EFFECTS OF ANTENATAL AND DELIVERY CARE ON NEONATAL MORTALITY: A STUDY OF RAJSHAHI DISTRICT, BANGLADESH

Md. Mizanur Rahman
Md. Nurul Islam
Md. Rafiqul Islam

Abstract: *The main purpose of this study is to investigate the effects of antenatal and delivery care on neonatal mortality in Rajshahi District, Bangladesh. The study has also been made to examine the differentials and their intensity of the influences on neonatal mortality by employing multiple classification analysis (MCA) technique. The results indicate that among the included variables, visit of health worker is the strongest contributing factors on neonatal mortality followed by medical check-up as the second strongest predictor. The results also reveal that taking vitamin, T T (tetanus toxoid) injection during pregnancy and place of delivery are also major influential factors on neonatal mortality.*

Keywords: neonatal mortality, antenatal care, and delivery care, multiple classification analysis (MCA), Bangladesh.

1. INTRODUCTION

In Bangladesh, one of the important reasons for high rates of infant and child mortality is the limited use of health care services by mothers (Kabir and Amin, 1993). Another important concern in the health sector is maternal nutrition; as measures indicate around 50% of Bangladeshi women suffer from energy deficiency. Anemia during pregnancy contributes to intra-uterine growth retardation leading to low birth weight babies and increased neonatal mortality.

Bangladesh is a poor country with a per capita income of US $ 289. The persistently high infant and child mortality levels were due to poverty, poor protection against pneumonia, small percentage of deliveries in hospitals, high level of malnutrition among children, and low tetanus toxic immunizations.

An updated strategic framework for childhood illness, health, and development is needed. Existing child health programs and strategies, including initiatives for the eradication and elevations of vaccine-preventable childhood diseases, and specific health and nutrition interventions need to be examined in the context of a broader child health framework that goes beyond disease, program, and sector-specific approaches (Mosley and Chen, 1984).

An important element in reducing health risks for mothers and children is to increase the proportion of babies delivered in proper health facilities. Proper medical attention and hygienic conditions during delivery can reduce the risk of infections and facilities management of complications that can cause death or various illnesses for the mother or the newborn child (Mitra and others, 1997). The demographic and health survey information on maternal and child health indicates that about 95 percent of births in Bangladesh are delivered at home and more than half of these births (57 percent) are attendant by untrained traditional birth attendants (*dais*), followed by relative/others at 25 percent (Howlader and Bhuiyan, 1999).

Mothers' behavior in seeking health care services, for either preventive or curative purposes, is an important factor in determining child survivorship through the child's health and nutritional status, as well as through her own health. A major goal of the country's fifth five-year plan is to active considerable reductions in infant, child and under-five mortality. The plan also provides strategies for improving access to health care services, in particular maternal and child health care services (Howlader and Bhuiyan, 1999)

UNICEF (2006) established an analytical framework (see Figure 1) that is useful in the analysis of health and nutrition outcomes and their determinants among mothers and children.

Figure 1
ANALYTICAL FRAMEWORK FOR MATERNAL AND CHILD HEALTH AND NUTRITION
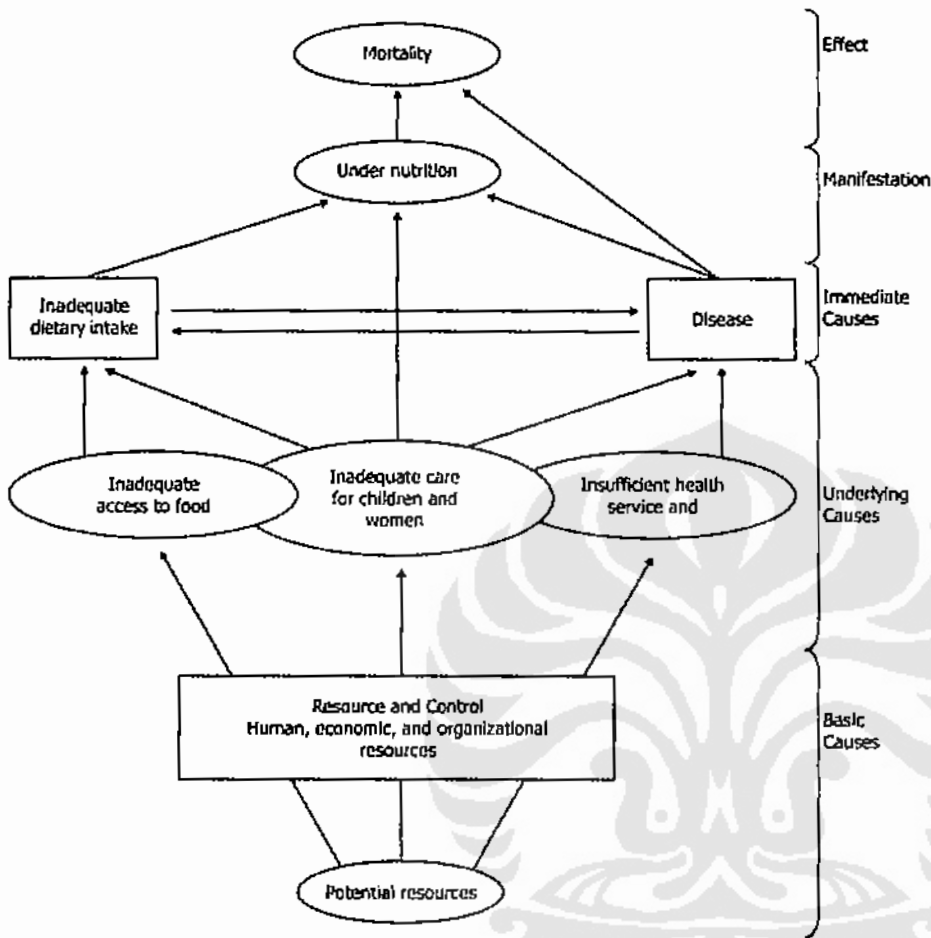
Save the Children Federation developed a conceptual framework for household and community neonatal and maternal care that focused attention on five pathways: (a) routine maternal and neonatal care and services of good quality, (b) response to maternal danger signs, (c) response to the non-breathing newborn, (d) care for the low-birth-weight infant, and (e) response to neonatal danger signs, particularly those signaling infection. The framework emphasizes that the health of the mother and the newborn are inextricably link. To improve prenatal and neonatal health outcomes, intervention strategies must encompass the health of the mother and antenatal,

intrapartum and immediate and routine postpartum maternal and newborn care (Gary, Lawn and Costello, 2003).

Antenatal care is an umbrella term used to describe the medical procedures and pregnancy related care provided by doctor or a health worker in a medical center or at home. The overall aim of antenatal care is to produce healthy mother and baby at the end of pregnancy (Rahman, Parkhurst, and Normand, 2003).

This paper examines the effects of antenatal and delivery care on neonatal mortality, specifically, the effects of number of antenatal-care visits, medical checkup during pregnancy, taking iron tablet or vitamin during pregnancy, and medical facility during delivery.

The main objectives of this study are:

i). to investigate neonatal mortality differentials by selected antenatal and delivery care variables and

ii). to examine the intensity of the effects of antenatal and delivery care on neonatal mortality.

2.   DATA AND METHODOLOGY

The data of this study was collected under the project of UNFPA entitled "Strengthening the Department of Population Science and Human Resource Development" of Rajshahi University, Bangladesh in 2004. The data were collected from rural, urban and suburban areas of Rajshahi district. In the above-mentioned project 6000 ever-married women of reproductive age who have at least one live birth were interviewed. Since the purpose is to examine the effect of antenatal and delivery care variables on neonatal mortality, the dependent variable is the number of children who have died less than one month. Some antenatal and delivery care variables are taken as independent variables such as antenatal-care visits, medical checkup during pregnancy, taking iron tablet or vitamin during pregnancy, and medical facility during delivery. We have taken 3,670 respondents out of 4,500 respondents from urban and rural areas.

To assess the influences of various factors, a well-known technique of Multiple Classification Analysis (MCA) is used (Andrews et al., 1973). The technique provides a mean value of the dependent variable for each sub-class of the independent variable and a deviation from the grand mean that are

adjusted simultaneously for the effects of all other variables considered and their inter correlations. The MCA model specifies as follows:

$$Y_{ijn} = \overline{Y} + a_i + b_j + c_k \cdots + e_{ijn}$$

where

Y_{ijk} = The score on the dependent variable of individuals n who falls in the category i of predictor A, category j of predictor B etc.

$\overline{Y}$ = Grand mean of the dependent variable.

a_i = The effect of the membership in the ith category of predictor A

b_j = The effect of the membership in the jth category of predictor B

c_k = The effect of the membership in the kth category of predictor C

e_{ijk} = The error term for this individuals.

The coefficients, which are estimated by solving the normal equation systems, are called the adjusted or net effect of the predictors. The unadjusted, eta-square (η^2) coefficient is a correlation ratio that is explained by the predictor alone and the beta-square (β^2) (adjusted) coefficient indicates the proportion of variation explained by a predictor variable taking into account the other predictor variables

3. RESULTS AND DISCUSSION

3.1 Factors Influencing Antenatal and Delivery Care on Neonatal Mortality

The health care practices of mothers such as attendance and utilization of health care facilities during antenatal and delivery periods as well as having their children protected from all immunizable diseases are important. The study found that nearly two thirds (63%) of mothers do not received antenatal care. In urban areas 59% mother receive antenatal care, while in rural areas the rate is only 28% (Rahman, Parkhust, and Mormand, 2003). However, in Bangladesh almost 92% births are delivered at home, often in unsafe and unhygienic conditions.
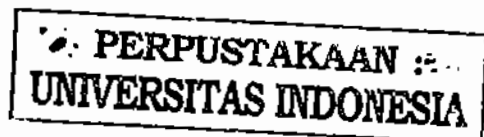
In this section, we shall discuss the health status of mothers during pregnancy and interpret the effects of antenatal care received, visit of health worker, tetanus toxoid vaccinations and delivery care on neonatal mortality.

3.2   Variables Considered in the Analysis

The Multiple Classification Analysis is employed to evaluate the contribution of antenatal and delivery care variables such as visit of health worker, taking iron tablet, vitamin A capsule, and TT injection during pregnancy, and place of delivery on neonatal mortality as dependent variable.

3.3   Determinants of neonatal Mortality: MCA

Table 1 presents the mean number of neonatal mortality by selected antenatal and delivery care variables. The result indicates that the proportion of variance explained by MCA is (Multiple R^2=0.041 and Multiple R= 0.201) for neonatal mortality.

Visit of health worker, taking iron tablet, vitamin A capsule, and T.T. injection during pregnancy and place of delivery appears as the important determinants of neonatal mortality.

Table 1 shows that the mean number of adjusted and unadjusted neonatal mortality by selected predictor variables along with the values of η^2 and β^2 from Multiple Classification Analysis.

Table 1 indicates that the mean number of adjusted neonatal mortality is higher (0.1484) for those respondents who had no visit by health worker and is lower (0.0469) number of adjusted neonatal mortality for those who had visit regularly. Table 1 also indicates that the respondents who were not taking iron tablet/syrup had higher mean number of (0.0935) adjusted neonatal mortality and was lower mean number (0.0579) of adjusted neonatal mortality who had taken iron tablet/syrup during pregnancy. The Table 1 also shows that the average number of adjusted neonatal mortality was lower (0.0588) whom took vitamin/syrup and were higher number (0.0990) of neonatal mortality that was not taking vitamin/syrup. Iron tablet/syrup and vitamin/syrup are another oral medicine, which is necessary for the good health of mothers and as well as the baby.

Table 1

MEAN NUMBER OF NEONATAL MORTALITY BY SELECTED ANTENATAL AND DELIVERY CARE VARIABLES (MULTIPLE CLASSIFICATION ANALYSIS), RAJSHAHI, BANGLADESH, 2004

Antenatal and Delivery care variable	Predictor mean		Correlation ratio	
	Unadjusted	Adjusted	η^2	β^2
Visit of health worker				
Regular	0.0469	0.0469		
Irregular	0.0670	0.0658		
No	0.1476	0.1484	0.118	0.120
Taking Iron tablet during				
pregnancy	0.1147	0.0935		
No	0.0421	0.0579		
Yes	0.0911	0.0829	0.107	0.052
DK				
Taking vitamin during pregnancy				
No	0.1192	0.0990		
Yes	0.0423	0.0588		
DK	0.0888	0.0692	0.111	0.057
TT injection during pregnancy				
No	0.1040	0.0935		
Yes	0.0467	0.0561		
DK	0.0726	0.0720	0.083	0.054
Taking vitamin-A during				
pregnancy	0.0846	0.0835		
No	0.0612	0.0643		
Yes	0.0000	0.0311	0.037	0.030
DK				
Medical Checkup during				
pregnancy	0.1050	0.0966		
No	0.0322	0.0432	0.113	0.083
Yes				
Place of delivery				
Hospital	0.0372	0.0507		
Home	0.0824	0.0790	0.056	0.035
Multiple R=0.201				
Multiple R²=0.041				
Grand mean=0.0733				

Tetanus Toxoid (TT) vaccines are given during pregnancy for prevention of tetanus among newborns. Tetanus is a fatal disease caused by unhygienic conditions at birth. Table 1 indicates that women who did not receive Tetanus Toxoid dose during pregnancy had higher average number (0.0935) of adjusted neonatal mortality than who received TT injection (mean umber of neonatal mortality is 0.0561). Tetanus is one of the major causes of

neonatal mortality in developing countries (Stanfield and Galazha, 1984). The finding is supported by our results.

Vitamin A deficiency (VAD) is a major public health problem in many developing countries like Bangladesh. Table 1 shows that the mean number of adjusted neonatal mortality was higher (0.0835) for mothers who were not taking vitamin A tablet during pregnancy and was lower (0.0643) mean number of neonatal mortality for mothers who were taking vitamin A capsule of that period. vitamin A deficiency in pregnancy contributes to exophthalmia leading to blindness, intra-uterine growth retardation, leading to low birth weight babies and can increase both the risk of maternal and neonatal death (Rahman, Parkhurst and Normand, 2003).

Table 1 shows that the mean number of adjusted neonatal mortality is higher (0.0966) for mothers who did not take any medical checkup during pregnancy and was lower (0.0432) of neonatal mortality among mothers who took medical checkup as antenatal care during pregnancy.

An important element in reducing health risks for mothers and children are to increase the proportion of babies that are delivered in hospital or clinic. Table 1 indicates that the mean number of neonatal mortality was lower (0.0507) for those children delivered at hospital or clinic compared with those who delivered at home. However, the average number of adjusted neonatal deaths was high (0.0790) for those children whose mothers delivered at home. The possible reason for this was the reverse causation effect where with the mass practice of home delivery, women were rushed to institutional setting for delivery as a result of complications arising that could not be managed by the traditional birth attendants or relatives. And such unnecessary delays led to more complications in delivery resulting in neonatal deaths even in institutional setting. However, hospital or clinic delivery shows less likelihood for neonatal and childhood mortality, which is supported by our results.

3.4   Intensity of the Effects of the variables on Neonatal Mortality

From an earlier section, it appears that antenatal and delivery care variables that are considered in the analysis have differential effects on neonatal mortality, producing different levels by those variables. However, the intensity of the influences of the variables considered is yet to be

analyzed. In this section an attempt was made and looked at the extent of influences of the variables on neonatal mortality of children on the basis of η^2 and β^2 results produced by MCA (see Table 2).

Table 2 indicates that visit of health worker was a positively associated (r=0.109) with neonatal mortality. The entire included antenatal and delivery care variables visit of health worker had the strongest significant contribution on neonatal mortality. Table 1 shows that the proportion of variance in neonatal mortality explained by visit of health worker was the highest (unadjusted value of η^2=0.118 and adjusted value of β^2=0.120) among all other variables while the proportion variance explained by taking vitamin-A capsule during pregnancy is the lowest (η^2=0.037 and β^2=0.030).

Table 2 shows that taking iron tablet/syrup was a negatively associated (r=-0.063) with neonatal mortality. Among the entire selected variable, taking iron tablet/syrup was also the fourth strongest significant influential factors of neonatal mortality. From Table 1, we can see that the proportion of variance explained by taking iron tablet/syrup (unadjusted value was η^2=0.107 and adjusted value was β^2=0.052).

Table 2
**ZERO-ORDER CORRELATION COEFFICIENT OF SOME SELECTED
ANTENATAL AND DELIVERY CARE DIFFERENTIALS OF NEONATAL
MORTALITY, RAJSHAHI, BANGLADESH, 2004**

	X1	X2	X3	X4	X5	X6	X7	X8
X1	1.000	0.109**	-0.063**	-0.066**	-0.055**	-0.037*	-0.114*	0.056**
X2		1.000	-0.036*	-0.011	0.082**	0.039*	0.041*	-0.045**
X3			1.000	0.589**	0.099**	0.074**	0.064**	-0.039*
X4				1.000	0.115**	0.058**	0.066**	-0.018
X5					1.000	0.225**	0.196**	-0.078**
X6						1.000	0.284**	-0.401**
X7							1.000	-0.215**
X8								1.000

Note:

* Correlation is significant at .05 levels; ** Correlation is significant at .01 levels.

X1= Number of neonatal Mortality.
X2= Visit of health worker.
X3=Taking Iron tablet during pregnancy
X4= Taking vitamin tablet during pregnancy

X5= TT injection during pregnancy
X6= Taking vitamin-A tablet during pregnancy
X7= Medical checkup during pregnancy
X8= Place of delivery

Taking vitamin during pregnancy had a significant contribution on neonatal mortality. It had negative association ($r=-0.066$) with neonatal mortality (from Table 2). Table 1 indicates that taking vitamin had the third strongest influence factor on neonatal mortality. The proportion of variance explained (unadjusted) by taking vitamin during pregnancy as well antenatal care is $\eta^2=0.111$ and the proportion of variance explained (adjusted) by this variable is $\beta^2=0.057$.

Tetanus Toxioid (TT) vaccinations during pregnancy has negative association ($r=-0.055$) with neonatal mortality. It was a major significant contribution factor of neonatal mortality (from Table 2). Table 1 indicates that the proportion of variance explained (unadjusted) by tetanus toxoid vaccinations was $\eta^2=0.083$ and the proportion of variance explained (adjusted) by this variable is $\beta^2=0.054$.

Medical checkup during pregnancy had also major significant contribution on neonatal mortality. It had a negative association ($r=-0.114$) with neonatal mortality (see Table 2). From Table 1, we can see that the strength in explaining the variability by medical checkup was (unadjusted) $\eta^2=0.0113$ and (adjusted) was $\beta^2=0.083$. Thus, the effect of this variable was found to be the second strongest differentials for explaining the variation on neonatal mortality among all the included variables. Therefore, medical checkup during pregnancy has strong influence on neonatal mortality.

Children delivered at a medical facility were also likely to a significant contribution on neonatal mortality. It had positive association ($=0.056$) with mortality. Table 1 shows that the proportion of variance explained (unadjusted) by place of delivery was $\eta^2=0.056$ and the proportion of variance explained (adjusted) by this variable was $\beta^2=0.035$. Children delivered at a medical facility are likely to experience lower mortality than children delivered at home because such facilities usually provide a sanitary environment and medically correct birth assistance (Pandey et al., 1998). The finding confirms that place of delivery is also influence on neonatal mortality.

4.   SUMMARY AND CONCLUSIONS

The main purpose of this paper is to analyze the effects of antenatal and delivery care on neonatal mortality in Rajshahi District, Bangladesh. The analysis was carried out using Multiple Classification Analysis. The neonatal mortality was changed due to an expansion of

preventive health care and, in particular, by a growing practice of antenatal check-up among pregnant women.

Of the variables considered, visit of health worker was, by far, one of the most important correlates in which its effect was the strongest for explaining the variability on neonatal mortality. Meanwhile taking vitamin A during pregnancy was the lowest effect for explaining the variability on neonatal mortality.

The results indicate that medical check-up and visit of health worker were most important contribution factors on neonatal mortality among all the included variables. Here visit of health worker was one of the strongest factors on neonatal mortality (η^2=0.118 and β^2=0.120) and medical check-up during pregnancy was the second strongest influence factors (η^2=0.113 and β^2=0.083). The results also indicate that the mean number of adjusted neonatal mortality was higher (0.0966) for mothers who taking medical check-up during pregnancy and was lower (0.0432) for mothers who were not taking medical check-up during this period.

The results of MCA also indicate that taking vitamin and iron tablet/syrup during pregnancy were the third and fourth strongest correlates of neonatal mortality. The proportion of variance explained by taking vitamin during pregnancy (unadjusted) was η^2=0.111 and (adjusted) β^2=0.057 and the proportion of variance explained by taking iron tablet/syrup during pregnancy was (η^2=0.107 and β^2=0.052). The MCA shows that the mean number of adjusted neonatal mortality was lower (0.0588) for mothers who had taken vitamin during pregnancy than who had not taken vitamin during pregnancy (0.0990). The result also shows that women who were taking iron tablet/syrup had lower (o.0579) number of adjusted neonatal mortality than that were not taking iron tablet/syrup (0.0935).

Place of delivery and received TT injection during pregnancy were also quite important, affecting neonatal mortality. The result indicates that the mean number of adjusted neonatal mortality was higher (0.0790) for mother whose children delivered at home and was lower (0.0507) for mother whose children delivered at hospital. So, place of delivery was found to be related child survival status; unhygienic delivery place influenced neonatal mortality. Similarly, women who received TT injection during pregnancy had lower number of neonatal mortality than who did not receive TT injection.

Women are at the heart of development because they constitute nearly half of the population. They rear and bear the children. Women and her child's health should get the top priority. Finally, among health-care interventions, medical checkup during pregnancy, taking vitamin and visit of health worker during pregnancy has a substantially effect in reducing neonatal mortality. Therefore, health program should be strengthened to provide this basic health-care service and delivery care to all pregnant women.

References

Andrew, F.M., N.M James, S. John,. and K. Laura. 1973. *Multiple Classification Analysis (2nd Edition.),* University of Michigan, Ann Arbor, Mich., USA: Institute for Social Research.

Ali M.S. 2001. "Poverty and Child mortality in Pakistan" *Mimap Technical Paper Series no. 6. Islamabad, Pakistan: Pakistan Institute of Development Economics.*

Bairagi R., S.C. Sutradhur and N. Alam. 1999. "Level Trends and Determinants of Child mortality in Bangladesh, 1966-1994", *Asia-Pacific Population Journal, No.2, Vol.14, 51-68.*

Ghosh, S. 2003, "Demographic and Socioeconomic Correlates of Neonatal, Post Neonatal and Childhood Mortality in Uttar Pradesh, India: A Study Based on NFHS-2 Data", *Journal of Health & Population in Developing Countries,* Dec 6: [28] p.

Galway, K., B. Wolff, and R. Sturgis. 1987. *Child survival: risks and the road to health* Columbia, Maryland: Institute for Resource Development/ Westinghouse.

Gary, L. D, Lawn. E. J, and Costello A. 2003. "Advancing the State of the World's Newborns"; *Bulletin of World Health Organization Vol.81 no. 3 Geneva.*

Howlader, A.A., and M U Bhuiyan. 1999. "Mothers' Health-Seeking Behaviour and Infant and Child Mortality in Bangladesh". *Asia-Pacific Population Journal, Vol.14, No.1. 59-75.*

Kabir, M. and R. Amin. 1993. "Factors Influencing Child Mortality in Bangladesh and Their Implication for the National Health Programme". *Asia-Pacific Population Journal, Vol.8, No.3, pp. 31-46.*

Mitra, S. N. and Associates. 2001. *Bangladesh Demographic and Health Survey, 1999-2000.* Dhaka, Bangladesh: National Institute of Population Research and Training (NIPORT).

Mitra, S.N., Al-Sabir, A.R Cross and K. Jamil. 1997. *Bangladesh Demographic and Health Survey, 1996-97. Main Report. Dhaka, Bangladesh: National Institute of Population Research and Training (NIPORT).*

Mosley, W. Henry and Lincoln C. Chen. 1984. "An Analytical Framework for the Study of Child Survival in Developing Countries", *Population and Development Review, Supplement to Vol. 10: 25-45.*

Pandey, A, K.M Chose, Y.N. Luther, D. Sahu and J. Chand. 1998. *Infant and Child mortality in India.* Mumbai, India: International Institute for Population Sciences.

Rahman, A.S, J.O Parkhurst, and C. Normand. 2003. "Maternal Health Review Bangladesh (Health Systems Development Programme)".

Islam, N.M. 1996. *Trends and Correlates of Marriage and Fertility in Bangladesh* Unpublished PhD. paper, Department of Statistics, Rajshahi University, Bangladesh).

Stanfield, J.P., and A Galazka. 1984. "Neonatal tetanus in the world today", *Bulletin of the World Health Organization 62(4).*

UNICEF. 2006. "UNICEF joint health and nutrition strategy for 2006-2015"; United Nations Children's Fund, Economic and Social Council, United Nations, E/ICEF/2006/8.

Md. Mizanur Rahman, Lecturer, Department of Population Science and Human Resource Development University of Rajshahi, Bangladesh
E-mail: mmr_f@yahoo.com

Md. Nurul Islam, Professor, Department of Statistics University of Rajshahi
E-mail: mnurul58@yahoo.com

Md. Rafiqul Islam, Associate Professor, Department of Population Science and Human Resource Development University of Rajshahi, Bangladesh
E-mail: rafique_pops@yahoo.com