Socio-Economic and Demographic Correlates of Infant and Child Mortality: The Case of Slum Areas in Rajshahi District of Bangladesh

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Abstract   The aim of this study is to identify the important effects of socio-demographic characteristics on infant and child mortality. For this reason, data were collected from slum areas of Rajshahi City Corporation at Rajshahi district in Bangladesh through purposive sampling technique. Chi-square test, correlation and multiple coefficients of determination techniques have been employed for analyzing the differential patterns, interrelationships and effects of socio-demographic correlates on infant and child death. Education of parents, income of household, occupation, age at first marriage and breast-feeding are significantly associated with infant and child death. The combined effects of social and demographic variables are wholly explained 46.2% and 82.5% for both infant and child death respectively. Therefore, female education, age at first marriage as well as income level should be increased at any cost to ensure reducing death of infant and child.

Keywords   Neonatal, Post neonatal, Infant and Child mortality, Socio-economic and demographic characteristics, Chi-square (χ^2) test, Multiple coefficient of determination (R^2)

1. Introduction

Bangladesh is one of the most densely populated countries comprising 1, 47,570 square kilometers area with accelerated population growth. In last few decades, infant and child health have been brought significant improvements. According to Population and Development Indicators for Asia and the Pacific report, 2008, in SAARC countries' infant and under five mortality rates in Bangladesh were 52 and 68 per 1,000 live births respectively which are still very high[1].

Many studies have shown that the infant and child mortality influenced by a number of socio-economic and demographic factors such as sex of the child, mother's age at birth, birth order, preceding birth interval and survival of preceding sibling(s) were the most important determinants of infant and child mortality in Bangladesh[2,3,4,5]. In socio-economical aspect, Bangladesh is comparatively disadvantage in terms of child mortality indicator as per capita GNI recently crossed the USD $500 and it is forecasted to continue to rise[6].

Many studies showed that low economic status is associated with increased rates of infant and child mortality[7,8,9,10]. Socioeconomic status is also strongly related to maternal education level, which impacts on the risk of disease through child-rearing practices such as breastfeeding, appropriate care-seeking[11]. Caldwell argued the maternal education of women plays an important role in determining child survival even after controlling for a number of socioeconomic factors[12]. Several other studies also established the influence of maternal education on infant and child mortality[13,14,15].

Hong and Rathavuth showed that levels of infant and child mortality in many developing countries remain unacceptably high, and they are disproportionably higher among high-risk groups such as newborn and infant of multiple births[16]. A number of studies have revealed that the influence of maternal age at delivery on the health and survivorship of children[17,18,19,20]. Rahman et al. show that the risk of infant and child mortality is higher for children whose mothers never breast-feed than for children who are breast-feed[21].

Therefore, the fundamental objective of this study is to identify the effects of socio-demographic correlates on infant and child mortality.

2. Sources of Data

This study was followed a personal interview approach for the purpose of data collection and took direct interview of women with the help of questionnaire. In order to observe the effects of the socioeconomic and demographic variables, 200 data were collected from slum area of Rajshahi City Corporation of Rajshahi district in Bangladesh from 1st-30th June 2006 out of 1276 respondents aged 15-49 years. We have chosen purposively university station slum area, shirol

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slum area, Mirjapur slum area and slum area of the Padma bank of Rajshahi City Corporation under Rajshahi district. Statistical Package for Social Sciences (SPSS), version 10.0 package program has been used for analyzing the data.

3. Methodology of this Study

The contingency analysis is used to test significance between the different phenomena on the basis of classification of variables or attributes by applying the Chi-square (χ^2) test in which $\chi^2 = \sum \frac{o_{ij}}{E_{ij}} - N$, follows χ^2 distribution with (r-1)(c-1) degrees of freedom[22].

Correlation coefficient (r) is used in this study to see the positive or negative correlation of infant and child mortality with socio-demographic variables, all explanatory variables are numerical as education 0 year, 1 year, 2 years,…, 16 years, income 1000, 2000,…. . Therefore, it has no restriction to employ Pearson correlation statistic in this study. Symbols used in this study, where, X_1 = Age at first marriage, X_2 = Women education, X_3 = Monthly income, X_4 = Breast feeding, X_5 = Children ever born, Y= age at death of infant and child as dependent variable.

Multiple coefficient of determination (R^2) is used for explaining the multiple effects of socioeconomic and demographic attributes on infant and child mortality. It is noted that coefficients of determination are obtained from the multiple regression models in which explanatory variables are all quantitative[22]. Further, for differentiality and association of socio-demographic characteristics between infant and child mortality, both dependent and independent variables are categorized.

4. Results and Discussion

In the Table 1, it is observed that most of women (36.5%) illiterates, 32.5% primary level and 31% secondary and higher level of education. Respondents' husband has 38% illiterate, 30% primary education, 29.5% secondary education and only 2.5% of them have higher education. In our study area, 68.5% respondent's house was made of tin, 19.5% semi-building, 9% building. Families earn per month 2500-3500 Tk. (53.5%) and 23.5% exist in the range 1500-2500 Tk. Most of women (83%) occupations were housewife. On the other hand, 38.5% respondent's husbands were labors, 24% in job, 21% in business and 11.5% in other occupations. In the study area, 42% women have occurred early marriage i.e; before age 15 years, 56% occurred within years 16-20 years. Women have breast-fed their children above 2 years (47.5%), 28% breast-fed 2 years and 17.5% breast-fed their babies less than 1 year.

Table 1.   Percentage of Women Aged 15-49 Years According to Some Selected Socio-Economic Characteristics in Slum Areas of Rajshahi City Corporation, Bangladesh.

Background characteristics	Number of cases	Percentages	Background characteristics	Number of cases	Percentages
Educational qualification of women			Occupation of women		
Illiterate	73	36.5	House wife	166	83.0
Primary	65	32.5	Job	2	1.0
Secondary and higher	62	31.0	Business	6	3.0
Total	200	100.0	Others	20	10.0
Educational qualification of husband			Maid servant	6	3.0
Illiterate	76	38.0	Total	200	100.0
Primary	60	30.0	Occupation of husband		
Secondary	59	29.5	Labor	77	38.5
Higher	5	2.5	Business	42	21.0
Total	200	100.0	Job	48	24.0
Household condition			Others	23	11.5
Tin	137	68.5	Total	190	95.0
Building	18	9.0	Age at first marriage		
Semi building	39	19.5	<15 years	84	42.0
Kacha	6	3.0	16-20 years	112	36.0
Total	200	100.0	21-24 years	3	1.5
Monthly income			>24 years	1	0.5
<1500 taka	7	3.5	Total	200	100.0
1500-2500 taka	47	23.5	Duration of Breast-feeding		
2500-3500 taka	107	53.5	< 1 years	35	17.5
3500-9500 taka	25	12.5	2 years	56	28.0
9500+ taka	14	7.0	>2 years	95	47.5
Total	200	100.0	Total	186	93.0

Table 2. Distributions of Infant and Child Mortality According to Socio-Economic and Demographic Attributes

Attributes	Infant		Child	Results of contingency analysis
	Neonatal	Post-neonatal		
Educational qualification of women (respondent)				
Illiterate	10 (43.5%)	3 (13.0)	10 (43.5)	$\chi^2 = 18.642$
Primary	6 (75.0%)	1 (12.5)	1 (12.5)	df = 2
Secondary and higher	-	-	4 (100.0)	$\rho = 0.037$
Total	16 (45.7%)	4 (11.4)	15 (42.9)	$\chi^2_{tab} = 9.488$
Educational qualification of husband				
Illiterate	10 (50.0)	1 (5)	9 (45.0)	$\chi^2 = 17.3181$
Primary	4 (44.4)	3 (33.3)	2 (22.2)	df = 2
Secondary and higher	2 (33.3)	-	4 (66.7)	$\rho = 0.024$
Total	16 (45.7)	4 (11.4)	15 (42.9)	$\chi^2_{tab} = 9.488$
Household condition				
Tin	14 (53.8)	4 (15.4)	8 (30.8)	$\chi^2 = 16.320$
Building	1 (20.0)	-	4 (80.0)	df = 2
Semi building	1 (25.0)	-	3 (75.0)	$\rho = 0.048$
Total	16 (45.7)	4 (11.4)	15 (42.9)	$\chi^2_{tab} = 9.488$
Monthly income				
<1500	9 (64.28)	3 (21.43)	2 (14.29)	$\chi^2 = 16735$
1500-2500	7 (53.8)	1 (7.7)	4 (25.0)	df = 3
2500-3500	-	-	5 (38.5)	$\rho = 0.029$
3500+	-	-	4 (100.0)	$\chi^2_{tab} = 12.592$
Total	16 (45.7)	4 (11.4)	15 (42.9)	
Occupation of respondent				
Housewife	13 (50.0)	3 (11.5)	10 (38.5)	$\chi^2 = 14.517$
Business and services	-	-	2 (100.0)	df = 2
Maid servant and others	3 (42.86)	1 (14.28)	3 (42.86)	$\rho = 0.036$
Total	16 (45.7)	4 (11.4)	15 (42.9)	$\chi^2_{tab} = 5.991$
Occupation of husband				
Labor	5 (31.25)	3 (18.75)	8 (50.00)	$\chi^2 = 3.313$
Business and job	9 (60.0)	1 (6.67)	5 (33.33)	df = 2
Others	2 (50.0)	-	2 (50.0)	$\rho = 0.769$
Total	16 (45.7)	4 (11.4)	15 (42.9)	$\chi^2_{tab} = 5.991$
Age at first marriage				
10-14	11 (44.0)	3 (12.0)	11 (44.0)	$\chi^2 = 6.306$
15-19	4 (44.44)	1 (11.11)	4 (44.44)	df = 2
20+	1 (100.00)	-	-	$\rho = 0.043$
Total	16 (45.7)	4 (11.4)	15 (42.9)	$\chi^2_{tab} = 5.991$
Breast feeding				
0-1 year	16 (61.54)	4 (15.38)	6 (23.08)	$\chi^2 = 12.838$
1-2	-	-	5 (100.0)	df = 2
2+	-	-	4 (100.0)	$\rho = 0.047$
Total	16 (45.7)	4 (11.4)	15 (42.9)	$\chi^2_{tab} = 5.991$
CEB				
<=3	4 (44.4)	1 (11.1)	4 (44.4)	$\chi^2 = 0.775$
4	5 (38.5)	2 (15.4)	6 (46.2)	df = 2
5 and above	7 (53.8)	1 (7.0)	5 (38.5)	$\rho = 0.942$
Total	16 (45.7)	4 (11.4)	15 (42.9)	$\chi^2_{tab} = 5.991$

Note: The values within the bracket indicate the percentage value.

4.1. Differential Patterns of Infant and Child Mortality

Table 2 represents the infant and child mortality differentials and statistical association with socio-demographic characteristics. The results reveal that illiterate women have higher (43.5%) both neonatal and child mortality level and haven't higher infant mortality level in primary, secondary and higher educated women. There exist association between women education and infant and child mortality at 5% level of significance. In case of respondents' husband education, the higher level mortality have in neonates (50%) and post-neonates (45%) those illiterate but child mortality level is high (66.7%). Respondent's husband education is also statistically significant at 5% level.

Respondent's lower monthly income (<1500 Taka) have higher neonatal mortality (64.28%) and lower level of mortality both infant and child whose monthly income of households are high. Condition of dwelling place-made of tin is higher level of neonatal mortality (53.8%) and in case of building and semi-building have higher level of child mortality 80% and 75% respectively. Both respondent's monthly income and condition of households are statistically significant at 5% level with infant and child mortality.

Respondent's of whom are housewives they have higher level of neonatal mortality (50%) but lower level mortality among business and service holders. While child mortality shows higher (100%) of business and service holders women. Highest neonatal mortality pattern exist of respondent's husband occupation are business and job holders (60%). Occupations of respondent's are statistically significant at 5% level but insignificant of husband's occupation with infant and child mortality.

Early age at first marriage is an important determinant of infant and child survival and nutritional improvements. It is evident from result that respondent's age at first marriage occurring early i.e; 10-14 years both neonatal and child mortality level are 44%, and 12.0% post-neonatal mortality. Both neonatal and child mortality (44.40%) occur for the mother whose age at marriage is in 15-19 years and 11.11% in post neonatal level. The propensy of infant and child mortality to the mother of who age at first marriage is lower as comparing to the older age of mother. Age at first marriage of respondent's and infant and child mortality have an association at 5% level of significance.

Results indicate that highest neonatal mortality (61.54%) occur who are breast-feed 0-1 years, 15.38% in post neonatal level and 23.08% in child age. Only child deaths occur who are breast-feed 1-2 years and 2+ years. Breast-feeding and infant and child mortality is statistically significant at 5% level. It is also observed that highest neonates' mortality (53.8%) for the mother who have given birth 5+ and child mortality is highest (46.2%) to the mother who have given birth 4. In case of CEB, it is seen that there is no association between CEB and infant and child mortality at 5% level.

4.2. Interrelationship between Infant and Child Mortality with Socioeconomic and Demographic Characteristics

Correlation analysis shows in Table 3 that infant and child mortality is negatively significantly correlated with women education (-0.253**), husband education (-0.248**), age at first marriage (-0.204**) and breast-feeding (-0.347*). That is, if educational qualification of parents and age at first marriage increase then mortality will begin to decrease. Through our correlation results, interrelationship of socio-economic variables on infant and child mortality can be shown in figure-1, where we can see in flow chart that infant and child mortality is negatively significantly correlated with parents' education, age at marriage and breast-feeding.

Table 3.   Correlation of Age at Death of Infant and Child with Socio-Economic and Demographic Variables

Variable	Age at death of infant and child	Women education	Husband education	Monthly income	Age at first marriage	Breast feeding	Children everborn
Age at death of infant and child	1	-0.253**	-0.248**	0.43	-0.204**	-0.347*	-0.123
Women education		1	0.688**	0.314**	0.209**	0.177**	-0.286**
Husband education			1	0.358**	0.245**	0.120*	-0.105
Monthly income				1	0.089**	0.119*	-0.047
Age at first marriage					1	0.152	-0.195**
Breast feeding						1	-0.265**
Children everborn							1

Note: * **Significance at p<0.01** ** **Significance at p<0.05** *** **Significance at p<0.10**
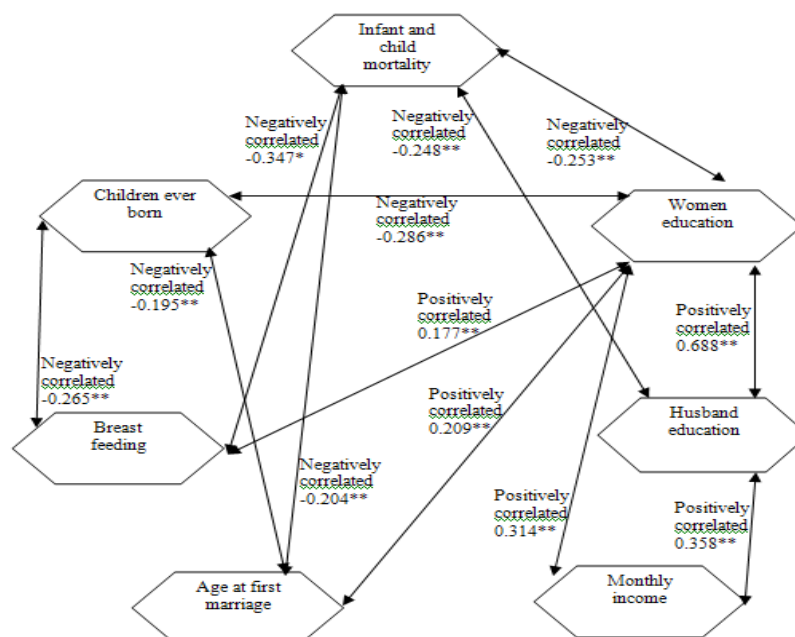

Figure 1.   Interrelationship between Socio-economic and Demographic Variables with Infant and Child Mortality

Table 4.   Estimates Multiple Co-Efficient of Determination (R^2) at age of Death of Infant in Terms of Multiple Covariates

Attributes	Multiple correlation coefficient of determination		Attributes	Multiple correlation coefficient of determination	
	R	R^2		R	R^2
$X_{1,2}$	0.388	0.150	$X_{1,2,5}$	0.421	0.177
$X_{1,3}$	0.602	0.363	$X_{1,3,4}$	0.665	0.442
$X_{1,4}$	0.433	0.187	$X_{1,3,5}$	0.621	0.386
$X_{1,5}$	0.311	0.097	$X_{2,3,4}$	0.580	0.337
$X_{2,3}$	0.549	.301	$X_{2,3,5}$	0.568	0.322
$X_{2,4}$	0.405	0.164	$X_{2,3,4,5}$	0.592	0.351
$X_{2,5}$	0.336	0.113	$X_{1,3,4,5}$	0.674	0.454
$X_{3,4}$	0.575	0.330	$X_{1,2,4,5}$	0.556	0.309
$X_{3,5}$	0.566	0.320	$X_{1,2,3,5}$	0.622	0.386
$X_{1,2,3}$	0.602	0.363	$X_{1,2,3,4}$	0.670	0.449
$X_{1,2,4}$	0.545	0.297	$X_{1,2,3,4,5}$	0.68	0.462

Table 5.   Estimates Multiple Coefficient of Determination (R^2) at age of Death of Child in Terms of Multiple Covariates
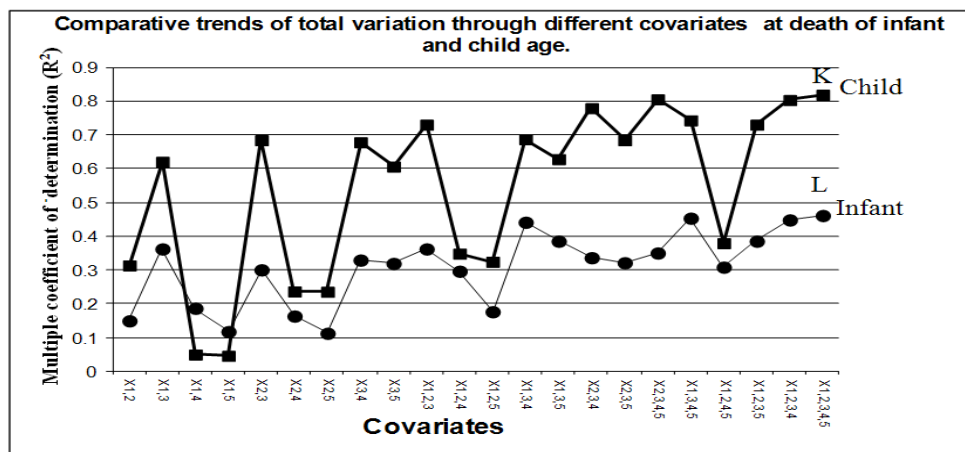
Attributes	Multiple correlation co-efficient of determination		Attributes	Multiple correlation co-efficient of determination	
	R	R^2		R	R^2
$X_{1,2}$	0.560	0.314	$X_{1,2,5}$	0.570	0.325
$X_{1,3}$	0.788	0.621	$X_{1,3,4}$	0.830	0.688
$X_{1,4}$	0.282	0.079	$X_{1,3,5}$	0.793	0.629
$X_{1,5}$	0.214	0.046	$X_{2,3,4}$	0.883	0.780
$X_{2,3}$	0.828	0.685	$X_{2,3,5}$	0.828	0.685
$X_{2,4}$	0.487	0.237	$X_{2,3,4,5}$	0.898	0.806
$X_{2,5}$	0.486	0.236	$X_{1,3,4,5}$	0.863	0.744
$X_{3,4}$	0.824	0.679	$X_{1,2,4,5}$	0.590	0.348
$X_{3,5}$	0.779	0.607	$X_{1,2,3,5}$	0.855	0.731
$X_{1,2,3}$	0.855	0.731	$X_{1,2,3,4}$	0.897	0.804
$X_{1,2,4}$	0.570	0.325	$X_{1,2,3,4,5}$	0.905	0.825

4.3. Impact of Socio-Economic and Demographic Factors on Age at Death of Infant and Child

From Table 4, it can be seen that the multiple co-efficient of determination of all orders viz. first, second, third and fourth are all statistically significant at 5% level of significance. All the five covariates age at first marriage, women education, monthly income, breast-feeding and children ever born are taken together explain about 46.2% of total variation in age at death of infant. CEB explains 44.9% of total variation while exclusion of age at first marriage explains 35.1% of the variation. Keeping out of monthly family income explains 30.9% of total variation. But women education, monthly income and duration of breast-feeding totally explain 45.5% of the total variation. Women education and monthly income together explain 54.9%, monthly income and duration of breast-feeding explain 57.5% of the total variation in infant death.

All the five variables, age at first marriage, women education, monthly income, breast-feeding and children ever born are taken together explain about 82.5% of total variation on age at death of child (Table 5). Execution of CEB explains 80% of total variation while omission of age at first marriage explains 81% of the total variation. Absence of monthly income explains 74% of total variation. Women education, monthly income and duration of breast-feeding totally explain 78% of the total variation. Women education and monthly income together explain 69% and monthly income and duration of breast-feeding explain 68% of the total variation on age at death of child. In the study area, monthly income appears to be the most influential covariate in explaining the variation of death of infant and child in presence of other covariates.

Figure 2.   Comparative Patterns of Total Variation at Death of Infant and Child in Terms of Multiple Covariates

4.4. Patterns of Death of Infant and Child in Terms of Multiple Covariates

Child line is conveying total variations at death of child than infant line for infant death. Child line get its highest peak position K, for highest value of $R^2=0.825$ highest peak K indicate, at the position covariates are age at first marriage, women education, monthly income, breast-feeding, children ever born explain highest 82.5% of total variation at death of child age. For infant line highest peak L indicate that at the position covariates are age at marriage, women education, monthly income, breast-feeding, children ever born explain highest 46% of total variation at death of infant age. Here, child line always keeps upward to the infant line. Now for comparative study of infant and child death, plotting co-variates through X-axis and multiple coefficients of deter-minations (R^2) through y-axis, we can form the Figure 2.

5. Conclusions and Policy Implications

Through differential patterns it can be observed that education of parents, income of household, occupation, age at first marriage and breast-feeding are significantly associated with infant and child death. From correlation analysis, we can see negative significant relationship exist among infant and child mortality with women education, occupation, age at first marriage and breast-feeding. In multiple coefficient of determination (R^2), all the five covariates: ages at first marriage, women education, monthly income, breast-feeding and children ever born (CEB) are taken together explain about 46% and 82.5% of total variation of age at death of infant and child respectively. In comparative graphical presentation of the total variation through different covari-ates at death of infant and child, child line always keeps upward to infant line.

Therefore, an effective policy and recommendations are needed to reduce infant and child mortality in particular slum areas of Rajshahi district in Bangladesh as well as developing countries. The policy implications and recommendations in this study are given below:

i) For reducing infant and child mortality, different cor-related sectors, e.g., health, women education and develop-ment, housing, environment, poverty alleviation in slum areas have to be consistently improved.

ii) Provide information and services including counseling services aimed at delaying age at first marriage of women; improved access to reproductive health education that help in reducing infant and child mortality.

iii) Breast-feeding combats with various infectious dis-eases and strengthen essential antibody system of the child. So, it is necessary to encourage the women to breast feed their child and it will reduce infant and child mortality.

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