ISSN 1022-4734

JUJSS
Vol. 31, 2012, pp. 11-24

Life table estimate of child mortality and influence of community factors on child mortality in rural Bangladesh

Anowarul Kabir[1], M. Kabir[2] and M. Shahjahan[3]

[1]Associate professor, Department of Statistics, Tejgaon College, Dhaka
[2]Professor, Department of Statistics, Jahangirnagar University, Savar, Dhaka
[3] Assistant Professor, Dept of Biostatistics, Bangladesh Institute of Health Sciences (BIHS), Dhaka

Abstract

Limited use of healthcare facilities by rural mothers is one of the important reasons for high rates of infant and child mortality in Bangladesh. Many researches established that various factors including community characteristics influence child mortality. This paper first estimates life table probability of dying by using Somoza's method and then investigates the influence of community factors on the change of child mortality in rural Bangladesh. The data for the study were derived from the Bangladesh Demographic and Health Survey 2004. The analysis shows that modern transport, distance of maternal and child welfare centres, and availability of MBBS doctor are important correlates of child mortality in rural Bangladesh. Besides availability of facilities in the community such as electricity, sanitation and access to mass media have also strong influence on child mortality. Logistic regression analysis shows that community characteristics play a significant role in the reduction of child mortality in rural areas of Bangladesh.

Keywords and Phrases: *Community, BDHS, Logistic regression model, Univarite, Bi-variate.*

1. Introduction

A group of peoples who live in a same area of a region is called community. Community participation means the people's active participation to make decision about development programme and their implementation (Sinha and Al-Sabir, 2001). Community characteristics have been recognized as an important component in improving the general condition of public health and family planning. It is especially essential to implement programmes, such as sanitation and hygiene, reproductive healthcare and child nutrition, immunization, family planning, and control of infectious diseases (Al-Sabir *et al*., 2001).

The Millennium Development Goal (MDG) on child mortality aims for a two-thirds reduction from 1990 to 2015 (Haines *et al*., 2007). Is Bangladesh on target for achieving the MDG for child mortality? The United Nation has recently assessed that, of the 10 developing-country regions, only 3 (North Africa, South Asia and Latin America) were on track to achieve the MDG 4 (United Nations, 2004).The target for Bangladesh is to reduce under-five mortality from 151 deaths per 1,000 livebirths in 1990 to 50 deaths per 1,000 livebirths in 2015 (BDHS 2004). In 2002-2006, according to the BDHS 2007 the under-five mortality rate is 65 per 1,000 livebirths. The most rapid rates of decline in mortality during 13 (1991-2004) years were in deaths of children aged in 1-4 years (9.3% per year), followed by post- neonatal mortality(6.0 % per year).The slowest decline was in neonatal deaths(2.6% per year). If these declines remain at the same pace, under-five mortality per 1.000 live births in 2015 will be 38 almost a quarter lower than the target. Using this logic, Bangladesh appears to be on track to achieve the MDG 4 targets by fair margin (BDHS 2007). Child survival of Bangladesh has improved since the mid 1980s. The pace of decline for child mortality than for infant mortality; the child mortality rate declined by 42% (63 per 1,000 live births in 1980 and 37 per 1,000 livebirths in 1996), while the infant mortality rate declined by 30%

over the same periods (BDHS 1996-19997).In BDHS 2007 the child mortality rate has a notable decline (14 per 1,000 live births), Despite reduction in infant and child mortality in Bangladesh, the level of infant and child mortality is still considered to be high because healthcare facilities in Bangladesh remain limited and inadequate. Besides, lack of health personnel, medicines, and other facilities are not uniformly available. Therefore, infant and child mortality is still a burning problem in Bangladesh (Mondal *et al*., 2009). Various factors including community factors also influence child mortality.

Huda (1980) investigated the impact of community factors on child mortality in Bangladesh. He used seven community variables, such as levels of agricultural modernization, urbanization, education, health surveillance, medical facilities, living condition, and transport facilities. Agricultural modernization, medical facilities, and surveillance were inversely associated with mortality while the remaining variables have showed a strong relationship with child mortality. Benefo and Schultz (1996**)** found that the economic resources of households, maternal education, access to market, and food prices are all associated with child mortality. A residence closer to a health clinic (public or private) is not a good predictor of child mortality in Ghana, perhaps because local proximity to a clinic does not capture the effect of prices for, or quality of, clinic-provided healthcare. Sastry (1997) found that child mortality rates are substantially and significantly lower in urban Brazil. His study suggested, however, that the urban advantage does not simply reflect the underlying differences in socioeconomic and behavioural characteristics at the individual and household levels; rather, the community variables appear to play an independent and important role. He also found that the effects of community characteristics on child survival were moderated by household and socio economic factors, especially maternal education. The differences in socioeconomic characteristics are, therefore, important in explaining the rural-urban child mortality differentials. In 1994, Frankenberg argued in another study that if increase in the availability of community institutions decrease mortality, the parameters of the community-level variables should be negative. The coefficients on maternity clinics, health centre, and doctors are negative, as is the variable indicating that a majority of village residents have access to private toilet. The effect of increasing access to doctors is small but encouraging. The presence of doctors does lower mortality risks. Ahmed and Hussein (2010) examined the households' data from the central region of Sudan to examine factors that affect infant and child mortality. Education of mother and father, community variables, and household income per adult were used. The ordinary least squares found that child mortality was inversely associated with household income per adult, community variables, and parental education. The effect of mother's education was more significant than father's education, and mother's age was also found to be the most important factor that influences child mortality.

There has not been much works to determine the life table estimates of infant and child mortality by using Somoza's life table technique and to investigate the influence of community characteristics on child mortality in rural Bangladesh. BDHS 2004 collected a set of community characteristics during the main survey from the same sample clusters where individual women were also interviewed. The objective of this paper first to estimate the life table estimates of infant and child mortality and to assess the community factors which have influence on infant and child mortality in rural Bangladesh.

2. Data and Methodology

The present study used data derived from the Bangladesh Demographic and Health Survey (BDHS)-2004.The 2004 BDHS sample is a stratified multistage cluster sample consisting of 361 PSUs (Primary sampling units). Among the clusters 239 were in the in the rural area. A systematic sample of 10,811 households was then selected. All ever-married women in the selected households were interviewed to collect birth and death history data. . The total number of births and deaths aged under-five years were 33830 and 6304 respectively. In this analysis only death from rural area (about 80%) aged under five years 10 years preceding the survey was considered. The individual women were linked with the clusters from where the community characteristics were collected. Somoza's procedure of calculating life table (Somoza, 1980) was used. Bivariate analysis has been carried out to assess the association of individual and community characteristics with under-five mortality using chi-square (χ^2) statistic. To identify the influence of community characteristics on child mortality logistic regression model was used.

3. Results

3.1 Somoza's life-table estimates

Somoza (1980) described the procedure used in the construction of life table for birth- cohorts. According to the scientific report "Illustrative Analysis: Infant and child mortality in Columbia" by Somoza in 1990, the notations of life table are given below.

(i) x: x denotes the exact age at start of interval.

(ii) n: n denotes the length of interval.

(iii) D_i: D_i denotes the number of children dying at age i (i denotes the sub- script of interval).

(iv) Si: Si denotes the number of surviving children at age i (i denotes the sub script of interval).

(v) ${}_nE_x$: ${}_nE_x$ denotes the total time lived in the interval.

(vi) ${}_nm_x$: ${}_nm_x$ denote the annual mortality rate between exact age x and $x+n$.

$${}_nm_x = Di \, / \, {}_nE_x$$

(vii) ${}_np_x$: ${}_np_x$ denotes the probability of survival between age x and $x+n$.

$${}_nP_x = 1- \{2\ n.\ {}_nm_x / \ (2 + n.\ {}_nm_x)\}$$

(viii) l_x: l_x denotes the probability of surviving to exact age x. which is defined as

$$l_{x+n} = l_{x} \, . \, {}_np_x$$

with an initial value $l_0 = 1$

(ix) $q_{(x)}$: $q_{(x)}$ denotes the cumulative probability of dying before exact age x, which is defined as,

$$q_{(x)} = 1 - l_x \, .$$

3.1.1 Calculation of child mortality rate for individual, housing and community characteristics

Rates of infant and child mortality were calculated in this study using life table using the Somoza's method. Somoza (1980) developed the procedure for constructing of life tables. Each child is observed from birth. For each child we know whether he/she is alive or dead at the time of the survey, and his/her age at the time of the survey or at death. In both the cases age is grouped in the following categories, indexed by the subscript *i*.

Table 1: Age-group of children and total number of deaths in10 years preceding the survey

Subscript	Age Groups	No of deaths
1	Under 1 month	525
2	Between 1 and less than 3 months	142
3	Between 3 and less than 6 months	69
4	Between 6 months and less than year	75
5	Between 1 and less than 2 years	113
6	Between 2 and less than 5 years	74
7	Between 5 and less than 10 years	5
8	10 years or more	0
	Total number of deaths	1,003

The first step is to calculate the time lived by each child within each of the above age- groups except the last one. The concept of time lived is best explained by reference to an example. Consider a child age 1 in completed year, i.e. a child who has reached the first birthday but not the second. For the purpose of the example, it is immaterial whether the child is alive or dead at the time of the survey. The time lived by that child includes all age groups preceding the first year, i.e. he/she has lived one twelfth of a year between ages 0 and 1 month, two-twelfths of a year between ages 1 and 3 months, three-twelfths of a year between ages 6 months and a year and so on. The total time lived during these ages is 1 year (Somoza, 1980).

This procedure leads to an estimate of total time lived in each age interval by the sample of children. This estimate is expressed in years and denoted nEx, where x indicates the lower bound and n denotes the width of the interval or age group considered. The ratio between the number of deaths reported between exact ages x and $x+n$, denoted nDx, and the total time lived in the interval nEx, defines the annual mortality rate for the age interval, denoted ${}_nm_x$

$${}_nm_x = nDx / nEx.$$

From the annual mortality rate for ages x to x+n we can estimate the probability of surviving from age x to age $x+n$, denoted by nPx in life table notation as follows:

$$nPx = 1- 2\, n\, {}_nm_x / (2 + n\, {}_nm_x).$$

This relationship represents as approximation, as it is based on the assumption that the life table survivorship function $l(x)$ is linear between ages x and $x+n$, an assumption which is not entirely correct. The approximation, however, is satisfactory in all cases considered in this study. The range from 0 to 5 years where the assumption of linearity would be grossly incorrect has been subdivided into six age groups within each of which the assumption is admissible.

Table 2 illustrates the calculation of the quantities defined above, namely the time lived the annual mortality rate and probability of surviving each age interval. The illustration uses data for the sample for the 10 years preceding the survey of the birth history, consisting of 11,360 children for whom we know the survivorship status at the time of the survey.

Table 2: Illustration of calculation of time lived and mortality rate by age in 10 years preceding the survey.

i	*x*	*n*	D_i	S_i	$\sum_{j=1}^{8}(D_j+S_j)$	*nEx*	$_nm_x$	$_np_x$	*lx*	*nqx*
1	0	1/12	525	61	11,360	922.25	0.56926	0.953661	1	0
2	1/12	2/12	142	302	10,774	1758.667	0.080743	0.986633	0.953661	0.046339
3	3/12	3/12	69	302	10,330	2536.125	0.027207	0.993221	0.940913	0.059087
4	6/12	6/12	75	461	9,959	4845.5	0.015478	0.992291	0.934535	0.065465
5	1	1	113	1,020	9,423	8856.5	0.012759	0.987322	0.92733	0.07267
6	2	3	74	3,160	8,290	20019	0.003696	0.988972	0.915573	0.084427
7	5	5	5	5,051	5,056	12640	0.000396	0.998024	0.905476	0.094524
8	10	-	-	-						
Total			1,003	10357						
Total births				11,360						

The first two columns establish a correspondence between the subscript i, used for simplifying the presentation, and the symbol *x* and *x+n* which denote respectively the lower bound and the width of 3 months or three twelfths of a year.

The next two columns show the distribution of the 11,360 children observed by survivorship status and age at the interview or at death. The symbol Di denotes the number of children dying at age i and Si the number of surviving children at age i at the time of survey. Thus for example, there are D_4 = 75 deaths of children aged between 6 months and less than 1 year, and S_4 =461 children of those ages surviving at the time of the survey.

The next column contains an auxiliary quantity which simplifies calculation of the time lived in each age. Time lived *nEx* is calculated as follows:

$$nEx = n\sum_{j=1}^{8}(Dj + Sj) - ½\, n\,(Di+Si).$$

For example, the time lived between ages 0 and 1 months is E_1 =1/12×11360- ½ * 1/12× (525+61) = 946.67-24.42= 922.25. To obtain the result we first multiplying the width of the interval (one twelfth) by the total number of births in the sample (11,360), obtaining 946.67. Next we calculated the time not lived in the interval by the children who died in the interval (525) and those who had not completed the interval (61), which is ½×1/12×(525+61) =24.42. Subtracting the later quantity from the former gives

$$_{1/12}E_0 = 946.67-24.42= 922.25$$

The annual mortality rate for the interval of 0 to 1/12 years is given by the ratio $_{1/12}D_0$ / $_{1/12}E_0$ = 525/922.25 = .56926 i.e. $_{1/12}m_0$ = .56926.

The probability that a live birth will survive the first month may then be estimated as

$$_{1/12}P_0 = 1-2\,(1/12)\ _{1/12}m_0 / (2+ (1/12)\ _{1/12}m_0)$$
$$= 1-2\,(1/12) ×.56926 / (2+ (1/12) × .56926))$$
$$= 0.953661.$$

Having calculated the function $_nP_x$, we may calculate any other table function, in particularly the probably l_x of surviving to exact age x, which is defined as

$$l_{x+n} = l_x\ {}_np_x$$

with an initial value $l_0 = 1$. Thus the probability of surviving to age 1 month is $l_{1/12} = l_0\, {}_{1/12}P_0 = 0.953661$ and to age 3 months is $l_{3/12} = l_{1/12}\, {}_{1/12}P_{2/12} = 0.986633$. One may also calculate the cumulative probability *q(x)* of dying before exact age x, defined as

$$q(x) = 1 - l_x.$$

For example the probability of dying in the first month after birth is 1-0.953661= 0.046339. So the neonatal mortality (The probability of dying in the first month of life) rate is (0.046339×1000) = 46.3 per 1,000 livebirths, the infant mortality (The probability of dying before the first birthday) rate is 65.46 per 1,000 livebirths and child (aged 1-5 years old) mortality was 29.06 per 1000 live births.

The illustration uses data for the sample for the five years preceding the survey of the birth history, consisting of 7,002 children for whom we know the survivorship status at the time of the survey. The infant mortality rate of the sample for five years preceding the survey is 66.4 per 1,000 livebirths and child mortality rate is 21.76 per 1,000 livebirths.

Table 3: Illustration of calculation of time lived and mortality rate by age in 5 years preceding the survey.

i	x	n	D_i	S_i	$\sum_{j=1}^{8} (D_j+S_j)$	nEx	${}_nm_x$	${}_np_x$	lx	nqx
1	0	1/12	285	69	7002	568.666	0.501172	0.95909	1	0
2	1/12	2/12	71	372	6647	1070.91	0.066298	0.989011	0.95909	0.04091
3	3/12	3/12	44	375	6204	1498.62	0.02936	0.992687	0.94855	0.05145
4	6/12	6/12	47	574	5785	2737.25	0.017171	0.991451	0.941614	0.058386
5	1	1	48	1269	5164	4505.5	0.010654	0.989403	0.933564	0.066436
6	2	3	8	3839	3847	5770.5	0.001386	0.99585	0.923671	0.076329
7	5	5	1	0	1	2.5	0.4	0	0.919851	0.080149
8	10	-	-	-						
Total			504	6498						
Total births			7,002							

The results from Table 2 and 3 the child mortality rates were shown in (Table 4 and Figure 1)

Table 4: The child mortality rate for 5 and 10 years preceding the survey.

Reference period	Child mortality rate (per 1,000 livebirths)
5 years preceding the survey	22
10 years preceding the survey	29

In BDHS 2004 the child mortality rate was 24 per 1,000 live births and 10 years preceding the survey the CMR was 30 per 1,000 live births whereas using Somoza's life table technique the CMR was 22 per 1,000 live births in 5 years preceding the survey and 29 per 1,000 live births in 10 years preceding the survey. There was a little difference between BDHS and Somoza's life table estimates.

We selected 9 community variables and 5 individual and household variables in his analysis. We calculated child mortality rate by using same somoza's procedure. For example calculation of child mortality for the community variable distance to maternal and child welfare centre. First we got a table of cross tabulation by child alive and distance to maternal and child welfare centre. SPSS (version 17.0) was used for the cross tabulation then columns of life tables were calculated using MS excel software.

Table 5 represents the calculation of different components of under-five mortality rates for distance to MCWC. Similarly the child mortality rates for the selected community and individual and household variables followed by the same procedure. The results are shown in table 6.

Figure 1. The child mortality rate for 5 and 10 years preceding the survey

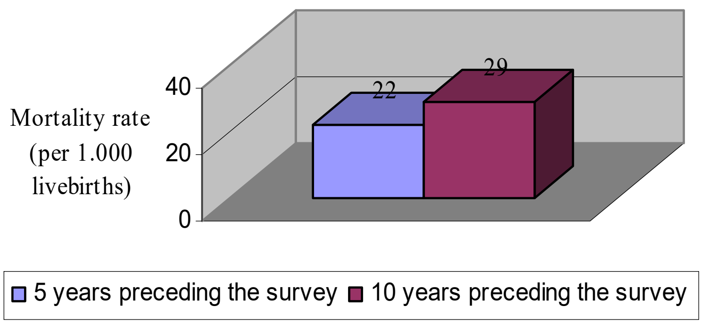

Table.6 represents the child mortality rates and values of chi-square test by selected community and individual characteristics. Among community characteristics, the information suggests that, better communication such as availability of modern transports connected to the thana headquarters is significant ($p<0.05$) and associated with child mortality. Availability of modern transports connected with thana headquarters had lower mortality than other type of transport. In our analysis we used the distance of the villages from medical facilities as indicator of the accessibility of the health facilities. Underlying this is the assumption that geographical distance is one determinant of the ability of rural Bangladeshis to make use of health facilities. The community characteristics such as distance to maternal and child welfare centre (MCWC), post office, and an MBBS doctor were significantly ($p<0.10$) related to child mortality, All individual characteristics were highly ($p<0.001$) significantly associated with child mortality. The information suggests that children of 1-4 years of age, whose mothers were illiterate, had unhygienic toilet facility, no electric connection to their residence and had no access to mass media experienced higher mortality rate.

Table 5: Calculation of infant and child mortality rate using life table method by distance to maternal and child welfare centre (10 years preceding the survey).

i	*x*	*n*	D_i	S_i	$\sum_{i=1}^{8}(D+S)$	*nEx*	$_nm_x$	$_np_x$	*lx*	*nqx*
		<5 km								
1	0	1/12	23	4	652	53.20833	0.4322631	0.9646154	1	0
2	1/12	2/12	16	13	625	101.75	0.1572481	0.974131	0.9646154	0.0353846
3	3/12	3/12	4	17	596	146.375	0.0273270	0.9931915	0.9396617	0.0603383
4	6/12	6/12	3	28	575	279.75	0.0107238	0.9946524	0.933264	0.066736
5	1	1	3	60	544	512.5	0.0058536	0.9941634	0.9282733	0.0717267
6	2	3	3	183	481	1164	0.0025773	0.9922978	0.9228554	0.0771446
7	5	5	1	294	295	737.5	0.0013559	0.9932432	0.9157474	0.0842526
8	10	-	-	-						
Total			53	599						
Total births				652						
		≥5 km								
1	0	1/12	470	54	9,957	807.9166	0.5817431	0.9526687	1	0
2	1/12	2/12	118	266	9,433	1540.166	0.0766150	0.9873118	0.9526687	0.0473313
3	3/12	3/12	62	271	9,049	2220.625	0.0279200	0.9930443	0.9405811	0.0594189
4	6/12	6/12	67	402	8,716	4240.75	0.0157990	0.9921315	0.9340386	0.0659614
5	1	1	102	889	8,247	7751.5	0.0131587	0.9869273	0.9266892	0.0733108
6	2	3	67	2742	7,256	17554.5	0.0038166	0.9886151	0.9145748	0.0854252
7	5	5	4	4443	4,447	11117.5	0.0003597	0.9982027	0.9041625	0.0958375
8	10	-	-	-						
Total			890	9,067						
Total births				9,957						

3.2 Multivariate analysis

To understand the significance of the factors when taken together, logistic regression was used for identifying the risk factor for child mortality. We investigated it by using multivariate logistic regression model. The purpose of logistic regression analysis was to identify which community variable found as a risk factor for child mortality. This study also tried to identify the risk factors of child mortality at individual and household level. Two important reasons for selecting the logistic regression methods: (a) it is a very flexible and very easy to use the mathematical function and (b) biologically meaningful interpretation of the coefficients exist in it. Let Yi be the binary response dependent variable which takes only two values 1 and 0 with probability P_i and 1-*Pi* respectively, so the logistic regression model of analysis is given in the following

$$Y_i = \log_e\left\{\frac{Pi}{1-Pi}\right\} = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_k X_k.$$

Here, Y_i= Log odds, β_0=Intercept term, β_i= Regression co-efficient of the respective variables and X_i= Independent variables. To estimate the co-efficient βi's employing the linear logistic model, the SPSS software version 17.0 is used which allows the derivation of fairly simple maximum likelihood estimation. The maximum likelihood is computed for each of the variables a likelihood ratio test is performed.

Table 6: Child mortality rate and values of chi-square test for the 10 years preceding the survey by selected community and individual characteristics (rural data only)

Variable and Category	No of children Alive	Dead	Total	Child mortality rate (per 1,000 livebirths)	Value of chi-square
Community characteristics					
Type of transport to thana headquarters					
Modern	4,551	65	4,616	19	3.42**
Others	6,308	120	6,428	23	
Type of roads to village					
All weather (paved roads)	6,012	107	6,119	22	.131^{Insig}
Others	5,094	86	5,180	21	
Members of Grameen Bank					
No	4,460	85	4,545	25	1.54^{Insig}
Yes	6,673	106	6,779	17	
Immunization by satellite clinics					
No	479	6	485	20	.85^{Insig}
Yes	9,089	167	9,257	24	
Distance (km) to maternal and child welfare centre (MCWC)					
<5	644	6	650	17	2.49*
≥5	9,784	174	9,958	29	
Distance (km) to weekly market					
<2	8,065	137	8,202	23	.047^{Insig}
≥2	3,012	53	3,065	19	
Distance (km) to post office	8,310	135	8,445	22	1.99*
<2	2,857	58	2,915	24	
≥2					
Distance (km) to pharmacy					
<2	10,223	178	10,401	22	.015^{Insig}
≥2	891	15	906	25	
Distance (km) to MBBS doctor					
<2	4,300	85	4,385	28	2.36*
≥2	6,777	107	6,884	29	
Individual characteristics					
Mothers education					
No education	5,168	126	5,294	35	27.53***
Primary, secondary and higher	5,998	67	6,065	24	

Variable and Category	No of children		Total	Child mortality rate (per 1,000 livebirths)	Value of chi-square
	Alive	Dead			
Region					
Barisal	761	15	776	31	
Chittagong	2,265	62	2,327	40	
Dhaka	3,196	53	3,249	30	23.85***
Khulna	1,136	9	1,145	16	
Rajshahi	2,826	34	2,860	19	
Sylhet	984	19	1,003	29	
Access to mass media					
No	4,585	113	4,698	28	23.80***
Yes	6,577	80	6,657	16	
Access to electricity					
No	8,129	164	8,293	27	14.26***
Yes	3,037	29	3,066	13	
Type of toilet facility					
Unhygienic	5,311	116	5,727	28	11.95***
Hygienic	5,854	77	5,931	17	

***p<0.001 **p<0.05 *p<0.10

Table. 7 show the specific factors which influenced child mortality using logistic regression method. The results revealed that access to health facilities and modern transports were significantly influenced under-five mortality. It is evident from Table. 7 modern transport emerged as the strongest determinants of child mortality; it had a highly significant (p<0.001) relationship with child mortality. Children of 1-4 years of age whose mothers travel to thana headquarters by modern transports experienced 47% lower risks of deaths compared to other type of transports. Mothers of the children who live within 5 km away from where they reside to the maternal an child welfare centre(MCWC), their children had about 57% lower risks of deaths compare to those children whose mothers live more than 5 km from the MCWC. Geographical distance to the different health facilities is an important factor on the reduction of child mortality (See Table 7). If the distance increased, the child mortality also increased. All individual variables were found to be significant except region. Mothers had access to mass media had also 27% less risks and used hygienic toilet had 33%lower risks of child mortality. Access to electricity had a highly significant with child mortality. Those children whose mothers enjoy access to electricity had 52% lower risks of death than that of the children whose mothers did not had the electric connection to their residence. Educated mothers had also lower risk of child death.

Table 7: Logistic regression of child mortality by selected community and individual characteristics

Variable and category	Co-efficient β	S.E.	Sig	Odds Ratio Exp(β)
Community characteristics				
Type of transport to thana headquarters				
Modern	-.622	.190	.001***	.537
Others	…….	……	……	1.00
Type of roads to village				
All weather (paved roads)	-.189	.175	.280	.827
Others	…….	…….	…….	1.00
Members of Grameen Bank				
No	…….	……	……..	1.00
Yes	-.012	.178	.947	.988
Immunization by satellite clinics				
No	…….	……	……..	1.00
Yes	-.258	.690	.708	.772
Distance (km) to MCWC				
<5	-.828	.521	.112	.437
≥5	…….	……	……..	1.00
Distance (km) to weekly market				
<2	-.119	.217	.583	.888
≥2	…….	……	……..	1.00
				Contd
Distance (km) to post office				
<2	-.031	.214	.887	.970
≥2	…….	……	……..	1.00
Distance (km) to pharmacy				
<2	-.284	.376	.451	.753
≥2	…….	……	……..	1.00
Distance (km) to MBBS doctor				
<2	-.470	.178	.008***	.625
≥2	…….	……	……..	1.00
Individual characteristics				
Mothers education				
No education	…….	……	……..	1.00
Primary, secondary and higher	-.353	.181	.051**	.702
Region				
Barisal	…….	……	……..	1.00
Chittagong	.778	.367	.034	2.176
Dhaka	-.125	.363	.731	.883
Khulna	-.806	.544	.139	.447
Rajshahi	-.412	.381	.279	.662
Sylhet	.076	.427	.859	1.079
Access to mass media				
No	…….	……	……..	1.00
Yes	-.321	.179	.073*	.725

Access to electricity				
No	…….	……	……..	1.00
Yes	-.723	.276	.009***	.485
Type of toilet facility				
Unhygienic	…….	……	……..	1.00
Hygienic	-.388	.186	.036**	.678
Constant	-3.379	.833	.000	.034
Chi-square	82.358		.000	
-2 log-likelihood	1461.569			

***p<0.001 **p<0.05 *p<0.10

4. Discussions and Conclusions

The under-five mortality rates with community characteristics are in expected pattern. For the community variables the distance to maternal and child welfare center and MBBS doctor are negatively associated child mortality. These two community characteristics emerged as the important determinants of child mortality because their existence in the community helps mothers to receive treatment for their sick children. As the distance increases so does the child mortality rates. Access to modern transport of the community is associated with lower mortality rate than that of other types of transports. Bivariate analysis of the individual and community variables is significantly associated with under-five mortality.

It is to be mentioned here that there is no straight forward relation between community characteristics and under-five mortality. The important limitations of the study are that some of the community factors such as (i) the small sample size as mortality is a rare event, (ii) the time reference of the community characteristics, and (iii) the distance to the facilities are not in linear form. Both bivariate and logistic regression analysis show that community characteristics, social, economic, cultural and health intervention are related in a complex ways with child mortality.

Logistic regression analysis revealed that, modern transport connecting to the thana headquarters, close distance to the MCWC and availability of an MBBS doctor in the community had significant influence on child mortality. Among the community characteristics some are found to be associated with the child mortality and some are not because of the complexity in their relationships. For instance, community education levels may affect child mortality by influencing norms and attitudes regarding child care and reproductive behavior. At the community level mass media also plays a significant role in disseminating the various child health and reproductive health care programmes.

The analysis of community characteristics and their associations with under-five mortality will be an important strategy to achieve MDG 4. The results show that, there is an indirect relationship between the community characteristics and child mortality. However, logistic regression analysis shows that, some community variables are statistically significant implying that availability of health facilities and good communication link with the health facility will play a significant role in the reduction of child mortality in rural Bangladesh. Community's awareness about child health through mass media will be equally important to the reduction of child mortality.

References

Ahmed, S. M. H. and Hussein, M. A. (2010). Infant and child mortality in Sudan: Case of central region, *Journal of US-China Public Administration*, ISSN U.S.A. **7**(3) (Serial No.53): 1548-6591.

Al-Kabir, A. (1984): Effect of Community Factors on under-five Mortality in Rural Bangladesh. World Fertility Survey (WFS) London, Scientific Reports. No 56.

Al-Sabir, A., Abdullah, A. K. M. and Badra, S. K. (2001): Community Participation in Bangladesh Health and Family Planning Program, *Dissemination Activities and Lessons Learned* National Institute of Population Research and Training (NIPORT), Dhaka, and October 2001.

Banefo, K. and Shultz, T. P. (1996): Fertility and Child Mortality in Cote d'Ivoire and Ghana, *The World Bank Economic Review*, **10**(1):123-158.

BDHS (Bangladesh Demographic and Health Survey) 2004: *National Institute of Population Research and Training* (NIPORT), Mitra and associates and ORC Macro, 2005. NIPORT, Dhaka.

BDHS (Bangladesh Demographic and Health Survey), 2007. *National Institute of Population Research and Training* (NIPORT), Mitra and associates and ORC Macro, 2009. NIPORT, Dhaka.

Frankenberg, E. (1994): The Effects of Access to Health care on Infant and Child Mortality in Indonesia. Labor and Population Programme, Working paper series 94-01:1-35.

Haines, A., Sanders, D., Lehmaan, U., Rowe, A. K., Lawn, J. E., Jan, S., Walker, D. G. and Bhutto, Z. (2007): Achieving Child Survival Goal: Potential Contribution of Community Health Workers, *www.thelancet.com*. **369:**2121-2131.

Huda, K. S. (1980): Differential in child mortality in Bangladesh: An analysis of individual and community factors, University Microfilms International, Michigan and London.

Mondal, M. N. I., Hossain, M. K. and Ali, M. K. (2009). Factors Influencing Infant and Child mortality: A case study of Rajshahi district, Bangladesh. *Journal of Human Ecology:* 31-39.

Sastry, N. (1997): What explain rural and urban differential in child mortality in Brazil? *Social Science and Medicine*, **44**(7):989-1002.

Sinha, A. C, and Al-Sabir, A. (2001). Community Participation in the Bangladesh Health and Family Planning Program, *A Presentation to Program Managers and Community Leaders*, National Institute of Population Research and Training, Dhaka, Bangladesh.

Somoza, J. L. (1980): Illustrative Analysis: Under-five Mortality in Colombia .WFS Scientific Report, Number 10, International Statistical Institute.

United Nations, (2004): *World population monitoring 2002: Reproductive rights and reproductive health*. New York, Department of Economic and Social Affairs (ST/ESA/SER.A./215). Available at www.un.org.