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Women's Status and Early Childhood Mortality in Bangladesh

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ABSTRACT: In this article , an attempt has been taken to focus light on the status of women in Bangladesh and also see its effect on early childhood mortality controlling the effect of other associated determinants. This paper examines the proposition that constraints on women's status adversely affect the survival of their children. BDHS 2007 data have been used to construct indices of women's household autonomy and authority , which are then linked to longitudinal data on survival of their neonates.

Key words: Infant mortality rate (IMR), Multinomial logistic regression, Neonatal mortality rate (NMR), Post-neonatal mortality rate (PNMR).

I Introduction: In global context, Bangladesh is now world's eighth populous country having 148.50 million people, but occupying only 3000th part of the world's land space. About 2.30 million people are currently being added to its existing population; and such pace will continue in the next one decade and a half, even if Bangladesh achieves 2- child family norm (i.e. TFR of 2.1 or NRR=1) in any time between 2015 and 2020. An important consequence of this increased population is its effect on early childhood mortality which includes both the infant mortality (neonatal and post neonatal mortality) and child mortality.

Infant mortality rate (IMR) indicates the number of deaths of babies less than one year of age per 1,000 live births. The rate in a given region, therefore, is the total number of newborns dying under one year of age divided by the total number of live births during the year, then all multiplied by 1,000. Talking about neonatal mortality, early neonatal mortality refers to a death of a live-born baby within the first seven days of life, while late neonatal mortality covers the time after 7 days until before 28 days. The sum of these two represents the neonatal mortality. Neonatal mortality and post neonatal mortality (covering the remaining 11 months of the first year of life) are reflected in the Infant Mortality Rate. The child mortality rate or under-5 mortality rate is the number of children who die by the age of five, per thousand live births.

The term "status" includes not only personal and proprietary rights but also duties, liabilities and disabilities. In case of Bangladesh, women's status means her personal rights, proprietary rights, her duties, liabilities and disabilities vis-à-vis the society and her family members. The status of women is an important factor affecting the overall development of a country. The total development of Bangladesh will undoubtedly be hampered if the status of women, constituting about fifty percent of the country's population, remains as low as it is today.

In Bangladesh , as elsewhere in the region , gender inequality is deeply enclosed in the overall structure .Social controls at all levels deprive their subservience to patriarchal control . In Bangladesh, traditionally the role of women has been that of daughter, wife and mother .Their activities in the socio-cultural environment of Bangladesh are primarily domestic in nature confined to the four walls of home. Women are vulnerable in every sector in Bangladesh. They have also lack access to justice on human rights, because of race, ethnicity, culture, religion, social and economic class distributions. In a word, women are discriminated against from home to parliament in Bangladesh.

Our objective hence is to check whether there is any association between women's status and early childhood mortality not only in the presence of other associated variables like maternal age ,parental education, sex of child, residence , household income , religion , length of preceding birth interval , duration of breastfeeding , parental occupation , place of delivery , delivery assistance etc. but also controlling their effect and see the impact of women's status on early childhood mortality.

II. Literature review: A good number of studies have been done in the area of infant mortality in Bangladesh. Most of them, however, concentrated on studying the levels, differentials and determinants of infant and child mortality. Here, some of the previous works regarding developed countries, developing countries as well as Bangladesh is presented in summarized form.

Previous demographic research provides estimates of some of the main effects analyzed in this paper ,though not in a unified framework :Madise and Diamond (1995) for analysis of the effects of birth-spacing on neonatal mortality, and Zenger (1993) or Frankenberg (1998) for analysis of the effects of neonatal mortality on birth – spacing . The limitation of these studies is that their estimates cannot be given a causal interpretation and overcoming this is our main contribution to demographic research . This paper also contributes to demographic literature on neonatal death clustering (e.g.Guo 1993, Zenger 1993, Sastry 1997a,b) by emphasizing the distinction between between-family heterogeneity and causal mechanisms such as birth-spacing, learning or maternal depression that operate within families. In this, it takes forward the work of Arulampalam and Bhalotra (2004a,b),who explore the role of state dependence in explaining neonatal death clustering , but who do not simultaneously analyze birth spacing .

Early economic work examines the determinants of neonatal mortality separately from infant mortality (Corman and Grossman 1985; Corman, Joyce and Grossman 1987). Since then, almost all economic work on infant mortality utilizes death within a year as the dependent variables unit of measure (Almond, Chay, and Lee 2005; Black, Devereaux, and Salvanes 2007; Royer 2009; Oreopolous, Stabile, Walld, and Roos 2006). A minority of papers study neonatal (death within a month) and post-neonatal (death within the following 11 months) mortality as outcomes of interest (Doyle et al. 2003 and Conley, Strully, and Bennett 2006).

Ahmed Al-Kabir (1984) identified religion as one of the important covariates of infant mortality in Bangladesh. He found that infant mortality to Muslim mothers was significantly lower than

mortality mothers belonging to other mothers.Many studies identified that among socioeconomic variables, education of mother plays a crucial role in the child survival and observed an inverse relationship between education of mother and infant and child mortality (Bhuia and Streatfield, 1991; Caldwell and Auffery, 1989; Hossain, 2000; Majumdar and Islam; Pandey et al., 1998).In a study, Shaikh and Rahman (1991) documented that mother's occupation has no impact on infant mortality in rural Bangladesh, but there is a volatile difference in infant mortality between children of employed and unemployed in urban areas.

Research shows that female children have higher mortality rate than male children due to the gender-based allocation of food and health service (D'Souza & Chen ,1980;Chen et al.,1981; Das-gupta , 1995 ; Ahmed et al., 2000).Gender bias also affects the survival of adult women ,who have lower life expectancies than men of equivalent age (Mumtaz & Fatima,1992). Sons are preferred over daughters because male children are believed to provide greater security to parents than female children (Das Gupta & Li, 1999). Reproductive decision making is very much affected by the gender composition of children born(Schuler & Hashemi, 1993a ; Schuler , 1994 ; Rahman, 1998; Mannan,2002),and boys are favored for schooling and household resource allocation (Mason , 1993). Research conducted by Balk (1997) has showed that many women who are allowed to take a sick child to the hospital or meet an unknown man such as a health worker only in a dire emergency .Constrained autonomy may therefore impact their role as health decision-makers for the children and the health outcomes of their children .

III. Data and methodology: In order to examine the objectives of the survey, data from 2007 Bangladesh Demographic and Health Survey (BDHS) has been used. It is the fifth BDHS undertaken in Bangladesh. The survey was conducted under the authority of the National Institute for Population Research and Training (NIPORT) of the Ministry of Health and Family Welfare. The data for mortality estimates were collected in the birth history section of the Women's Questionnaire. The 2007 BDHS asked all ever-married women age 15-49 to provide a complete history of their live births, including the sex, month, and year of each birth, survival status, and age at the time of the survey or age at death. Age at death was recorded in days for children dying in the first month of life, in months for children dying before their second birthday, and in years for children dying at later ages.

This study considers bivariate analysis of infant and child mortality for some selected independent variables. For the sake of brevity, multivariate analysis to identify the net and interaction effects of covariates for early childhood mortality is also performed using multinomial logistic regression model. The dependent variable used in the multinomial logistic regression model analysis is neonatal, post-neonatal and child survival time. It is measured as the duration starting from the infant birth to death, if the event occurred or from the infant birth to the survey date for censored data. Categories of independent variables of the study are: socio-economic variables which include type of place of residence, religion, region, father's education, wealth index, place of delivery and exposure to mass media; demographic variables which include age of mother at child's birth, birth order, sex of the child, sex of the household head and preceding birth interval; household environment variables which include source of drinking water, type of toilet facilities and housing materials and women's status related variables which include mother's education ; women's

authority consisting of decision making about spending money, decision making about child's health care, decision making about own health care, decision making about household purchases and women's autonomy consisting of decision making about visiting family or relatives, women's employment and decision making about going to health centers.

Bivariate analysis: To determine the factors influencing early childhood mortality and to select covariates for multivariate analysis, we are to perform bivariate analysis. With the bivariate analysis, we are testing the hypotheses of "association" and causality. Using bivariate analysis, we examine the survival status of children by the selected socio-economic, demographic, household environment & women's status related variables.

Multinomial logistic regression model: Multinomial logistic regression models are a straightforward extension of logistic models. For a dependent variable with M categories, this requires the calculation of M-1 equations, one for each category relative to the reference category, to describe the relationship between the dependent variable and the independent variables. Generalizing to a multinomial dependent variable requires us to make some notational adaptations. Let J represent the number of discrete categories of the dependent variable, where $J \geq 2$. Now, consider random variable Z that can take on one of J possible values. If each observation is independent, then each Z_i is a multinomial random variable. Once again, we aggregate the data into populations each of which represents one unique combination of independent variable settings. As with the binomial logistic regression model, the column vector n contains elements n_i which represent the number of observations in population i, and such that

$$\sum_{i=1}^{N} n_i = M, \text{ the total sample size}$$

Since each observation records one of J possible values for the dependent variable, Z, let y be a matrix with N rows (one for each population) and J-1 columns. Note that if J = 2 this reduces to the column vector used in the binomial logistic regression model. For each population, y_{ij} represents the observed counts of the jth value of Z_i. Similarly, π is a matrix of the same dimensions as y where each element y_{ij} is the probability of observing the jth value of the dependent variable for any given observation in the ith population. The design matrix of independent variables, X, contains N rows and K +1 columns where K is the number of independent variables and the first element of each row, $x_{io} = 1$, the intercept. Let β be a matrix with K + 1 rows and J-1 columns, such that each element y_{kj} contains the parameter estimate for the kth covariate and the jth value of the dependent variable. For the multinomial logistic regression model, we equate the linear component to the log of the odds of a jth observation compared to the Jth observation. That is, we will consider the Jth category to be the omitted or baseline category, where logits of the first J-1 categories are constructed with the baseline category in the denominator.

$$\log\left(\frac{\pi_{ij}}{\pi_{iJ}}\right) = \log\left(\frac{\pi_{ij}}{1-\sum_{j=1}^{J-1}\pi_{ij}}\right) = \sum_{k=0}^{K} x_{ik}\beta_{kj} \quad ; i = 1, 2\ldots.. N$$

$$j = 1, 2\ldots...J-1$$

Solving for π_{ij} , we get:

$$\pi_{ij} = \frac{e^{\sum_{k=0}^{K} x_{ik}\beta_{kj}}}{1 + \sum_{j=1}^{J-1} e^{\sum_{k=0}^{K} x_{ik}\beta_{kj}}} \qquad j < J$$

$$\pi_{ij} = \frac{1}{1 + \sum_{j=1}^{J-1} e^{\sum_{k=0}^{K} x_{ik}\beta_{kj}}}$$

Parameter Estimation: For each population, the dependent variable follows a multinomial distribution with J levels. Thus, the joint probability density function is:

$$f(y|\beta) = \prod_{i=1}^{N}\left[\frac{n_i!}{\prod_{j=1}^{J} y_{ij}!}\prod_{j=1}^{J}\pi_{ij}^{y_{ij}}\right]$$

Since we want to maximize this with respect to β, the factorial terms that do not contain any of the terms can be treated as constants. Thus, the kernel of the log likelihood function for multinomial logistic regression models is:

$$L(\beta|y) \simeq \prod_{i=1}^{N}\prod_{j=1}^{J}\pi_{ij}^{y_{ij}}$$

Replacing the Jth terms, it becomes:

$$\prod_{i=1}^{N}\prod_{j=1}^{J-1}\pi_{ij}^{y_{ij}}\frac{\pi_{ij}^{n_i}}{\pi_{ij}^{\sum_{j=1}^{J-1} y_{ij}}}$$

Since $a^{x+y} = a^x a^y$, the sum in the exponent in the denominator of the last term becomes a product over the first J-1 terms of j. Continue by grouping together the terms that are raised to the y_{ij} power for each j up to J-1:

$$\prod_{i=1}^{N}\prod_{j=1}^{J-1}\left(\frac{\pi_{ij}}{\pi_{iJ}}\right)^{y_{ij}}\pi_{ij}^{n_i}$$

Now, substitute for π_{ij} and π_{iJ} , we get:

$$\prod_{i=1}^{N}\prod_{j=1}^{J-1} e^{y_{ij}\sum_{k=0}^{K}x_{ik}\beta_{kj}}\left(\frac{1}{1+\sum_{j=1}^{J-1}e^{\sum_{k=0}^{K}x_{ik}\beta_{kj}}}\right)^{n_i}$$

Taking the natural log, it gives us the log likelihood function for the multinomial logistic regression model:

$$L(\beta)=\sum\sum\left(y_{ij}\sum_{k=0}^{K}x_{ik}\beta_{kj}\right)-n_i\log\left(1+\sum_{j=1}^{J-1}e^{\sum_{k=0}^{K}x_{ik}\beta_{kj}}\right)$$

We want to find the values for β which maximize the above equation. We will do this using the Newton-Raphson method, which involves calculating the first and second derivatives of the log likelihood function.

IV. Results and Discussion: Using contingency table analyses, the association between all possible factors and early childhood mortality was assessed. Based on those results, we selected variables which are potential for our study. In order to estimate the effects of the potential variables having other variables controlled, we ran multinomial logistic regression model in the SPSS. All of the potential predictors were entered into the model to examine their effects simultaneously.

Table 1: Rate ratios for the multinomial logistic regression models of neonatal, post-neonatal and child mortality in Bangladesh

Mortality rate ratio				
Variables		Neonatal	Post-neonatal	Child
Mother's age at birth	15-24 years	3.87***	0.82	0.87
	25-34 years	2.27*	0.75	0.70
	Above 35 years (RC)	1.00	1.00	1.00
Mother's education	no education	1.97	1.51	1.57
	primary	1.38+	1.01	1.04
	secondary & higher (RC)	1.00	1.00	1.00
Sex of the child	male	1.07	1.11	0.99+
	female (RC)	1.00	1.00	1.00
Birth order	1	0.86*	0.62	0.79
	2	0.64***	0.55*	0.96
	3+ (RC)	1.00	1.00	1.00
Wealth index	poor	1.14	1.03	1.34*
	middle	1.39	0.96	1.28
	rich (RC)	1.00	1.00	1.00

Preceding birth interval	less than 24 months 24-36 months greater than 36 months(RC)	1.92** 0.66 1.00	2.89** 1.03 1.00	2.02 1.37 1.00
Decision on own health care	respondents alone respondent & husband others (RC)	0.96 1.23 1.00	0.53 1.27 1.00	1.10 1.85+ 1.00
Decision on large household purchases	respondents alone respondent & husband others (RC)	1.74 1.44 1.00	1.49 0.72 1.00	2.17 1.34 1.00
Decision on other daily household purchases	respondents alone respondent & husband others (RC)	1.14 1.11 1.00	1.04 1.09 1.00	1.01 0.95 1.00
Decision on visiting family or relatives	respondents alone respondent & husband others (RC)	0.72 0.92 1.00	0.89 1.17 1.00	0.98 1.43 1.00
Decision on spending money	respondents alone respondent & husband others (RC)	1.10 1.33 1.00	0.93 1.12 1.00	0.22 0.49 1.00
Decision on going health centre	no yes , alone yes , with kids others (RC)	1.75* 1.02 0.74 1.00	1.12 1.08 1.04 1.00	1.37 0.79 1.01 1.00
Women's employment	yes no (RC)	1.03 1.00	1.14 1.00	1.17+ 1.00
Decision on child's health care	respondents alone respondent & husband others (RC)	0.39** 0.44*** 1.00	0.34** 0.62 1.00	0.37 0.47 1.00

RC = Reference category

Significance level: +p < 0.10, *p < 0.05, **p < 0.01, ***p < 0.001

As expected, male infants had a higher odds of dying in the neonatal period, as compared with female infants (RR=1.07). Similar pattern follows in the post-neonatal period also (RR=1.11). However, a higher risk of death for girls is apparent in the child mortality model ($p < 0{\cdot}10$), the period during which selective deprivation of girls is widely practiced. Younger motherhood significantly increased the risk of neonatal mortality (RR=3.87, $p < 0{\cdot}001$). This finding suggests that in the presence of most proximate factors, infants of older mothers survive longer. Older mothers are more likely to be married, and to have fewer mistimed pregnancies. The babies of short previous birth intervals have statistically significantly greater chances of dying during the neonatal period (RR=1.92, $p < 0{\cdot}01$). The effects of father's education are stronger: children of fathers with no education are at higher risk of neonatal mortality (RR=2.09 , $p < 0{\cdot}05$) , post-

neonatal mortality (RR=1.81) as well as child mortality (RR=1.44 , p < 0·05) compared with children of fathers with secondary and higher education . Children of fathers with above-primary education are at lower risk of death. The risk of death in all three periods decreases with increasing birth order. It has significant effect on the survival status of the infants, RR=0.86, p < 0·05 in case of neonatal mortality when the birth order is one and RR=0.64, p < 0·001 when the birth order is two and RR=0.55, p < 0·05 when the birth order is two. Another variable having significant effect on early childhood mortality is the size of the families. We have RR=3.19, p < 0·001 in case of neonatal death when the families consist of one to four family members. In case of post-neonatal death, RR=4.81, p < 0·001 when the families consist of one to four family members and RR=2.10, p < 0·01 when the families consist of five to eight family members. In case of child mortality, RR=2.31, p < 0·1 when the families consist of one to four family members. With reference to the rich wealth index (RR = 1.0) the adjusted risk ratios for middle and poor categories of wealth index show a highly statistically significant child mortality (RR=1.34, p < 0·05) when the category was poor.

We are now going to analyze the results regarding those specific variables that belong to women's status obtained from the fitted model. Mother's with no education had the highest risk of neonatal mortality (RR=1.97), post-neonatal mortality (RR=1.51) as well as child mortality (RR=1.57). Maternal education is associated with reduced early childhood mortality. Decision making about spending money does not have any significant effect on any of the early childhood mortality categories. But the important fact to notice is that when a woman decides all her alone to spend money, the risk of early childhood mortality is the lowest one. Decision making about children health care has a significant impact on infant's survival status. Risk of neonatal mortality was the lowest (RR=0.39 , p < 0.01) , so was for post-neonatal mortality (RR=0.34 , p < 0.01) and also in case of child mortality (RR=0.37) when women themselves take decisions about child's health care. Decision making about own health care has insignificant effect on neonatal and post-neonatal mortality. But it has a significant effect on child mortality (RR=1.85, p < 0.1) when women make decision about their own health care along with their husband. Decision making about large and all other daily household purchases have insignificant effect on early childhood mortality. It is also to be noted that the mortality rate is there on the lower side when women take decisions about household purchases along with her husband. According to the result shown in Table 1, every category of the early childhood mortality is there on the lower side when women take decisions about visiting family or relatives all her alone. When women are employed, the mortality rate is higher in every categories of early childhood mortality. It has significant effect in case of child mortality (RR=1.17, p < 0.1). Decision making about going to health centers has significant effect on neonatal mortality (RR=1.75, p < 0.05) when she does not go to health centers at all. Also in the remaining two categories of early childhood mortality, it has the highest risk when she does not go to health centers at all.

V. Conclusion: In Bangladesh, women are very often the primary decision-makers regarding child health care, family health and nutrition. The status of women is an important factor affecting the overall development of a country. The total development of Bangladesh will undoubtedly be hampered if the status of women , constituting about fifty percent of the country's population, remains as low as it is today. In this paper, we have tried to check whether women's status

adversely affect the survival of their children or not. Along with the variables associated to women's status, we have also investigated the effect of all other associated bio-demographic and socio-economic variables regarding early childhood mortality. The analysis presented in this paper suggests that women's status have an impact on the survival chances of their children. More autonomous women are likely to have greater freedom to take their children to health centers for immunizations and other preventive services, as well as curative services, which are likely to have a large impact on health and survival of children.

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