely to reflect biological characteristic, the sufficiently negative coefficient of previous birth interval, suggest that newborns were less likely to die when there were fewer children competing for resources.

Maternal socioeconomic characteristics are important determinants of infant survival. Mothers schooling has a negative effect on infant mortality, particularly higher secondary grades (10 through 12) and higher education, as compared to the reference category of no schooling. This suggests that the impact of maternal formal education on infant health, though it is possible that maternal education is approximating household socio-economic status. Indicators of maternal schooling, possibly by indicating educated women enhanced decision making in the household.

However, maternal education is known as the main determinant of child survival in developing countries (Sullivan et al., 1994; Bicego & Ahmad, 1996). The relationship is known to be much stronger after the neonatal period. In recent years, other studies have found weak correlation between maternal education and child mortality in sub-Saharan Africa compared with results of other Third World regions (Hobcraft, 1993; Folasade, 2000). The relative inequalities across all educational groups in developing countries were high, and had probably increased over time.

The multivariate analysis also substantiated that female child mortality was higher than males although it is imprecise. These might be the cause of gender discrimination. In most population, male mortality is higher than female mortality at almost all ages. In south Asia, however, female mortality is higher than male mortality at many ages especially during the childhood periods. Socio-economic inequalities in under 5 mortality are often partly explained by the fact that lower socioeconomic groups tend to live in rural areas, which typically exhibit characteristics that instigate high mortality (Houweling 2007). The location (place of residence, rural/urban) had an important effect on infant and child survival chance, once controlling the other factors. This analysis demonstrated that place of residence was an important mediator of the relationship between economic inequality and mortality. The regional disparities in childhood mortality might be the factors of socioeconomic position as well as the health service availability (Doorslaer, 2006). An other south-Asian study found that the high and increasing relative inequalities in under 5 mortality in Sri Lanka seemed to be a predominantly socio-economic, rather than a regional phenomenon.

Socio-economic status is an important determinant of infant mortality risk: there is now estimated impact of wealth. The results of this study revealed significant association between socioeconomic inequality and incidence of death among children. Regression analysis reveals that infant mortality of richest quintile had significantly lower than the poorest quintile. The study also stated that wealth distribution affected almost similar pattern on infant mortality and child mortality.

According to the results it is concluded that the children of poorest families suffered more in mortality than the children of rich families. Due to existing socioeconomic situation in Bangladesh, the poor children were more vulnerable to death occurrence. The proportion of mothers received health care service in Bangladesh, under coverage becomes increasingly

concentrated in lower socio-economic groups. To achieve Millennium Development Goal 4 (MDG 4) by 2015 in Bangladesh, health sector program may give special emphasis of reduce relative inequalities between socio-economic groups.

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