

## Early Childhood Mortality and Affecting Factors in Developing Countries: An Experience from Bangladesh

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**Abstract:** Within a method of a cross-sectional survey that adopts following as key variable i.e., demographic, socio-economic and health-care factors, this study aimed to understand early childhood mortality rate and probable reasons in Bangladesh. In order to have probable rationality “logistic regression” of “multivariate statistical” technique is used to figure out the factors that are responsible for childhood mortality. The women who were married in the range of ageing 10-49 were asked to provide a complete history about their ‘giving birth’ for the reference period of 5 years. Statistical findings state that the rate of “neonatal”, “infant” and “under five year mortality” is, respectively 286, 461 and 525. Multi-examined statistical investigations sum up that “preceding birth interval”, “birth order” and “number of living children” are significantly affect early childhood mortality. In addition, with the functionality of socio-economy, mother’s education, source of drinking water and hygienic sanitation have also a significant impact on the rate of children mortality. Moreover, exposures to mass media, healthcare facilities have positive impact. Results also indicate that mothers who are more aware about healthcare are likely to be less mortality experience than their unaware counterparts.

**Key words:** Neonatal, Infant, child mortality, logistic regression, Bangladesh

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### INTRODUCTION

Before the time of first birth anniversary, more than 10 million children with an age of under five year die globally in each year. Of 40% of those who are unfortunate to survive until the first birth anniversary, die within the first 28 days of life (Ahmad *et al.*, 2000).

Surprisingly, 300,000 children of age less than 5 years died in Bangladesh, of whom about 75% died within one year of age and 50% died in the neonatal period (Talukder, 2007). Ibid also confirms that most deaths occurred from the poorest families. Factually, government and partners for development may take a note of that most of these deaths are preventable with low-cost interventions. Even though, these low costs interventions are available in the country but not reachable to them because of a number of constraints (i.e., finance, awareness and intention). The Millennium Development Goal (MDG)-4 targets that under-five mortality rate supposed to be reduced from 151 deaths per thousand live births in 1990 to 50 in 2015 in Bangladesh. Reduction

of neonatal, infant and under-five mortality will be necessary for achievement of the target outlined (MDG, 2005). Nonetheless, following the MDG-4 Bangladesh has made significant progress in improving the health of its children and women.

Only a few countries in the developing world is on track to achieve MDG-4 target while there has been an appreciable drop in under-five death rates from 151 deaths per thousand live births in 1990 to 82 in 2001. Based on the calculation of earlier achievement, it is necessary to maintain a pace of reducing the deaths for every respective area of child mortality (i.e., under-five, infant and neonatal) with a minimum figure of three, thirty two and two yearly in the span period of 2005 to 2015 (NIPORT, 2005). Health care for newborns mortality is a serious problem globally that receives high attention to developed world while problems seem to be somehow neglected in the developing world due to constraints in balancing the high level of priorities (UNICEF, 2009).

Infant and child mortality rates are linked to a country’s level of socioeconomic development. It reflects

the quality of life in the developing countries and uses for monitoring and evaluating health program and policy choice for further requirements. Infant and child mortality rates are also important in monitoring the progress of the MGDs. For a developing country, like Bangladesh early childhood death causing a serious problem and considered as a major obstacle to further progress to achieve the targets (Chidambaram *et al.*, 1985). The risk of death among infants and young children is closely associated with their mother's characteristics and the environment in which they live (Kabir *et al.*, 1997). Child mortality rate is a reflection of the care, health and nutrition status of children below the age of five years and also indicates the social, cultural and economic progress in the country (United Nations, 1991). NIPORT (2003) study showed neonatal deaths as the consequence of events usually associated with poor maternal health and non-availability of care during delivery or immediately after birth. Consequently, it is apparent from different studies that, particularly in the developing countries poor socio-economic condition, lack of standard demographic background, poor healthcare facilities and unhygienic setting along with mothers lack of education as well as awareness makes the situation worst.

There exists also a strong negative relationship between mothers' education level and childhood mortality. Education creates awareness about marriage and child-bearing age, interval between births, health-care and other socio-economic factors responsible for high childhood mortality. But, how education facilities can increase health-care knowledge make available to every doorstep by formal and non-formal institutions. Therefore, we feel necessary for relevant study to witness the core reason of the raised mortality factors in Bangladesh and statistical justification to support effective policy scope in the way forward. However, before designing policy scope we need some sort of analytical grounds for better approach of integrating maternal and child health and family planning programs to reduce neonatal, infant and under-five mortality which is aim in our study.

## **MATERIALS AND METHODS**

To identify the influencing factors thought, to be the causes of early childhood mortality in Bangladesh, logistic regression analysis was used. It is similar to a linear regression model but is suited to models where dependent variable is dichotomous. The data for this study satisfy the conditions of unconditional logistic regression model (Matin, 1996).

Let  $Y_i$  represent a dichotomous variable that equals 1 if the mother experienced early childhood mortality and 0 if it was not, then the  $\Pr(Y_i = 1)$ , is the cumulative density function  $F$  evaluated at  $X_i\beta$ , where,  $X_i$  is a vector of independent variables and  $\beta$  is a vector of unknown parameters. This kind of probability function has the following form:

$$\Pr(Y_i = 1) = \frac{\exp(X_i\beta)}{1 + \exp(X_i\beta)}$$

The estimation of the logistic transformation of the probability of dead;  $\Pr(Y_i = 1)$  can be represented as:

$$\ln\left[\frac{p_i}{1-p_i}\right] = \beta_0 + \beta_1 X_1 + \dots + \beta_k X_k$$

In this case, the dichotomous dependent variable is:

$$Y_i = \ln\left[\frac{p_i}{1-p_i}\right] = \beta_0 + \beta_1 X_1 + \dots + \beta_{12} X_{12}$$

The set of independent variables are: (i) Mother's age at birth, (ii) Sex of the child, (iii) Previous birth interval, (iv) Birth order, (v) Number of living children, (vi) Place of residence, (vii) Region, (viii) Mother's educational level, (ix) Sources of drinking water, (x) Access to safe sanitation, (xi) Habit of reading newspapers or magazine and (xii) TT injection during pregnancy.

With the help of the employed methodology, the study intends to investigate the selected demographic, socio-economic and healthcare factors associated with early childhood mortality in Bangladesh. This study places analytical ground for better approach of integrating maternal and child health and family planning programs to reduce neonatal, infant and under-five mortality and statistical supports to observe effective policy scope in the way forward. Descriptive statistics, bivariate analysis and multivariate analysis employs to analyze the scope. A good number of information such as selected demographic, socio-economic and healthcare factors are associated in this study and which is drawn from the Bangladesh demographic and health survey (BDHS, 2004 <http://www.unescap.org/esid/psis/population/popheadline/308/art4.asp>). The BDHS sample covers the entire population residing in private dwelling units all over Bangladesh. The 2004 BDHS sample is a stratified, a multistage cluster sample consisting of 361 Primary Sampling Units (PSUs) of which 122 in the urban area and 239 in the rural area. After the target sample was allocated

to each group according to urban and rural areas, the number of PSUs was calculated in terms of an average of 28 completed interviews of eligible women per PSU. A systematic sample of 10,811 households was selected and 10,523 were occupied of which 10,500 were successfully interviewed. In the sampling, 11,601 women were identified as eligible for the individual dialogue. Mitra and Associate (with the technical assistance from ORC Macro, NIPORT and Ministry of Health, Government of Bangladesh) conducted the survey which is utilized in this current study (NIPORT, 2003; NIPORT, 2005).

**RESULTS AND DISCUSSION**

The results in Table 1 provide insight into the nature of tradeoff between mortality rates and selected affecting factors. Here we present the mortality rates for the five years preceding the survey by selected characteristics and the mortality rates are counted here as the number of deaths per 1000 live births and examines differentials in early childhood mortality at various ages by demographic, socio-economic and health care characteristics of child and mother. The relationship between mother’s age at birth and childhood mortality (i.e., infant and under-five) rates exhibits a U-shaped pattern. Children of both the youngest and oldest mothers experience the highest mortality risks. But the mother’s age at birth is inversely related to neonatal mortality. Male children experience higher early childhood mortality than female children. The pattern of gender differentials is expected early childhood mortality (which reflects largely congenital conditions) tends to be higher for boys than girls. Short birth intervals are associated with increased risk of dying. We observe an association between short birth interval (less than 24 months) and increased mortality, even after controlling for other demographic and socio-economic variables. In Table 1, all childhood mortality rates show a sharp decline, as the birth interval gets larger. The neonatal, infant and under-five mortality rates are as twice as high for children born after an interval of less than 24 months, compared with children who are born after an interval of 48 months or more. Childhood mortality rates also tend to have a U-shaped relationship with birth order, with first births and very high order births having prominent mortality rates.

There is very little difference in mortality levels in urban and rural areas of infants. The neonatal and under-five mortality is still somewhat higher in rural areas than in urban areas. 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

**Table 1: Mortality rate due to some selected characteristics**

Characteristics	Category	Under-five	Infant	Neonatal
Mother’s age at birth	<20	84	73	56
	20-29	67	60	39
	30-39	82	71	37
	40+	99	82	26
Sex of child	Male	78	68	41
	Female	70	63	40
Preceding birth interval	0-23	105	88	52
	24-35	74	59	31
	36-47	59	51	28
	48+	54	50	27
Birth order number	1	87	79	58
	2-3	60	51	31
	4-6	77	66	36
	7+	106	97	44
Place of residence	Urban	73	65	36
	Rural	78	66	42
Educational level	No education	100	86	50
	Primary	72	63	40
	Secondary	65	57	36
	Higher	53	50	34
Safe toilet facility	Yes	65	58	36
	No facility	86	74	46
Access to electricity	No	77	67	42
	Yes	69	62	38
Listen to radio	No	78	67	42
	Yes	67	61	38
Iron tablet during pregnancy	Yes	39	36	23
	No	46	41	24
Received TT during pregnancy	No	68	59	27
	Yes	39	35	23
Number of ANC visits	No antenatal visits	52	48	32
	1	40	33	22
	2	51	44	24
	3	35	33	25
	4+	29	29	29
Postnatal care (Qualified doctor)	No	67	59	42
	Yes	57	51	34

Mortality rates are counted here as the number of deaths per 1000 live births

information about better nutrition, use of contraception to limit and space births and childhood illness and their treatment. The data shows that early childhood mortality declines sharply with increased level of mother’s education. The mortality risk of Children is associated with economic status of the household. The early childhood mortality rates are highest in limited access of hygiene sanitation, electricity usage and exposure of mass media. In addition, iron tablet and received any TT during pregnancy, ANC visits and PNC by qualified doctors also have positive role to reduce the risk of early childhood mortality. Chi square test ( $\chi^2$ ) was adopted at a minimum level of significance for testing the association of various analyzed factors (such as selected demographic, socio-economic and health care) with the mother’s experience of early childhood mortality.

Table 2 represents the association between the early childhood mortality (neonatal, infant and under-five) and the selected demographic, socio-economic and health care variables. Among the selected demographic variables,

Table 2: Association between early childhood mortality and some selected variables

Variable ( $\chi^2$ )	Under five	(d.f)	Infant	(df)	Neonatal	(df)
<b>Demographic</b>						
Mother's age at birth	8.804*	(3)	4.612	(3)	8.4*	(3)
Sex of child	1.54	(1)	0.755	(1)	0.2	(1)
Preceding birth interval	25.55***	(3)	16.8**	(3)	12.4**	(3)
Birth order number	19.66***	(3)	23.87***	(3)	24.6***	(3)
Number of living children	29.34***	(1)	32.14***	(1)	42.6***	(1)
<b>Socio-economic</b>						
Place of residence	0.36	(1)	0.025	(1)	0.8	(1)
Region	15.05*	(5)	14.74*	(5)	7.8	(5)
Educational level	54.83***	(3)	30.19***	(3)	14.2**	(3)
Source of drinking water	10.09**	(2)	9.32**	(2)	4.8	(2)
Safe toilet facility	10.62**	(1)	7.02**	(1)	4.9*	(1)
Has electricity	1.63	(1)	0.82	(1)	0.9	(1)
Has radio	2.59	(1)	0.93	(1)	0.5	(1)
Has television	4.17*	(1)	1.9	(1)	0	(1)
Exposure of newspaper or magazine	14.5***	(1)	10.19**	(1)	4.1*	(1)
<b>Health care</b>						
Tetanus injection	13.83***	(1)	10.54**	(1)	0.432	(1)
Antenatal visits for pregnancy	19.65	(7)	16.71	(7)	8.2	(7)
Place of delivery	16.55*	(7)	19.88**	(7)	32.9***	(7)
Iron tablets during pregnancy	1.9	(2)	1.21	(2)	0.116	(2)
Postnatal care (Qualified Doctor)	0.31	(1)	0.25	(1)	0.391	(1)

Significant level:  $p < 0.001$ \*\*\*,  $p < 0.01$ \*\* ,  $p < 0.05$ \*

preceding birth interval, birth order and number of living children are significantly associated with early childhood mortality. Mother's age at birth is also associated only for neonatal and under-five mortality. Socio-economic variables such as, mother's education, source of family drinking water and hygienic sanitation facilities are closely associated with early childhood mortality, though region and access to television is also associated in some context. Other socio-economic variables mentioned in Table 2 are not directly associated with early childhood mortality in Bangladesh. A significant relationship is found between early childhood mortality and health cares. Exposures to newspapers and magazines, tetanus injections and place of delivery are severely associated with child mortality. A mother who is more aware about health care is likely to less experience of early childhood mortality compared with their counterpart. Other variables like ANC and PNC visits and iron supplementation during pregnancy are not associated with childhood mortality but they need special attention.

The risk of early childhood mortality is significantly associated with mother's age at birth, previous pregnancy interval, birth order and number of living children, mother's educational level and habit of reading newspaper or magazine and TT injection during pregnancy. The likelihood of early childhood mortality is higher (Table 3) among mothers whose age at birth is 20+ compared with younger mothers. The odds ratios are 2-10 times higher compared with reference category with desired confidence intervals. The preceding birth interval is statistically significant showing that higher the birth interval is less likely to have risk of childhood mortality.

The preceding birth interval of 24 months and above have 40 to 60% less likely to have risk of childhood mortality compared with birth interval less than 24 months. Statistically significant results are also found in birth order numbers. Two to three birth orders are considered to be the ideal size with less early childhood mortality compared with single birth. This birth orders are 37 to 50% less likely to have risk of early childhood mortality compared with single birth. The number of living children also has significant affect on early childhood mortality. The odd ratios indicate that, more than four living children are highly significant and about 99% less likelihood of early childhood mortality compared with single living child with desired confidence intervals. Mother's level of education has direct influence on early childhood mortality. The higher the education level, the less likelihood of risk associated with childhood mortality.

The odds ratios indicate that, the mother having completed primary level of education has 33 to 42% less risk of early childhood mortality compared with uneducated mother. In addition, the mother had higher education, 82 to 84% less risk of mortality than their uneducated counterparts. Print media such as reading newspapers or magazines has influence on early childhood mortality in Bangladesh. The mothers who have the habit of reading newspapers or magazines at least once per week have 30 to 52% less risk of mortality, though the coefficients of neonatal and infant is relatively insignificant. Tetanus toxic injections during pregnancy have positive impact to reduce the early childhood mortality, though the odds ratio for neonatal is insignificant but TT injection has statistically significant

Table 3: Logistic regression analysis to determine the factors affecting under-five, infants and neonatal deaths

Factors	Under-five		Infant		Neonatal	
	Odds ratio	95.0% C.I.	Odds ratio	95.0% C.I.	Odds ratio	95.0% C.I.
<b>MAB</b>						
<20(r)	1.000	-	1.000	-	1.000	-
20-29	2.962**	(1.379, 6.364)	4.153**	(1.626, 10.607)	2.703	(0.982, 7.441)
30-39	5.900***	(2.644, 13.165)	7.976***	(3.014, 21.109)	4.591**	(1.575, 13.384)
40+	8.285***	(3.345, 20.523)	10.843***	(3.702, 31.762)	3.647	(0.962, 13.821)
<b>Sex of child</b>						
Male(r)	1.000	-	1.000	-	1.000	-
Female	0.969	(0.773, 1.215)	0.971	(0.809, 1.313)	0.984	(0.749, 1.420)
<b>PBI</b>						
1-23(r)	1.000	-	1.000	-	1.000	-
24-35	0.671*	(0.488, 0.923)	0.640*	(0.453, 0.905)	0.583*	(0.370, 0.918)
36-47	0.532***	(0.373, 0.758)	0.539**	(0.368, 0.789)	0.537*	(0.327, 0.883)
48+	0.421***	(0.304, 0.582)	0.477***	(0.339, 0.672)	0.480**	(0.308, 0.749)
<b>BO</b>						
1 (r)	1.000	-	1	-	1.000	-
2-3	0.679***	(0.548, 0.842)	0.622***	(0.496, 0.782)	0.512***	(0.388, 0.676)
4-6	0.875	(0.686, 1.115)	0.815	(0.630, 1.054)	0.600**	(0.433, 0.832)
7+	1.254	(0.890, 1.766)	1.248	(0.874, 1.782)	0.766	(0.469, 1.251)
<b>NLC</b>						
1 (r)	1.000	-	1.000	-	1.000	-
2-3	0.011***	(0.003, 0.11)	0.022***	(0.004, 0.120)	0.031***	(0.007, 0.132)
4+	0.004***	(0.000, 0.028)	0.007***	(0.001, 0.038)	0.009***	(0.002, 0.040)
<b>PR</b>						
Urban (r)	1.000	-	1.000	-	1.000	-
Rural	1.076	(0.692, 1.375)	1.050	(0.722, 1.525)	1.316	(0.775, 2.234)
<b>Region</b>						
Barisal (r)	1	-	1	-	1	-
Chittagong	1.029	(0.598, 1.772)	1.163	(0.635, 2.129)	1.590	(0.598, 4.224)
Dhaka	1.167	(0.691, 1.971)	1.293	(0.720, 2.323)	2.113	(0.821, 5.435)
Khulna	0.677	(0.350, 1.307)	0.805	(0.394, 1.642)	1.530	(0.528, 4.437)
Rajshahi	0.772	(0.442, 1.349)	0.801	(0.429, 1.495)	1.349	(0.506, 3.598)
Sylhet	1.200	(0.665, 2.164)	1.481	(0.778, 2.819)	2.343	(0.857, 6.410)
<b>HEL</b>						
No education (r)	1.000	-	1.000	-	1.000	-
Primary	0.679**	(0.518, 0.889)	0.628**	(0.469, 0.840)	0.543**	(0.368, 0.802)
Secondary	0.517**	(0.342, 0.782)	0.448**	(0.285, 0.706)	0.330**	(0.174, 0.628)
Higher	0.168**	(0.044, 0.639)	0.177*	(0.046, 0.677)	0.160*	(0.026, 0.985)
<b>SDW</b>						
Pipe water(r)	1.000	-	1.000	-	1.000	-
Tube well	0.765	(0.451, 1.298)	0.805	(0.451, 1.437)	0.998	(0.421, 2.367)
All others	1.143	(0.538, 2.430)	1.400	(0.634, 3.092)	1.517	(0.490, 4.693)
<b>TSTF</b>						
Yes(r)	1.000	-	1.000	-	1.000	-
No	1.035	(0.815, 1.315)	1.096	(0.771, 1.287)	1.067	(0.761, 1.497)
<b>HRM</b>						
Not at all (r)	1.000	-	1.000	-	1.000	-
At least once/week	0.483*	(0.262, 0.892)	0.565	(0.300, 1.067)	0.703	(0.301, 1.642)
<b>TT</b>						
No (r)	1.000	-	1.000	-	1.000	-
Yes	0.555***	(0.407, 0.758)	0.578**	(0.416, 0.805)	0.869	(0.545, 1.387)

r: Reference category \*p<0.05, \*\*p<0.01, \*\*\*p<0.00; MAB: Mother age at birth, HEL: Highest educational level, PBI: Preceding birth interval, SDW: Source of drinking water, NLC: Number of living children, HRM: Habit of reading newspaper or magazine, TSTF: Type of safe toilet facility, PR: Place of residence, BO: Birth order number, TT: TT injection during pregnancy

for infant and under-five mortality. The mothers who received any TT injections during pregnancy have 43 to 45% less risk of infant and under-five mortality compared with mother's who never received any TT injection. On the other hand, the sex of child, place of residence, administrative regions, source of drinking water, safe toilet facility are not statistically

significant, though they are associated with early childhood mortality as indicated by the chi-square test.

International studies on public policy confirm that the evidence on concrete policy discourse lacks in developing nations which generates heat in the discourse rather providing a decent policy of consensus (Al-Amin and Alam, 2011; Al-Amin *et al.*, 2011;

Kabir *et al.*, 2011; Zarra-Nezhad and Hosainpour, 2011; Rezaie, 2011; Rouf, 2011; Javadein *et al.*, 2011; Attitalla, 2011; Sohail and Munir, 2011; Aderibigbe *et al.*, 2010; Ahortor, 2010; Sepehrdoust, 2009; Alam, 2009; Alam *et al.*, 2009).

#### RECOMMENDATION AND CONCLUSION

This study identified the overall scenario of early childhood mortality and the factors that are affecting the problem in Bangladesh. The key factors are mother's age at the time 'birth giving', 'previous pregnancy interval', 'birth order' and level of mothers' education. Therefore, to offer a solution to the problem, 'maternal health care services' should be given a high level of preference. Statistical techniques identified some important determinants of early childhood mortality. The findings also suggest in favor of providing a fair access and available health services to all children. Widely justified integrated maternal and family planning programs are also important to reduce neonatal, infant and under-five mortality. Being an underdeveloped country, Bangladesh is in urgent need to come out with a way of that ensures sufficient information to make accurate localized risks for health-care issues to the national policy orientation.

Setting an 'agenda table' involving a number of important stakeholders, legislators and implementers with an use of the findings of this study and along with past and future studies, a policy ensuring a room for further revisions need to put in place with an important and urgent commitment of the state. The policy guideline should provide an attention on pre-pregnancy and postnatal health care for all clusters of the people of the society for reducing the shortfalls. Evident and experience suggest that improving children mortality through community and home-based strategies have also the potential to reduce children mortality. Therefore, nation needs to walk a further step on community and home-based strategies to response the commitments made by the nation towards MGD4.

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