CHILD MORTALITY IN A DEVELOPING COUNTRY: A STATISTICAL ANALYSIS

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Abstract: *This study uses data from the "Bangladesh Demographic and Health Survey (BDHS] 1999-2000" to investigate the predictors of child (age 1-4 years] mortality in a developing country like Bangladesh. The cross-tabulation and multiple logistic regression techniques have been used to estimate the predictors of child mortality. The cross-tabulation analysis shows that parents' education is the vital factor associated with child mortality risk but in logistic regression analysis only the father's education has been found significant to reducing child mortality. Occupation of father has been found a significant characteristic in both analyzes, further mother standard of living index, breastfeeding status, birth order has substantial impact on child mortality in Bangladesh. The findings also show that in both statistical analyzes maternal health care variables such as timing of first antenatal check and tetanus toxoid (TT] during pregnancy has momentous effect on child mortality. Finally these findings specified that an increase in parents' education, improve health care services which should in turn raise child survival and should decrease child mortality in Bangladesh.*

Key words: *Neonatal; Post-neonatal; Tetanus Toxoid; SLI*

Introduction

The study of child mortality becomes one of the most important researches of the developing countries including Bangladesh. There are two major reasons behind this: (i] high level of infant & child mortality and (ii] its relationship with fertility. The reduction of infant and child mortality indirectly helps in reducing fertility by decreasing the desired number of children to be born due to increased probability of survival of a child. The child mortality is a composite index reflecting environmental, social, economic, health care services and delivery situation on the one hand and maternal as well as family and community norms and practices on the other.

A child is highly vulnerable to two categories of acquired ailments; one is a heavy load of infectious diseases and the other, those diseases that are caused by inadequate nutrition. The relationship between child mortality and socio-economic factors might be relatively weak in developed countries, may be due to low child mortality. In contrast, in the developing countries, a significant portion of deaths occurs during childhood, which may be due to poor public health measures and lack of access to health care facilities. It is documented that the risk of morbidity and mortality is directly influenced by 14 intermediate or proximate determinates including education of mother, sanitation facilities, access to safe drinking water and maternal and child health care services (38). There is evidence of some recent decline in infant and child mortality. Mother education, higher birth order had significant independent effects upon the reduction of infant and child mortality. Other variables such as father education, fetal loss or land ownership had no effect on child mortality [3][5]. Another study considers some characteristics as mother's age at the birth of child, birth order, previous child loss, mother's residence, father's occupation and mother's work experience since marriage [1].

Maternal education has been observed strong predictor of child mortality in developing countries [6, 10, 15, 21, 28, 33, 41]. The education of the mother is emerged as one of the strongest predictors of child mortality though other factors like women's autonomy, income, working status of parents, standard of living index, household size, place of residence, better conditions of water supply and sanitation have influence upon it [26, 20, 43]. Some studies indicated that the mother's education is a more decisive determinant of child survival than other family characteristics such as father's occupation and father's education [2, 10]. Mother's education may be attributed to the children of enjoying better diets and better overall care than the children of non-educated mothers [4] and there are strong inverse relationship between mother's education and child mortality [21, 31]. Another study also identified that mother-working status exerts a significant negative influence on child mortality. But mother education has a greater influence on child survival in Bangladesh than that of father's education [32].

Few studies have focused on the health and survival of children who migrate from rural areas or who are born to migrants in urban areas of developing countries, although several studies have incorporated maternal migrant status as an explanatory variable on child mortality [9, 19]. In many societies religious differentials have significant impact on child mortality such as the BFS [1989] data indicated that Hindus have a higher child mortality rate than Muslims [30].

Investigations on historical and modern third world countries have shown that children who were exclusively breast-fed survive longer and are healthier than artificially fed

children in direct proportion [16, 27]. The child mortality causes the cessation of breastfeeding, thus increasing the probability of return to ovulation, so also the conception of the next child, resulting in a shortened birth interval. The strength of this effect is found to be related to the intensity, frequency and duration of breastfeeding [22]. In developing countries including Bangladesh, mother's age at birth played an important role in child mortality. A number of studies deal with mother's age at the birth of the child [5, 13, 24] and the optimal ages of child bearing is confined of 20 to 34. It will help to reduce maternal mortality and childhood mortality [44]. Birth interval played significant role on infant and child mortality [23, 35, 39] and the length of the birth interval is short the probability of dying is very high. The probability of dying before age five for children born less than two years after a previous birth is more than double than for those children born four or more years after a previous birth [25]. There are three mechanisms about short birth interval such as –(i) short birth intervals can relate fetal growth resulting in low birth weight and increased death risks due to endogenous causes. (ii) they may impair the potential milk production for the child whose birth closed the intervals. (iii) too closely spaced birth on the distribution of resources increasing maternal care among children in the household [40]. Children through out the developing countries are much more likely to die if they are born less than two years after the mother's previous birth than their birth interval is longer [23]. Another study observed that in first pregnancies the childhood mortality is highest, in 2nd and 3rd pregnancies that are lowest [12, 34]. A study have used ICDDR'B data for the period October 1975 to January 1980 and identified that 60% to 80% children died in the first two years of life whose birth interval was 15 months with preceding birth [35]. The short birth interval is a risk factor with some qualifications. For example, the bad affect of short birth intervals on child mortality may be reduced by favourable socio-economic conditions [8].

Sex discrimination in infant and child mortality was studied by many researchers [7]. The rural areas of western south Asia, stretching across Pakistan and the northern states of India to Bangladesh, female child death rates are often very much higher in early ages [18]. In few developing countries such as South Asian countries, the Middle East and Northern Africa, it has been observed the excess female mortality during infancy and childhood [45]. The higher mortality rates during childhood period are consistent with overpowering event that biological risk of male is higher than female. The study also examined that male children got more advantages than female in parental care, feeding patterns, intra family food distribution and treatment of illness [12].

In a rural community of Bangladesh, the under five death occurred for most significant causes such as diarrhorea and dysentery, tetanus, measles, fever, respiratory and dropsy [11]. The health care services including higher coverage with immunization, safe delivery of birth is more developed in urban area than rural area in Bangladesh [14, 30]. The availability of adequate health service may bring the mortality rate significantly down for the children aged between 1-4 years, but various social and cultural biases in the population keep them away from using such services and ultimately neutralize the supposed potentials of health service facilities [17]. The number of antenatal care visit and timing of the first antenatal check-up are considered as important factors in preventing an adverse pregnancy outcome. Maternal health care is most effective if the visits are started early stage during pregnancy and continue at regular intervals throughout the pregnancy [37]. The prenatal management, maternal age, maternal nutrition, the process of child birth, treatment of obstetric emergencies played an important role in improving child survival [42]. In

developing countries women face many health risks that associated with sexuality and child bearing [29] and in Bangladesh, the lack of health care service for mothers is one of the important reasons for the high rates of infant and child mortality [30]. The proper medical attention and hygienic conditions during delivery can reduce the risk of infections and facilitate management of complications that can be caused death or various illnesses for the mother or the newborn child [36].

The review of the literature of child mortality showed that a number of variables affecting child mortality. However, the predictors of child mortality are changing through time since the facilities and awareness are changing day by day. Hence it is necessary to give more emphasis on using the current data to identify the segment of population where programmes need to be strengthening in order to achieve the goal for reducing child mortality.

Objective of the Study

In this study an attempt has been made to examine the predictors of child mortality in Bangladesh. The specific objectives of this study are: to identify the factors which is affecting child mortality and to suggest viable strategies to increase health service and reduce child mortality in Bangladesh.

Data and methods

This study uses data from the Bangladesh Demographic and Health Survey [BDHS] conducted in November 1999 to March 2000 under the authority of the National Institute of Population Research and Training [NIPORT]. The BDHS is intended to serve as a source of population and health for policy makers and research community. The BDHS (1999-2000) is a nationality representative survey of 10544 ever-married women aged 10-49 and 2556 currently married men aged 15-59. The sample has been taken 5 years prior to BDHS (1999-2000) survey. That means, in this study all birth considered between November 1994 to October 1999 and deaths considered between November 1994 to October 1999 and with age 12 months and above.

The interlinkage between child mortality and socio-economic, bio-demographic and maternal health care variables have been tested by applying cross-tabulation analysis. The cross-tabulation analysis is an important in first step for studying the relationship between mortality with several characteristics. However, such analyses fail to address mortality predictors completely because of ignoring other covariates. Hence multiple logistic regression approach is also adopted in order to estimate independent effects of each variable while controlled for others. Multiple logistic regression analysis is carried out for the child according to the age at death. This analysis considered all the covariates that were found significant in cross-tabulation analysis.

Variables: education of mother, education of father, occupation of mother, occupation of father, religion, family size, exposure to mass media, standard of living index, place of residence, breastfeeding status, birth order, sex of child, birth spacing with previous child, mother age at birth of child, complication during birth, type of birth, timing of first

antenatal check during pregnancy, TT during pregnancy, number of antenatal visit during pregnancy, place of delivery.

Results and Discussion

In this section, we examine the predictors of child mortality. Child mortality reflects a country's level of socio-economic development and quality of life. Bangladesh has witnessed a large decline in child mortality during the last two decades [37]. The child mortality varies according to socio-economic, health care and bio-demographic characteristics of the population concerned. There are many predictors of child mortality in a particular group of variables and it is necessary to analyze them separately in order to get the idea about the insight variation of that particular type of variables.

The distribution of child mortality by socio-economic, bio-demographic, and maternal health care variables is shown in Table 1 (Appendix 1). Among socio-economic variables, maternal education has a strong relationship with child mortality and child survival. Various studies have supported a direct causal relationship between mother's education and child mortality [26, 28, 29]. The result indicates that the child mortality rate was highest (1.64%) for the children of illiterate mothers and lowest (0.54%) for the children whose mother's educational level is secondary and above. It is clear that the child mortality rate decreases with the increase of mother's education. Like mother's education, father's education also plays significant role on child mortality. Father's level of education has been regarded as a valid proxy of income and wealth status of the household in Bangladesh. It is likely that higher educated people belong to higher economic class. An investigation of the Table reflects that among the total deaths, highest number of deaths (63.3%) is observed for the illiterate father and the lowest number of deaths (3.8%) is observed for the father whose educational level is H.S.C and above. The child mortality rate was also found highest (1.71%) among the children whose father is illiterate and the child mortality was found lowest (0.43%) for the children whose father's education is secondary and above. This result shows that child mortality sharply decreases as the father's educational level increases. So it may be concluded that the risk of child mortality is low for children whose parents are educated. The highest child mortality rate (1.94%) was found among the children whose mothers were laborer and lowest (0.95%) for the mothers who were engaged in service but from the result it is clear that mother's occupation has no significant effect on child mortality. Father's occupation is one of the important Socio-economic characteristics for child mortality. The child mortality rate (1.63%) was found highest for the children whose father's occupation was agriculture and the rate was found lowest (0.64%) for the children of service-holder fathers. This result was similar to previous studies [30). Standard of living index is another important differential factor of child mortality. Children born in households with low standard of living index experienced highest mortality. Among the total deaths, about three-fifths were found for the children with mother's low standard of living index. The mortality rate has been observed 1.52% for the children whose mothers belong to low SLI group. The lowest (0.39%) child mortality rate was found among the children whose mothers belong to high SLI group. It is clear that the relation between mother's SLI & child mortality is negative. Some of the factors which have no significant effect on child mortality are religion, family size, exposure to mass media, place of residence, currently working status of mother.

Among the bio-demographic variables, breastfeeding status was found with significant effect on child mortality. Among the total deaths, about 47% deaths were found among the children whose mothers were currently breastfeeding and about 53% deaths were found among the children whose mothers were not currently breastfeeding. However, the rate of child mortality was found significantly lower (0.78%) for the children whose mothers were currently breastfeeding than that of children whose mothers were not currently breastfeeding (2.13%). Among the total deaths, 17.7% deaths were found for first birth cohort, 43% and 39.2% deaths were found for the birth order 2-3 and 4^+ respectively. From the child mortality rate it is clear that mortality increases steadily with birth order. The increase in the child mortality rate with birth order may reflect a more intense competition faced by higher birth order children in terms of care givers time, medical resources, and nutritious food while children needed. The effect of complication during birth, type of births, and sex of child has no significant impact on child mortality.

The maternal health care services variables have strong indirect influence in reducing child mortality, because the mothers who sought antenatal care during pregnancy, are well aware about utilization of existing health facilities and they can properly utilize such facilities when needed for their child. The result indicates that the child mortality rate was found highest (1.55%) among the children whose mother did not receive antenatal check during pregnancy and the rate was found lowest (0.19%) for the children whose mother received first antenatal check during the 4+ months of pregnancy. The effect of timing of first antenatal check during pregnancy on child mortality was found statistically significant. In this analysis the child mortality was found significantly higher (1.89%) for the children whose mothers had not received tetanus immunization than for children whose mother had received TT during pregnancy. Antenatal visit plays significant role on child mortality. The child mortality rate was found highest (1.55%) among the children for the mothers who did not attend any antenatal visit during pregnancy. In Bangladesh most of the women used to deliver their children at home. Among the total child deaths, only 1.3% deaths have been observed among the children whose place of delivery in Hospital/ Clinic. However, the effect of place of delivery on child mortality was not statistically significant.

Table 2 (Appendix 2) presents the estimated coefficients, S.E. and odds ratio for child mortality. In the odds ratio significant variables are indicated by asterisk sign. The significant variables found in cross-tabulation analysis were considered as the covariates of the logistic regression analysis. Though mother's education is one of the most important characteristics for child mortality but in this analysis, mother education was found to have insignificant effect on child mortality. The risk of child mortality was found 38 percent, 40 percent and 39 percent lower for the children whose father's having primary, secondary and higher education as compared to the children of father's who had no education. These results clearly indicated that the risk of child mortality was decreasing with increasing of father's education and it is also found that father's education has significant effect on child mortality. This result may be due to the fact that child mortality mainly effected by environmental factors and an educated father may be more conscious to the environment where child grow up. Father's occupation was found to have significant effect on child mortality. The risk of child mortality was found 1.62 times, 1.64 times, 1.49 times and 1.34 times higher for the children whose father engaged agriculture, labourer, skilled manual and others job respectively as compared to the children whose father engaged in service. This may due to the fact that a service father may be higher educated and he provides better advantage

(food, nutrition and health facilities) to his child than other fathers. Standard of living index is an important characteristic for child mortality [28] but in this analysis this variables has no significant effect on child mortality. Breastfeeding status of children has significant influence on child mortality. The risk of child mortality was found 39 percent lower for the children whose mothers currently breastfeeding to their children as compared to the children whose mothers were not currently breastfeeding their children. Breastfeeding practice is a universal in Bangladesh, and in the current analysis it is clear that breastfeeding has significant effect on child mortality. Timing of first antenatal check has significant impact on child mortality. The odds ratios were found 0.36 and 0.24 for 1-4 months and 4+ months respectively. This implies that the child mortality risk were 64 percent and 76 percent lower for the children whose mothers received first antenatal check during 1-4 and 4+ months of pregnancy respectively as compared to mothers who have not received any antenatal check during pregnancy. TT during pregnancy was also found significant variable for child mortality. The risk of child mortality was found 57 percent lower for the children whose mother have taken TT injection during the pregnancy as compared to the children whose mothers have not taken any TT injection during the pregnancy.

Conclusions

This study investigates the predictors of child mortality in Bangladesh. It utilized the nationally representative data from the Bangladesh Demographic and Health Survey 1999-2000. The body of evidence accumulated during the two decades shows the existence of a relationship between several characteristics and childhood mortality across societies. Both cross-tabulation and multiple logistic regression techniques have been applied to identify the important predictors of child mortality. From these analyses several interesting observation can be made, although the analysis itself was subject to various types of problems including small sample size for mortality analysis. Also, interpretations of the findings appear to be problematic in many cases. Sometimes it is observed that logical or theoretical hypothesis are supported by the results of crude analysis (like cross-tabulation) but are rejected as invalid when checked by those based on refined techniques such as logistic regression. Such a situation may be due to interrelationship between covariates.

The findings suggest that parents education has been identified the most important socio-economic predictors of child mortality that means mortality rate decrease with increase in both mothers and fathers education level but in multiple logistic regressions only father's education has significant effect on child mortality. The study indicates that occupation of mothers has no significant impact on child mortality but in both analysis fathers' occupation has played significant role in reducing the risk of child mortality. Some characteristics have no major effect on child mortality these are religion, mother exposure to mass media, place of residence (urban/rural) and currently working status of mother. The association between child mortality and mothers' standard of living index was found to have a significant variable for child mortality. Several bio-demographic variables have a substantial effect on child mortality. Among these variables breastfeeding status and birth order have significant effect on child mortality. The child mortality was found lower for the children who were currently breastfeed. Further the results also investigated that several health care characteristics have a principal effect on child mortality in Bangladesh. These are TT during pregnancy, timing of first antenatal check, and antenatal visit during pregnancy. The risk of child mortality was

found lowest for the children whose mother's received antenatal check and TT vaccine during pregnancy. So, attention should be given to parent education, father's occupation, currently breastfeeding, and maternal health care factors in order to reduce the risk of child mortality in a developing country like Bangladesh

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Appendix 1.

Table 1. Distribution of Child Mortality According to Selected Variables†

Selected Variables	Number of children		Total	Percent of death	Chi-square (χ^2)
	Alive	Dead			
Education of mother					
Illiterate	3062(46.3)	51(64.6)	3113(46.6)	1.64	11.90**
Primary	1902(28.8)	19(24.1)	1921(28.7)	0.99	
Secondary above	1643(24.9)	9(11.4)	1652(24.7)	0.54	
Education of father					
Illiterate	2875(43.6)	50(63.3)	2925(43.8)	1.71	13.77**
Primary	1587(24.1)	16(20.3)	1603(24.0)	0.99	
Secondary	1140(21.8)	10(12.7)	1450(21.7)	0.67	
Above Secondary	693(10.5)	3(3.8)	696(10.4)	0.43	
Occupation of mother					
Service	104(1.6)	1(1.3)	105(1.6)	0.95	3.75
Laborer	607(9.2)	12(15.2)	619(9.3)	1.94	
Skilled manual	406(6.2)	6(7.6)	412(6.2)	1.46	
Household work	5459(83.0)	60(75.9)	5519(82.9)	1.09	
Occupation of father					
Service	1871(28.5)	12(15.4)	1883(28.3)	0.64	9.34**
Agriculture	1304(19.9)	18(23.1)	1322(19.9)	1.36	
Laborer	2180(33.2)	36(46.2)	2216(33.4)	1.63	
Skilled manual	899(13.7)	9(11.5)	908(13.7)	0.99	
Others	311(4.7)	3(3.8)	314(4.7)	0.96	
Religion					
Muslim	5850(88.5)	72(91.1)	3441(51.5)	1.22	0.52
Non Muslim	757 (11.5)	7(8.9)	764(11.4)	0.92	
Family size					
Small 2-4	1680(25.4)	24(30.4)	1704(25.5)	1.41	1.52
Medium 5-7	2983(45.1)	36(45.6)	3019(45.2)	1.92	
Big 8+	1944(29.4)	19(24.1)	1963(29.4)	0.97	
Exposure to mass media					
No	3602(54.5)	53(67.1)	3655(54.7)	1.45	4.95
Yes	3002(45.5)	26(32.9)	3028(45.3)	0.86	
Standard of living index					8.88**
Low	3106(47.0)	48(60.8)	3154(47.2)	1.52	

Medium	2478(37.5)	27(34.2)	2505(37.5)	1.08	
High	1023(15.5)	4(5.1)	1027(15.4)	0.39	
Place of residence					
Urban	1689(25.6)	17(21.5)	1706(25.5)	0.97	1.51
Rural	4118(74.4)	62(78.5)	4980(74.5)	1.24	
Currently working status of mother					
Yes	1171(17.7)	19(24.1)	1190(17.8)	1.60	2.13
No	5434(82.3)	60(75.9)	5494(82.2)	1.09	
Breastfeeding Status					
Yes	4678(70.8)	37(46.8)	4715(70.5)	0.78	21.57**
No	1929(29.2)	42(53.2)	1971(29.5)	2.13	
Birth spacing with previous child					
=<15 month	232(3.5)	5(6.3)	237(3.5)	2.11	
15-30	1300(19.7)	29(36.7)	1329(19.9)	2.18	3.92
30^{+}	3100(46.9)	31(39.2)	3131(46.8)	0.99	
First birth	1975(29.9)	14(17.7)	1989(29.7)	0.70	
Birth order					
First	1965(29.7)	14(17.7)	1979(29.6)	0.71	6.58**
2-3	2714(41.1)	34(43.0)	2748(41.1)	1.24	
4^{+}	1928(29.2)	31(39.2)	1959(29.3)	1.58	
Complication during birth					
No	4249(69.2)	48(69.6)	4297(69.2)	1.12	0.005
Yes	1895(30.8)	21(30.4)	1916(30.8)	1.09	
Type of birth					
Single	6498(98.4)	79(100)	6577(98.4)	1.20	1.32
Multiple	109(1.6)	-	109(1.6)	-	
Sex of child					
Male	3405(51.5)	36(45.6)	3441(51.5)	1.07	1.11
Female	3202(48.5)	43(54.4)	3245(48.5)	1.33	
Timing of the first antenatal check					
1-4	821(12.4)	2(2.5)	823(12.3)	0.38	20.67**
4^{+}	1037(15.7)	2(2.5)	1039(15.5)	0.19	
None	4749(71.9)	75(94.9)	4824(72.2)	1.55	
TT during pregnancy					
Yes	3766(57.0)	24(30.4)	3790(56.7)	0.63	22.53**
No	2841(43.0)	55(69.6)	2896(43.3)	1.89	
Antenatal visit during pregnancy					
1-2	963(14.6)	3(3.8)	966(14.4)	0.31	20.89**
3-4	443(6.7)	-	443(6.6)	-	
5^{+}	451(6.8)	1(1.3)	452(6.8)	0.22	
None	4750(71.9)	75(94.9)	4825(72.2)	1.55	
Place of delivery					
Home	5563(84.2)	69(87.3)	5632(84.2)	1.23	3.89
Hospital/clinic	436(6.6)	1(1.3)	437(6.5)	0.23	
Other	608(9.2)	9(11.4)	617(9.2)	1.46	

† Figures within the parenthesis indicate the percent of column ** Significant at 5% level

Appendix 2.

Table 2. Multiple Logistic Regression Analysis of Child Mortality

Variables	β	*S.E*	Odds Ratio (OR)	95% Confidence Interval of OR	
				Lower Limit	Upper Limit
Education of Mother					
Illiterate[Rc]	-	-	1.00		
Primary	-0165	0.286	0.85	0.4841	1.4852
Secondary and above	-0.303	0.484	0.74	0.2861	1.9072
Education of Father					
Illiterate[Rc]	-	-	1.00		
Primary	-0.472	0.308	0.62*	0.3411	1.1417
Secondary	-0.509	0.395	0.60	0.2771	1.3037
Higher 10^{+}	-0.363	0.732	0.61	0.1657	2.9204
Occupation of Father					
Service[Rc]	-	-	1.00		
Agriculture	0.480	0.388	1.62	0.7554	3.4573
Laborer	0.495	0.360	1.64*	0.8101	3.3221
Skilled manual	0.400	0.449	1.49	0.6188	3.5968
Others	0.289	0.655	1.34	0.3697	4.8201
Standard of Living Index					
Low[Rc]	-	-	1.00		
Medium	0.022	0.263	1.02	0.6105	1.7117
High	-0.459	0.600	0.63	0.1949	2.0482
Breastfeeding Status					
No[Rc]	-	-	1.00		
Yes	-1.185	0.233	0.31**	0.1936	0.4827
Timing of First Antenatal Check During Pregnancy					
None[Rc]	-	-	1.00		
1-4	-1.015	0.749	0.36	0.0835	1.5731
4^{+}	-1.416	0.733	0.24**	0.0577	1.0000
TT During Pregnancy					
No[Rc]	-	-	1.00		
Yes	-0.835	0.263	0.43**	0.2591	0.7264

Rc-Reference category ** Significant at 5% level *Significant at 10% level

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