

CHILD MORTALITY AND ITS IMPACT ON REPRODUCTIVE PATTERN IN BANGLADESH

REPRODUCTIVE PATTERN IN BANGLADESH

PhD Dissertation

By

Mohammad kamruzzaman

*Doctor of Philosophy
In
Statistics*



Institute of Bangladesh Studies
University of Rajshahi,
Rajshahi, Bangladesh

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Researcher

Mohammad Kamruzzaman
PhD Research Fellow
Session: 2008-09
Institute of Bangladesh Studies
University of Rajshahi, Rajshahi.

Supervisor . .

Dr. Md. Nurul Islam
Professor
Department of Statistics
University of Rajshahi,
Rajshahi.



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**Institute of Bangladesh Studies
University of Rajshahi, Rajshahi**

June, 2011

DEDICATED
TO
MY PARENTS

Dr. Md. Nurul Islam.
Professor
Department of Statistics
University of Rajshahi, Rajshahi-6205
Bangladesh



ডঃ মোঃ নুরুল ইসলাম
প্রফেসর
পরিসংখ্যান বিভাগ
রাজশাহী বিশ্ববিদ্যালয়, রাজশাহী
Phone: Off 088-0721-750041
Mobile: 01715-078277
E-mail : mnurul58@yahoo.com

CERTIFICATE

I have the pleasure to certify that the dissertation entitled “Child Mortality and Its Impact on Reproductive Pattern in Bangladesh” is the original work of Mohammad Kamruzzaman. As far as I know, this is the candidate’s own achievement and is not a conjoint work. He has completed this dissertation under my direct guidance and supervision. I also certify that I have gone through the draft and final version of the dissertation and found it satisfactory for submission to the Institute of Bangladesh Studies (IBS), University of Rajshahi in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Statistics.

Rajshahi

A handwritten signature in dark ink, likely belonging to Dr. Md. Nurul Islam.

(Dr. Md. Nurul Islam)
Professor
Department of Statistics
University of Rajshahi,
Rajshahi.
and
Supervisor

DECLARATION

I do hereby declare that the dissertation entitled “Child Mortality and Its Impact on Reproductive Pattern in Bangladesh” submitted to the Institute of Bangladesh Studies (IBS), University of Rajshahi for the degree of Doctor of Philosophy in Statistics is exclusively my own and original work. No part of it in any form, has been submitted to any other University or Institute for any degree, diploma or for other similar purposes.

Rajshahi



(Mohammad Kamruzzaman)
PhD Research Fellow
Institute of Bangladesh Studies (IBS)
University of Rajshahi,
Rajshahi, Bangladesh

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ABBREVIATIONS

ASFR	Age Specific Fertility Rate
ASMFR	Age Specific Marital Fertility Rate
BBS	Bangladesh Bureau of Statistics
BDHS	Bangladesh Demographic and Health Survey
BFS	Bangladesh Fertility Survey
BMHS	Bangladesh Maternal Health Service
BRAC	Bangladesh Rural Advancement Committee
CBR	Crude Birth Rate
CPS	Contraceptive Prevalence Survey
DHS	Demographic and Health Survey
DPT	Diphtheria, Pertussis and Tetanus Vaccine
EA	Enumeration Area
EPI	Expanded Program of Immunization
FP	Family Planning
GFR	General Fertility Rate
GMFR	General Marital Fertility Rate
GNI	Gross National Income
GOB	Government of Bangladesh
GPS	Global Positioning System
GRR	Gross Reproduction Rate
IBS	Institute of Bangladesh Studies
ICDDR'B	International Centre for Diarrhoeal Disease Research, Bangladesh
IMR	Infant Mortality Rate
ISRT	Institute of Statistical Research and Training
MAM	Mean age at Marriage
MMS	Maternal Mortality Survey
NIPORT	National Institute for Population Research and Training
NM	Neonatal Mortality
NRR	Net Reproduction Rate
OLS	Ordinary Least Square
PCA	Principal Component Analysis
PSU	Primary Sampling Unit
PRSP	Poverty Reduction Strategy Paper
SMA	Statistical Metropolitan Area
SMAM	Singulate Mean Age at Marriage
SPSS	Statistical Package for Social Science
TA	Total Abortion

Abstract

The actual picture of infant and child mortality is important not only for demographic assessment of the country's population, but also for the design and evaluation of health programs. Infant and child mortality is a sensitive indicator of the socio-economic status, nutritional standard and health condition prevailing in a community. This estimate is used for monitoring and evaluating population and health programs and policies. Again reproduction is the most significant demographic characteristic of women, which plays a vital role in population changes and strategies of a country. Its aspects cannot be denied in the fertility behavior of a human population. This study aims to investigate the level and trends of infant and child mortality followed by differentials with respect to some socio-economic, demographic and maternal health care service utilization characteristics, the bivariate analysis is used to examine significant association of socio-economic, environmental and demographic factors as the determinants of infant and child mortality. The analysis further wants to identify the factors affecting infant and child mortality at national level. This study also attempts to observe the level and trends of reproductive pattern, fertility situation of Bangladesh and direct and indirect effect of selected fertility related variables in order to find out the infant and child mortalities impact on reproductive pattern. All these investigations have been based on nationally representative data from Bangladesh Demographic and Health Survey (BDHS) 2007. Association between independent and dependent variables exist or not are examined by Chi-square test. Percentage distribution approach used to observe the overall picture of child mortality and reproductive pattern based on the different determinants in each age group. Brass indirect technique is used to assess child mortality level. Multiple logistic regressions applied to find out those variables which are truly related to child mortality differentials. Bongaart's technique applies to identify the changes in fertility level in terms of proximate variables. Finally path analysis helps in estimating the magnitude of the linkages between interrelated variables and provides information about intensity of the variables, when estimate the impact of child mortality on reproductive pattern.

The levels, trends, and differentials in infant and child mortality provide an opportunity to evaluate the performance of population and health programs and policies. Between the periods 1989-1993 and 2002-2006, neonatal mortality

declined by about 30% from 52 deaths per 1000 live births to 37 per 1000 and 10% declined from immediate past survey. Post-neonatal morality declined by about 60% from 35 deaths per 1000 live births to 15 per 1000 and it is 38% declined from immediate past survey. Child mortality rate is declined by about 70% from 50 deaths per 1000 live births to 14 per 1000 and it is 42% declined from last BDHS survey. The infant mortality rate (IMR) appears to have dropped sharply in the early 1900s, but barely dropped from 198 infant deaths per 1,000 live births to 145 deaths during the five decades between 1921 and 1971. In the immediate aftermath of Bangladesh's independence, the IMR actually increased to 145. But since then the IMR has fallen secularly and rapidly, reaching a level of 98 by 1989 and 52 in 2007.

Differentials in infant and child mortality reveals that residence in rural areas, parents illiteracy, fathers low level of working status, household without electricity, household with open or hanging latrines, without tube-well based sources of drinking water, poor housing conditions, early marriage, teenage motherhood, mothers with higher birth order and with short birth interval, mothers without mass media facilities, more than six members family, mothers whose birth giving place at home are responsible for infant and child mortality.

Child mortality levels are estimated by using indirect technique of Brass model. From the analysis we observed that child mortality has been falling. Children probability of dying increases with the rises of both age of mother and duration of marriage. Child mortality levels are high in those age groups where fertility rates also high. By applying logistic regression analysis in 4 groups (neonatal mortality group, post-neonatal mortality group, infant mortality group and child mortality group) in order to observed the effect of the socio-economic, demographic and maternal health care service utilization variables on risk of dying of children in the previous year. In the neonatal mortality group, out of all the variables that were included in the logistic regression, division, father's education, main roof materials, main wall materials, main floor materials, wealth status, sex of child, birth order number, age of mother at first birth, duration of breastfeeding, place of delivery, timing of first antenatal check and tetanus injection before pregnancy appeared to be the most significant factors in determining the likelihood of dying before reaching the first month of life. In the post-neonatal mortality group, division, mother's education, mother's occupation, electricity, main wall materials, wealth status, type of cooking fuel, sex of child, previous birth interval and tetanus injection before pregnancy appeared to be the most significant factors in determining the likelihood of dying before reaching one to eleven months of life. In

the infant mortality group, division, father's education, father's occupation, refrigerator as household goods, main roof materials, sanitation system, sex of child, birth order number, age of mother at first birth, number of household members appeared to be the most significant factors in determining the likelihood of dying before reaching the first birth day.

In the child mortality group, place of residence, mother's education, father's occupation, religion, wealth status, sources of drinking water, birth order number, previous birth interval, age of women at first birth, age at first marriage and mother's media exposure appeared to be the most significant factors in determining the likelihood of dying before reaching five years of life. High risk of child mortality in Bangladesh could be exists in those families where it is situated in rural areas, where parent's education is low, father's are farmer, mother's are either worker or service holder, absence of radio and refrigerator in the house, thatch/palm leaf based house, without pipe based sources of drinking water, without flush based sanitation system, new born babies are male, children's were born with very short and very long birth intervals, women age at first marriage is below 15 years, mother age at first birth is also below 15 years, duration of breastfeeding is below 1 month, household with 4—6 members and which families do not use electricity.

To review the level, trends and differentials of reproductive pattern of Bangladesh, fertility in Bangladesh is declining over the past 36 years by observing the trends in fertility. Total fertility rate has declined about 60 percent from 6.3 births per women in the period 1975 to 2.7 births for the period 2007. Period fertility approach reveals that the level of fertility is still very high in Bangladesh although the age specific fertility rate has been decreasing over time in each age group. The mean number of children ever born per ever married women has been declining over time but it is slightly lower on recent years in each age group. Most of the first marriage occurs within a short period of life. The age patterns of marriage and the contraceptive use have changed in a positive direction in reducing fertility. The regional differentials reveal the regional variation in fertility may be the result of education, occupation, religion, urbanization and economic condition of that area. The urban-rural differentials of fertility show that the rural fertility is higher than the urban. Level of education may effectively reduce reproductive performance of the women in Bangladesh. Fathers who are engaged in professional work have less number of children than the physical labour. Age at marriage and age at first birth effectively reduce reproductive performance of the women.

The Bongaarts model of the proximate determinants of fertility is one of the most widely used tools in fertility analysis. To identify the change of fertility in terms of proximate variables Bongaart's model has been used. Bongaat's model of the proximate determinants of fertility express that there is a downward trend in all the proximate indices. The proximate determinants of fertility suggest that late marriage, divorce, widowhood and contraceptive use are the key factors to reduce the level of fertility. The use and prevalence of contraception has been identified as an important determinant for the reduction in fertility that has to be achieved in the future. Infant and child mortality's impact on fertility analyzed based on Bongaart's model indices. Proportion of marriage for child losing mothers have less contribution in reducing fertility than the proportion of marriage for child living mothers. Proportion of lactational infecundability of child losing mother has greater contribution in reduction of fertility with compare to child living mother. The contraceptive use for child living mother is greater than child losing mother. Postponement of marriage for the women who lost their baby contributes lower births in reduction of fertility than the women who did not lost their baby. From the application of Bongaart's model, if 60% Contraceptive Prevalence Rate (CPR) achieved in 2020, TFR for the women who did not lost their baby earlier will be higher than the women who lost their baby. Again in order to achieve replacement level of fertility, CPR for the women who lost their baby will be higher than the women who did not lost their baby.

Impact of infant and child mortality on reproductive pattern is analyzed by using some selected fertility related variables. Women who lost their baby have more children per women than the women who did not lost baby before. ASFR for child losing teenage mothers are very low because of teenage child losing mothers may give dead child in their first issues. First and second birth order number is very low for those mothers who lost baby before. The mother who did not lost baby before have highest portion in 2 years duration of previous birth interval. Women who lost baby before get married in early ages. Short length of breastfeeding periods are preferred by the mother who lost baby earlier. With the increasing in age there is a decreasing tendency in sterilization for child losing mother. Child losing mother discourage contraceptive use than the mother who did not lost child. Child losing mothers are the highest portion for having another child but lowest portion for wants no more in their fertility preferences and declared infecundity is highest in earlier child losing mothers. Early child losing mothers are highest in number for taking tetanus injections during pregnancy.

Where infant and child mortality occurs among the women— fertility preference, number of household members, mother age at first birth, currently pregnancy are found to have significant direct negative effects. On the other hand, desire for more children, fertility preference, age at sterilization, women age at marriage, mother age at first birth, contraceptive use are found to have significant direct negative effects on fertility where infant and child mortality did not occurs. Age at sterilization and contraceptive use is essential to reduce fertility for those women who did not lost their child earlier, while it is not necessary for those women who lost baby earlier. Again number of household member and current pregnancy is important to lowering fertility for those women who lost baby before. Encourage all women for rising contraceptive prevalence rate, mother age at first birth and women age at first marriage in order to reduce fertility.

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Chapter: One

Introduction



Chapter: One

Introduction

1.1 Introduction

1.1.1 Background of the Study

The mortality level in a population is an important indicator of its health and well-being. Infant and child mortality rate have used as measures of socioeconomic development, or as indices of the quality of life. Mortality data by age and sex, as well as mortality trends over time provide key insights into the health status of populations which are important inputs in the planning and implementation of preventive measures. The analysis of mortality is generally considered as infant, child and adult mortality. Child mortality is a sensitive indicator of the socio-economic status, nutritional standards and health conditions prevailing in a community. For infant and young children, the risk of death is closely related to the environment in which they live, because they are ill equipped to deal with infection and nutrition deficiency condition, inadequate food and lack of elementary hygiene. A child is highly vulnerable to two categories of acquired ailments; one is a heavy load of infectious diseases and the other is inadequate nutrition. The profile of childhood diseases in Bangladesh is generally similar to those of other developing countries in the tropics such as Asia, Africa and South America.

The infant mortality rate during 1995–2000 was 14 in more developed regions (United Nations, 2004). Within the less developed regions vast variations were observed in the infant mortality rates during the same period, ranging from 102 for Africa to 49 for Latin America. The child mortality among the less developed regions was also much higher than that for the more developed regions. There were 106 deaths among children under-five years of age in the less developed regions compared with only 17 in the more developed regions (United Nations, 2004). In spite of the achievement made in the reduction of infant mortality and under five mortality rates, there appears to be wide disparities among countries and provinces. The relationship between child mortality and socio-economic factors might be relatively weak in developed countries, may be due to low infant and child mortality. In contrast, in the developing countries, a significant portion of deaths occurs during

infancy, which may be due to poor public health measures and lack of access to health care facilities. Such poor health and environment aspects are associated with the high child mortality too. Mortality situation improved especially in infant and child mortality over the last three decades in Bangladesh. Bangladesh has achieved this progress against unemployment, ignorance, backdrop of low literacy rate, low status of women, poor health condition of women and children, infectious and malnutrition condition and low per capita income and so on.

The World Health Organization (WHO) is now defining reproductive health as a condition in which reproduction is accomplished in a state of complete physical, mental and social well-being, and not merely the absence of diseases or disorders of the reproductive process. In other words, it is now realized that human reproduction problem is not a physiological problem but also a problem of greater extent. Reproduction is the most significant demographic characteristic of women, which plays a vital role in population changes and strategies of a country. Reproductive process can be expressed in terms of birth interval; family-planning pattern etc. Birth interval is an important measure of the place of childbearing. Over the last two decades, the availability of data and substantial progress on statistical method has led to research on human fertility through the analysis of birth interval. So its aspects cannot be denied in the fertility behavior of a human population. Moreover, these intervals are taken as indicators of reproductive performance to reflect differential patterns of reproduction.¹ In recent years a great deal of attention has been focused on whether family planning can significantly improve children's health by shifting births away from the highest risk of maternal age, birth spacing and parity groups.

Women's age has been considered nearly as a reference to human reproduction. As effective contraceptive measures has been introduced in the early 1950s, a women's age no longer plays the exclusive role in determining reproduction, and birth order or parity of women has emerged as an important factor in the formation of reproductive patterns of the human population. Women face many health risks that associated with sexuality and child bearing. About one third of the total disease burden that women face is linked to pregnancy, child birth, abortion and various reproductive tract disorders (World Bank, 1993). Infant and child mortality not only creates mothers physical complicity but also creates demand among the mothers

¹ G. Rodriguez, and J.N. Hobcraft, "Illustrative Analysis: Life Table Analysis of Birth Intervals in Colombia," *Scientific Report*, (Voorburg, The Netherlands: International Statistical Institute, 1980), pp.66-67.

for more child. Moreover, infant and child mortality is a great threat for of a nation. Child losing mother's reproductive pattern is different than child living mothers.

1.1.2 Statement of the problem

Infant and child mortality rates reflect a country's level of socio-economic development. It is used for monitoring and evaluating population and health programs and policies. It is also important for monitoring progress towards the Poverty Reduction Strategy Paper (PRSP) and the United Nations Millennium Development Goal (MDG) to reduce child mortality by two-thirds by the year 2015. In Bangladesh, one-third of the population is under 15 years of age, 63 percent are age 15–63 years and 4 percent are age 65 or older (CIA, 2008). Total Fertility Rate (TFR) is 2.7 and Women of reproductive age (15–49) represent 58.4 percent of the total female population (BDHS, 2007). The maternal and infant mortality rates are reported to be 3.3 and 52 per thousand live births respectively. Life expectancy at birth has increased to 64 years for male and 66 for female (BBS, 2008) compared with the 2001 level of 62 and 62 years respectively (United Nations, 2004).

Child mortality is a problem that has many dimensions with the complexity of the issues that child mortality encompasses. It has especially been a daunting problem for the developing world including Bangladesh. Such widespread prevalence of this problem in developing nations is mainly due to the limited resources and infrastructure that they have at their disposal to combat infant and child death. In Bangladesh one in seven children dies before his/her fifth birthday and more than half (52%) of the deaths occur during infancy, at least 20 percent of these deaths are caused by diphtheria, tetanus, measles, poliomyelitis and tuberculosis (BDHS, 2007). There are six childhood diseases [diphtheria, pertussis (whooping cough), tetanus, polio, measles, and tuberculosis] for which effective vaccines are now available. As a result of use of these vaccines through the WHO sponsored Expanded Program of Immunization (EPI) throughout countries of the developing world, incidence of these diseases is rapidly declining (United Nations, 2008). Among the infectious diseases, diarrhoeal diseases are perhaps the most common illness for children in Bangladesh due largely to unsafe drinking water and poor health and sanitation practices. The next major category of illness involves the respiratory system, the most severe being acute respiratory infection of which pneumonia is the prototype. Intestinal parasitic diseases caused by helminthes and parasitic diarrhoea caused by the intestinal

protozoa *Giardia* is also common particularly in rural children and children living in urban slums (Banglapedia, 2003).

The intricacy of the human reproduction process can be improved by understanding the causes of fertility variation. These variations are not only governed by a number of biological and behavioural factors but also by a lot of socio-economic and cultural factors. These social, economic and environmental factors are termed as the determinant of fertility because these determinants directly affect the fertility. Determinants of fertility in a population are a complex process. While fertility behavior influences population growth, which has consequences towards pressure on resources, employment situations, health and other social facilities, saving and investment, such consequences become great bearing on the socio-economic variables that affect fertility behavior. The level of fertility in a society is directly influenced by a set of intermediate variables or proximate dominants. The socio-economic, cultural and environmental variables through which biological and behavioural factors affect fertility are called an intermediate fertility variable. The primary characteristics of an intermediate fertility variable are its direct influence on fertility. It is widely recognized that the demographic transition in Bangladesh has begun against unfavourable social, economic and institutional constraints for reproduction changes.

When a woman lost her child with due many reasons, it creates many difficulties for her maternal health. In that situation child mortality creates great impacts on reproductive health. Since the reduction of child mortality indirectly helps in reducing fertility by decreasing the desired number of children to be born due to increased probability of survival of a child, an attempt should be start to identify the impacts of child mortality on reproductive pattern for our future generation. Moreover, the child mortality is a composite index reflecting environmental, social, economic and health care services delivery situation on the one hand and maternal as well as family and community norms and practices on the other. A large number of studies on the infant and child mortality have been conducted by the demographers in the developing countries during the recent years but simultaneously the relationship between child mortality and reproductive pattern or impact of child mortality on reproductive pattern type study is very rare. It is needless to mention that several studies conducted in the issue of child mortality, mainly to determinants of mortality which is helpful in identifying the segment of population whose mortality is still higher. Here the study

aims at finding out level, trends and behaviour of child mortality and reproductive pattern; causes and effect of child mortality and reproductive pattern, finally trying to investigate the impact of child mortality on reproductive pattern. Some of the important studies were reviewed here in order to get idea about their contributions to identify the necessity of current research.

1.1.3 Research Questions

This research work would be based on the following Research Questions:

- What are the level, trend and behaviour of child mortality in Bangladesh?
- Why do the present level, trend and behaviour of child mortality exist?
- What are main the causes for child mortality in Bangladesh?
- What is the reproductive pattern's behaviour in Bangladesh?
- How the level, trend and behavior of reproductive pattern are affected by child mortality?
- What are the impacts of child mortality on reproductive pattern?

1.2 Objectives of the Study

Following the statement of the problem and the research questions, the objectives of the study were set to empirically analyze the child mortality and its impact on reproductive pattern in Bangladesh. The objectives of the study were as follows:

(i) Broad Objective: The broad objective of the study was to evaluate and analyze the child mortality and its impact on reproductive pattern in Bangladesh.

(ii) Specific Objectives: The specific objectives of the study were:

- To investigate the levels, trends and differentials of child mortality;
- To analyze the factors which are effecting child mortality;
- To identify the levels, trends and behaviours of reproductive pattern;
- To find out the factors which are affecting reproductive pattern; and
- To assess the effects of child mortality on fertility, if any.

1.3 Review of the Literature

A numerous number of studies related to child mortality and reproductive pattern had been conducted in the developing countries mainly due to high rate of child mortality. For obvious reason, this research highlighted the studies related to developing countries, particularly for Bangladesh. The risk of mortality directly influenced by

different intermediate or proximate determinates. Among them education and occupation of father and mother, residential condition, sanitation, access to safe drinking water, working status of mother, maternal and child health care service had received much attention.

Adlakha, A.L. and Suchindran, C.M. (1985) examined the factors of child mortality in four near east countries using World Fertility Survey (WFS)–1975 survey data.² They consider some characteristics as mother age at the birth of child, birth order, previous child loss, mother residence, father occupation and mother's work experience since marriage. They using multivariate logistic regression analysis and obtained the effect of each factor on mortality. The model constituted according to child mortality in each country. The mortality variation has been observed in four countries. They indicated that female child mortality is higher than male child. The demographic variables have significant effect on mortality, particularly length of the preceding birth interval. Among the socio-economic variables they found residence is influential.

Amin, R. (1988) used the data of World Fertility Survey–1975 and Contraceptive Prevalence Survey–1979 in his study and examined socio-economic differentials and trends in child mortality in Bangladesh.³ He identified that there is evidence of some recent decline in child mortality. Mother education, higher birth order had significant independent effects upon the reduction of infant and child mortality. Other variables such as father education, fetal loss or land ownership had no effect on child mortality.

Ahmed, F.M. (1991) indicated that it is very difficult to reduce infant mortality in Bangladesh because of poor public health facilities.⁴ Pubic health and related activities will have to be significantly increased. A simultaneous activity should be direct towards increasing in female education and reduction of existing urban-rural and socio-economic differentials, which have been found to be important factor in reduction infant mortality.

Ahmed *et al.* (1999) conducted their study based on Matlab data of ICDDR'B. They had shown that the education and another indicator of socio-economic status, viz., the size of the dwelling space of the household were negatively associated with

² A.L. Adlakha, and C.M. Suchindran, "Factors Affecting Infant and Child Mortality," *Journal of Bio-Social Science*, vol.17, No. 40 (1985), pp.481–496.

³ R. Amin, "Infant and Child Mortality in Bangladesh," *Journal of Bio-Social Science*, vol. 20, (1988), pp.59–65.

⁴ F.M. Ahmed, "Infant Mortality in Bangladesh: A Review of Recent Evidence," *Journal of Bio-Social Science*, vol. 23 (1991), pp.327–336.

child mortality.⁵ The mother's education is a more decisive determinant of child survival than other family characteristics such as husband's occupation and husband's education. Bairagi (1980) indicated that mother education may be attributed to the children of enjoying better diets and better overall care than the children of non-educated mothers.

Abdur Razzaque and Peter Kim Streafield (2000) have studied the past, present and future fertility in Bangladesh⁶. They observed that the population of Bangladesh has been much increases in the second half of the 20th century, 41 million in 1950 to 120 million in 1998. Such huge increases mainly due to mortality decline after the war-II with improvement of medical science and public health measures. However, in Bangladesh, fertility decline at a very low level of socio-economic development. The study used two data sources: Matlab Demographic Surveillance, ICDDR,B and Demographic and Health Survey of Micro International, 1993–94, 1996–97, 1999–2000. They observed that in the past, fertility was high because familial, social and economic conditions were favorable to many rather than few children but recent data shows widespread motivation for small family size and it is mainly due to increase in the direct economic cost of living. Such appreciable decline in fertility was possible mainly due to the family planning program have been successful. It has also documented that a large proportion of birth is still unwanted in Bangladesh as well as in both the MCH-FP and comparison area of Matlab. If the unwanted birth could have been eliminated, fertility would have been much lower along with fewer abortions, because contraceptive use can lower down abortion by reducing unwanted birth. They also discussed the future level of fertility in Bangladesh.

Ahmad Kabir *et al.*, (2001) attempted to identify important factors influencing infant and child mortality using the data based on 1993–94 Bangladesh Demographic Health Survey (BDHS).⁷ Application of Cox's proportional hazard model suggests that socio-economic status of the parents is associated with child survival. The factors that have received the most attention are maternal education, sanitation and access to safe drinking water. For instance, risk of infant mortality is 13% lower

⁵ M.K. Ahmed, M. Rahman, and J.V. Ginneken, "Epidemiology of Child Death Due to Drowning in Matlab, Bangladesh," *International Journal of Epidemiology*, vol. 28 (1999), pp.306–311.

⁶ A. Razzaque, and K. Streafield, "The fertility in Bangladesh: Past, Present and Future," ICDDR,B, Centre of Health and Population Research, Bangladesh, (2000).

⁷ Ahmad Kabir, Mohammad Shahidul Islam, Muhammad Shabbir Ahmed, and M.A., Khalique Barbhuiya, "Factors Influencing Infant and Child Mortality in Bangladesh," *Journal of Medical Science*, vol.1 (2001), pp.35–47.

among the women having primary education and 25% lower among the women having secondary or higher education than those having no education. It was observed that 35 and 29% lower among the households having safe drinking water and good sanitary facilities, respectively than those who do not have such facilities. Similarly, risk of child mortality decreases with increased female education and wider access to safe drinking water and good sanitary facilities.

Alam, N (1995) examined the effects of birth spacing on early childhood mortality, 3729 singleton births in 1983–84 were followed for 3 years in rural Bangladesh.⁸ Logistic regression analysis were used to assess whether the survival of older siblings modifies the effect of preceding birth intervals and to see if the effects of preceding and succeeding birth intervals are inter-related, controlling for the effects of sex of the child, mother's age and household economic status. With the exception of the neonatal period, birth spacing effects were highly significant. A preceding birth interval of <15 months was associated with a greater mortality risk in the post-neonatal period for children with an older sibling who survived infancy. However, a short preceding birth interval did not adversely affect post-neonatal mortality if the older sibling died in infancy. Neonatal and post-neonatal deaths were higher if older siblings had died in respective age intervals. A pregnancy interval of <12 months after childbirth raised the risk of death at ages 1–2 years considerably if the child was born after a short birth interval (< 15 months). The results suggest that the high mortality risks of closely spaced children are due to sibling competition for parental resources.

Breastfeeding has an important role on infant health because human breast milk contains the most complete form of nutrition for infants (AAP, 1997). Breastfeeding protect diseases and ill health in different ways. (Palloni & Millamn, 1986) find that breast milk gives the infant a balanced diet during the first six months of his life.⁹ Another studies investigated that breast milk contains all the nutrients requirements of the child both in quality and composition in right proportion. It is also rich in antibody substances and gives the baby with best protection against diarrhoea, infections, food allergies etc. and thus reduces child mortality (Page et al., 1982; Agarwal et al. 1982). Investigations on historical and modern third world children

⁸ N. Alam, "Birth spacing and infant and early childhood mortality in a high fertility area of Bangladesh: age-dependent and interactive effects," *Journal of Bio-Social Science*, vol. 27, no. 4 (October, 1995), pp.393–404.

⁹ A. Piloni, and M. Tienda, "The Effects of Breast Feeding and Pace of Child Bearing on Mortality at Early Ages," *Demography*, vol. 23 (1986), pp.31–52.

have shown that infants who are exclusively breast-feed survive longer and healthier than artificially feed children in direct proportion. A.S. Cunningham, (1981) identified that the child's mortality causes the cessation of breastfeeding, thus increasing the probability of return to ovulation, so also the conception of the next child, resulting in a shortened birth interval.¹⁰ The strength of this effect is found to be related to the intensity, frequency and duration of breastfeeding.

Bongaart's, J. (2005) in an examination of causes of the slow change of fertility in seven mid-transition countries: Bangladesh, Colombia, Dominican Republic, Ghana, Kenya, Peru and Turkey revealed a systematic pattern of leveling off or near leveling in a number of determinants¹¹. The findings suggest no major deterioration in contraceptive access during the stall, but levels of unmet need and unwanted fertility are relatively high. At the onset of the stall the level of fertility was low relative to the level of development in all but one of the stalling countries.

Cleland (1990) investigated that the most important features of the maternal education and early childhood mortality associated may be summarized, thus the association is found in all major developing regions; the linkage is stronger in childhood than infancy; only about half the gross association can be accounted for by material advantages associated with education, reproductive risk factors play a minor intermediate role in the relationship; greater equity of treatment between sons and daughters is no part of the explanation; the association between mother's education and child mortality is slightly greater than for father's education and mortality.¹² He also showed that among all the social and cultural factors of health and child mortality, education consistently emerges as the most powerful and presents everywhere.

Chowdhury, M.K. and Bairagi, R (1992) estimated the effect of age at marriage on fertility using Matlab data¹³. They suggest that most of the girls who married before age 12 or 13 years were not fecund at the marriage and their age specific

¹⁰ A.S. Cunningham, "Breast-feeding and Morbidity in Industrialized Countries an Update," *In Advances in International Maternal and Child Health*, edited by D.B Jelliffe & E.F.P Jelliffe (Oxford: Oxford University Press, 1981), p.51-54.

¹¹ J. Bongaart's, "The Cause of Stalling Fertility Transitions," Population Council Policy Research Division, Working Paper No. 204, (2005).

¹² J. Cleland, "Maternal Education and Child Survival: Further Evidence and Explanation," pp.400-419 in *Health Transition: The cultural, social and behavioral determinants of Health*, Ed. J. Caldwell (Health transition Centre, The Australian National University, Australia, 1990)

¹³ M.K. Chowdhury, and R. Bairagi, "The Effects of Age at Marriage on Fertility and Mortality in Rural Bangladesh," Paper Presented at annual meeting of the Population Association of America, Denver, Colorado, USA, 1992.

fecund ability, at least for first 10 years of married life (this follow-up time was for about 10 years), is not different from that of women married at a higher age. In other words, age specific fecundability up to 25 years of life does not depend on age at marriage. They also suggested that the monthly risk of a birth during 20–24 years of life and up to 25 years of life did not vary with age at marriage could potentially affect fertility, because the age specific monthly risk of birth, which is equivalent to age specific fecundability in this population, has not affect by age at marriage, which in turn produce a higher total fertility for women married at a young age. They also estimated the average first birth interval, which has been almost two years (1.9 years) for women whose age at first marriage was 18 years, most of the births, which took place to the mothers before age 20 could be averted. Assuming that age at first marriage on crude birth rate (CBR) and total fertility rate (TFR) have been estimated by applying these results to the age specific births rates. The results showed that CBR would be reduced by 13 percent and TFR by 9 percent. If the minimum female age at marriage could be raised to 21 (which is the minimum age at marriage set for males in the Bangladesh Population Policy), CBR could be reduced by 32 percent and TFR by 20 percent.

C.M. Suchindran, N.K. Namboodiri and K. West (1997) introduced an increment-decrement life table method to study the family building patterns among women.¹⁴ They considered age at the occurrence of a specific birth as the principal duration variable. Data from a sample of currently married women from the 1965 US National Fertility Study were used to illustrate the method.

Deborah Balk (1994) had examined that women's status is well represented neither by one direct measure nor one indirect single proxy¹⁵. The data (approximately 5,000 women) are implemented from some villages of rural Bangladesh. Different dimensions of women's status influence fertility differently in terms of magnitude, direction and statistical significance. The effects of status on fertility are widely different in rural Bangladesh and measures that not account for the simultaneous determination on reverse causality of women's status and fertility will probably mistake the direction and under estimate the effects of status on fertility.

¹⁴ C.M. Suchindran, N.K. Namboodiri, and K. West, "Increment–Decrement Table for Human Reproduction," *Journal of Bio-Social Science*, vol. 11 (1997), pp.51–53.

¹⁵ Deborah Balk, "Individual and Community Aspects of Women's Status and fertility in Bangladesh," *Journal of Population Studies*, vol. 48, (1994), pp. 21–45.

Claeson *et al.* (2000) identified some factors which were played significant role in lowering child mortality.¹⁶ They found non-income factors, such as mother and child health intervention has played a significant role in decreasing child mortality. Child mortality in urban areas has been lower than in rural areas. They also found improving female education & nutrition, as well as increasing the use of health services during pregnancy & delivery would lower child mortality.

Das Gupta and Narayana (1996) criticized the World Bank Report (Cleland *et al.*; 1994) on fertility decline in Bangladesh from other stances¹⁷. They showed that Bangladesh's socio-economic, family planning and demographic trends were not unique but were similar to some Indian states. They explained the fertility traditions not only by local events but every largely by happening on a much larger scale.

Environmental factor like use of type toilet, use of household's water supply, cooking fuel etc also influence the child mortality. Access to a flush or pit toilet is an important factor of child mortality in developing countries. The lack of such access could have higher exposure to other children to diseases such as tetanus, and digestive disorders (Puffer and Swrrano, 1978; UN,1985). Mishra and Retherford (1997) identified that the type of cooking fuel used in a household could affect child mortality if children spend a great deal of time where cooking takes place, because cooking fuel that emits harmful smoke could elevate their risk of respiratory diseases and hence mortality.¹⁸ Hobcraft (1981) proposed that in inter American study the condition of diarrhoeal disease was lowest for the households having piped drinking water and flush toilet facilities. Current access to proper toilet facilities was found to influence child mortality reduction especially beyond the post-neonatal stage. Martin *et al.* (1983) also shown that the safe drinking water and improved sanitary conditions are important factors contributing to reduce in infant mortality. Dashtseren (2002) also found that the mortality rates are lower for children whose household uses electricity attached bathrooms and toilets.¹⁹

¹⁶ M. Claeson, E.R. Bos, T. Mawji, and I. Pathmanathan, "Reducing Child Mortality in India in the New Millennium," *Bulletin of the World Health Organization*, vol. 78 (2000), pp.1192–1199.

¹⁷ M. Das Gupta, and D. Narayana, "Bangladesh's Fertility decline from a Regional Perspectives, *Journal of Genus*, vol. L-III, No. 3 & 4, (1997), pp. 101–128.

¹⁸ V. Mishra, and R.D. Retherford, "Cooking Smoke Increasing the Risk of Acute Respiratory Infection of Children," *National Family Health Survey Bulletin*, No. 8 (Mumbai: International Institute for population Sciences, India, 1997), p.16.

¹⁹ A. Dashtseren, "Determinants of infant and child Mortality in Mongolia," (National Statistical Office in Mongolia, UNFPAFO in Mongolia, 2002) Paper Presented at the IUSSP Regional Conference, Bangkok, Thailand (June, 2002), p.9–12.

Grabill (1945) published a paper on first marriage tables based on the data from the 1940 census. These data were adjusted (generally downward, by use of available vital statistics for 1920 to 1940) to a level so that the marriage behavior could be represented as a relatively longer period. In these first marriage life tables, Grabill showed two decrements marriage and death (ordinary life tables show only one decrement death and were limited to the single population).

Ghosh R, and Bharati P (2010) examined the rates of infant and child mortality and associated demographic and socio-economic factors in 2 socio-economically vulnerable populations, comprising 195 Munda and 334 Poundrakshatriya women having similar access to health care facilities in a periurban region of Kolkata city.²⁰ Higher infant mortality rate (IMR) was noted in the older and young Munda women, in contrast to lower IMR in younger Pod women. Child mortality rate was lower in younger women in both the ethnic groups. Stagnation in IMR in younger Munda women indicates poor delivery practices whereas lower rate among the Pod reflects better adoption of safe delivery practices. Differential association of factors with infant and child deaths in the 2 populations indicate that a better understanding of determinants in culturally heterogeneous populations at the community or household level is needed to develop more effective strategies for child survival and development.

Halder AK *et al.*, (2009) investigated rates and causes of under-five deaths in an urban community near two large paediatric hospitals in Dhaka, Bangladesh and evaluated the impact of different recall periods.²¹ They conducted a survey in 2006 for 6971 households and a follow up survey in 2007 among eligible remaining households or replacement households. The initial survey collected information for all children under five years old who died in the previous year, the follow up survey on child deaths in the preceding five years and compared mortality rates based on 1-year recall to the 4 years preceding the most recent 1 year. The initial survey identified 58 deaths among children < 5 years in preceding year. The follow up survey identified a mean 53 deaths per year in the preceding five years (SD+/- 7.3). Under-five mortality rate was 34 and neonatal mortality was 15 per thousand live births during 2006–2007. The leading cause of under-five death was respiratory

²⁰ R. Ghosh, and P. Bharati, "Determinants of infant and child mortality in periurban areas of Kolkata city, India," *Asia Pacific Journal of Public Health*, vol. 22, No.1 (January, 2010), pp.63–75.

²¹ A.K. Halder, E.S. Gurely, A. Naheed, S.K. Saha, W.A. Brooks, S. Arifeen, H.M. Sazzad, E. Kenah, S.P. Luby, "Causes of early childhood deaths in urban Dhaka, Bangladesh," *PLoS one*, vol. 4, No. 12 (3 December, 2009), pp.81–145.

infections (22%). The mortality rates among children under 4 years old for the two time periods (most recent 1-year recall and the 4 years preceding the most recent 1 year) were similar (36 versus 32). The child mortality in urban Dhaka was substantially lower than the national rate.

Halder AK, Kabir M (2008) used Principal Component Analysis (PCA) to assets and other household data, collected as part of the Bangladesh Demographic Health Survey (BDHS) 2004, to rank individuals according to a household socio-economic index and to investigate whether this predicts access to the sanitation system or outcomes.²² PCA was used for determining wealth indices for 11,440 women in 10,500 households in Bangladesh. The index was based on the presence or absence of items from a list of 13 specific household assets and three housing characteristics. PCA revealed 35 components, of which the first component accounted for 18% of the total variance. Ownership of assets and housing features contributed almost equally to the variance in the first component. In this study, ownership of latrines was examined as an example of sanitation-intervention access and rates of mortality of neonates, infant and children aged less than five years (under-five mortality) as examples of health outcomes. The analysis demonstrated significant gradients in both access and outcome measures across the wealth quintiles. The findings call for more attention to approaches for reducing health inequalities. These could include reforms in the health sector to provide more equitable allocation of resources, improvement in the quality of health services offered to the poor and redesigning interventions and their delivery to ensure that they are more pro-poor.

Hong R (2006) examined the relationship between high-risk infant of multiple birth and infant mortality in Bangladesh.²³ He uses information on 7001 childbirths in 5 years preceding the 2004 Bangladesh Demographic Health Survey to examine the relationship between multiple birth and infant mortality using multivariate analysis, controlling for child's sex, birth order, prenatal care, delivery assistance, mother's age at child birth, nutritional status, education level, household living conditions and several other risk factors. Results of his study indicate that children born multiple births were more than six-times as likely to die during infancy as those born

²² A.K. Halder, and M. Kabir, "Child mortality inequalities and linkage with sanitation facilities in Bangladesh," *Journal of Health Population Nutrition*, vol. 26, No.1 (March, 2008), pp.64–73.

²³ R. Hong, "Effect of multiple birth on infant mortality in Bangladesh," *Journal of Paediatric Child Health*, vol.42, No 10 (May, 2007), pp.630–635.

singletons (hazard ratio = 6.51, 95% confidence interval: 4.10, 10.36). Controlling for all other risk factors does not change the strength and direction of the relationship (hazard ratio = 6.18, 95% confidence interval: 3.65, 10.46). Receiving prenatal care and access to safe drinking water are associated with lower risk.

Hossain MB *et al.*, (2007) found that women's status adversely affect the survival of their children.²⁴ Survey data are used to construct indices of women's household autonomy and authority, which are then linked to longitudinal data on survival of their children. Proportional hazard models indicate that enhanced household authority significantly decreases child mortality. A simulation based on estimated effects of eliminating gender inequality suggests that achieving complete gender quality could reduce child mortality by nearly fifty percent and post-neonatal mortality by one-third.

In developing countries including Bangladesh, mother age at birth played an important role on child mortality. A number of studies deal with mother's age at the birth of the child. When a woman is too young, pregnancy-wanted or unwanted can be dangerous for both mother and infant. H. Tiwari (1989) investigated that the optimal ages of child bearing is confined of 20 to 34.²⁵ It will help to reduce maternal mortality and infant mortality. It is reported that infant mortality rates are expected to associate positively with mother's age (Population reports May-June, 1984). Evidence from around the studies world showed that the risk of infant illness and death is highest for the mothers who were pregnant before age 20 and after age 35.

In few developing countries such as South Asian countries, the Middle East and Northern Africa, it has been observed the excess female mortality during infancy and childhood (UN, 1988; Rutstein, 1984). Male child mortality is higher in neonatal period than that of girls in South Asian countries including Bangladesh. Hobcraft *et al.* (1985) identified that in Egypt, Pakistan, the mortality of girls after the neonatal period (post-neonatal) higher than that of boys but in Bangladesh and Yemen it was observed that in post-neonatal period male child mortality is higher than female child.²⁶ Using data from the 1988 two-per-thousand survey of fertility and birth control, Minja *et al.* (1995) examined the effects of gender, birth order and other

²⁴ M.B. Hossain, J.F. Phillips, and B. Pence, "The effect of women's status on infant and child mortality in four rural areas of Bangladesh," *Journal of Bio-Social Science*, vol.39, No.3 (May, 2007), pp.355–366.

²⁵ H. Taiwari, "Estimation in Decline in the Infant Mortality Rate in India Due to Fertility Reduction," *Journal of Family Welfare*, vol. 35 (1989), p. 75.

²⁶ J.N. Hobcraft, J.W. Mc Donald and S.O. Rustein, "Demographic Determinants of Infant and Early Child Mortality: A Comparative Analysis," *Journal of Population Studies*, vol.39, No.3 (1985), pp. 363–385

correlates of childhood mortality in China. They found that among first born children, the difference between male and female children between ages 1 and 5 experienced higher mortality than male children. Childhood mortality was slightly higher for children who have older brothers only than whom have older sisters only and it is highest for those who have both older brothers and sisters. Gupta and Bhat (1997) examined and explained about many existing cultural factors that predispose females to excess mortality, especially in childhood. In the developing countries especially African and half of the Asian countries, male child is a lower than female child. This excess female child mortality has been explained by cultural pattern of placing less value and consequently less care for the female child. Intachat *et al.* (2005) find that a biological factors that makes male infant mortality always higher than female is reversed by social determinants which expose females to risk as high as or higher than males.²⁷

Islam, N. *et al.*, (1991) had estimated the fertility inhabiting effect of the three most important proximate determinants: marriage, contraception and lactational infecundability²⁸. The analysis shows that although the fertility level of Bangladesh is declining, it is still very high (around 3 births per women). They suggest that fertility reducing effect of the marriage variable is also increasing but at a very slow rate. In fact, the fertility inhabiting effect of marriage and lactational infecundability are compensating each other. The study reported that, among females marrying before the age of 18 years, the impact of age at marriage on children born till the age 45–49 years was small. But the reliability of this estimation is questionable for several reasons. Firstly, the data were collected retrospectively and accuracy of both an individual's age and age at marriage data is unknown. Secondly, the findings that completed fertility of women married before their tenth and twelfth births days are highly unlikely.

Islam, N. and Abedin, S. (1996) indicated by application of Bongaart's model that there was a downward trend in all the proximate indices²⁹. He estimated that between 1975 and 1989, the amount of decrement of fertility was about 23 percent

²³ N.Y. Intachat, Y. Sawangdee, B. Entwisle and C. Podhisita. "Cause of Death in Thailand: Gender Differential Perspective," *Journal of Population and Social Studies*, vol.13, No.2 (January, 2005), pp.

²⁸ N. Islam. *et al.*, "Proximate Determinants of Fertility in Bangladesh, 1975–1989," Proceedings of the one-day seminar on Applied and Theoretical Statistics, Organized by the Bangladesh Statistical Association, ISRT, and Dhaka University, Bangladesh, 1991.

²⁹ N. Islam, and S. Abedin, "Some Observations on Marriage, Contraception and Fertility in Bangladesh," *Journal of Genus*, vol. L-II, No.1–2 (1996), pp.

and it was about 31 percent in between 1975 to 1991. Islam concluded that this was primarily caused by an increase in the use and effectiveness of contraception. He also investigated the fertility differentials by various demographic and socio-economic works status of women, education of husband and occupation of husband. He suggested that socio-economic variables have positive or negative effect on proximate variables, which in turn affect reproductive performance. He concluded that age at marriage and education have strong determinant of fertility as well as higher age at marriage and educational level affect on fertility decreasing.

Islam, N. and Abedin, S. (2001) examined the effect of women's education on age at marriage of the females and as well as on fertility³⁰. They showed that education is one of the important social variables of fertility differentials. It is an achieved status of individuals, which does not change over time like some other variables and is expected to traditional ones. Women engaged in such activity contribute in rising age at marriage and thereby affect fertility to reduce.

Islam, M.A., Islam, M.M., and Chakraborty, N. (2002) focused on the exploration of the reality underlying the fertility change in Bangladesh³¹. They have identified a number of factors responsible for unchanging of fertility in Bangladesh since 1993–94, which are due to population momentum effects, shifting of childbearing towards younger ages, shifting towards adoption of a less effective method mix, no substantial improvement in child survival status and reduction in postpartum infecundability period. They mentioned that the actual level of fertility in Bangladesh in 1999–2000 after adjusting for tempo effect would be close to 4, as compared to that of 3.8 in 1996–97. They analyzed statistical characteristics such as location, dispersion and skewness of age specific fertility distribution, which indicate an emerging pattern: (1) the fertility is tending towards young age during the recent past, (2) the births are occurring at a relatively lower span in recent times, that is the births are taking place at shorter distance from the central tendency of fertility, and (3) the fertility curve is now less skewed to the right, indicating that more births are taking place within a shorter span now than before.

Islam, M.A. (2003) examined the current status of the process of fertility change in Bangladesh and highlighted the major policy concerns stemming from dynamics of

³⁰ N. Islam, and S. Abedin, "Effect of Education on age at marriage and fertility in Bangladesh," *Journal of Man in India*, vol. 81, No.3 & 4 (2001), pp. 339–343.

³¹ M.A. Islam, M.M. Islam, and N. Chakraborty, "Achieving Replacement Level Fertility in Bangladesh: Challenges and Prospects," Paper No. 18, CPD-UNFPA Program on Population and Sustainable Development, CPD, Dhaka, (2002).

population³². He showed that universal education with uncrossed mean years of schooling could reduce under-5 mortality thereby reducing the fertility to replacement level. He argued that the impact of population momentum could be reduced through some deliberate efforts. The policy strategies are instrumental in order to complete stage 3 of the demographic change in Bangladesh. Three possible means to keep the impact of population momentum relatively small are: an achieve replacement level fertility soon, to increase mean age at marriage and to encourage further widening space between births.

Jacobson (1959) presented four first-marriage tables (males and females, 1940 and 1948) in his book entitled as *American Marriage and Divorce*. These tables came partly from published and published data compiled by the Census Bureau, but mostly from personal (his) correspondence with government officials in states and smaller areas, Jacobson's description of his basic data is rather sketchy; hence a thorough evaluation of it cannot be made. Several attempts by Mertens (1965), Saveland and Glick (1969) and others have been made to construct tables from the knowledge of Jacobson. Jacobson constructed tables with the experience of death and divorce of married persons while Krishnan (1971) concerned with divorce only. Moreover, Jacobson produced re-marriage tables for both divorce and widowed persons while Niessen (1949), Jones (1962) and others for widows only. Further, Jordan (1967) discussed the construction of disability of mortality and their application combined with other tables in actual work but used very restrictive approximations.³³

Kabir, M and Rab, A.K.U. (1990) had analyzed Coal's index, I_m (the index of proportion married) to see the change in marriage patterns³⁴. The index of proportion married among women in the childbearing ages is divided by comparing the experiencing Hutterite Schedule of marital fertility rates; with the number of children all women bear subject to the same fertility schedule. The interpretation of the index is straightforward. The proportion-married index indicates how much marriage contributes to the overall fertility of the given population. Thus the proportion-married

³² M.A. Islam, "Demographic Transition and Policy Challenges," Paper 22, CPD-UNFPA Program on Population and Sustainable Development, CPD, Dhaka, (2003).

³³ C.W. Jordan, *Life Contingencies*, Society of Actuaries (Chicago: University of Chicago Press, 1967), p. 24.

³⁴ M. Kabir, and A.K.U. Rob, "Fertility and Its Proximate Determinants," *South Asia Study of Population and Programs: Bangladesh*, (UNFPA: Dhaka, Bangladesh, 1990), pp.

index can be thought of as a weighted index of the proportion of women married in each age group with weight varying at the level of potential of women married in each age group with weight varying at the level of potential fertility. The nuptality index began to change since 1975 and modest decline in fertility is observed around this time. These lead us to conclude that the decline in fertility can be partly explained by change in proportion married.

Kabir and Amin (1993) find that in Bangladesh, the lack of health care service for mothers is one of the important reasons for the high rates of child mortality.³⁵ Similarly, Mitra *et al.* (1997) indicated that proper medical attention and hygienic conditions during delivery can reduce the risk of infections and facilitate management of complications that can be caused death or various illnesses for the mother or the newborn child.

Khan HT, Islam SM, Khan HM and Bari R. (1993) analyzed data from two sources in rural Bangladesh had been used in this study to examine the differentials in fertility by selected socio-economic and demographic factors. They found that age at first marriage; education of spouses and availability of electricity in the household had inverse relationship with fertility. Higher fertility is observed for Muslim's women than for non-Muslims. It had also been found that fertility was the lowest to those women whose husbands were service holders and the highest for those engaged in agriculture.

Mosley and Chen (1984) described the results of a reproductive study of birth interval dynamics in rural area of Bangladesh.³⁶ This study was conducted between 1969 and 1971 in conjunction with epidemiological and demographic investigations carried out by the Cholera Research Laboratory. The analytical framework of this investigation goes beyond considering only the length of the components of the birth interval, but also considers the timing of birth interval events. Although the estimates for the components of the birth interval in this study have been crude, because of the limited data available, it is of interest to see how well the sum of these components relate to the overall observed live birth interval. The analytical model proposed by Perrin and Sheps is used to estimate the live birth interval from its component parts.

³⁵ M. Kabir, and Ruhul Amin, "Factors Influencing Child Mortality in Bangladesh and Theirs Implication for the National Health Program," *Asia-Pacific Population Journal*, vol. 8, No.3 (September, 1993), pp.31–45.

³⁶ W.H. Mosley, and L.C. Chen, "An Analytical Framework for the Study of Child Survival of Developing Countries," *Population and development Review*, vol.10(supplement)(1984), pp.25–48.

Majumder AK, Islam SM (1993) examined the differentials in child survival in Bangladesh using a number of socio-economic and environmental factors in data from the 1989 Bangladesh Fertility Survey.³⁷ Multivariate analysis reveals that both wife's and husband's education and household electricity show a significant positive association with child survival. The respondents working status exerts a significant negative influence. Wife's education has greater influence on child survival in Bangladesh than that of husband's education.

Mozumder *et al.* (1998) indicated that in the post neonatal, DPT has an important role in reducing mortality.³⁸ He also had shown that father education is more important than mother education. The birth spacing with previous child associated with the reducing of post-neonatal mortality. Birth intervals, drinking tube well water, immunization were significant effect in reducing mortality of children ages 12–23 months.

Md. Jamal uddin and Md. Zakir Hossain (2008) attempt to investigate the predictors of neonatal and post-neonatal mortality in Bangladesh by utilizing the data of Bangladesh Demographic Health Survey (BDHS) 1999–2000.³⁹ In their study the Cross-tabulation analysis reveals that infant mortality varied significantly by several variables. Among these variables, parent's education had significant negative effect on infant mortality, while occupation of parents had significant influence on post-neonatal mortality only. The infant mortality was found higher in small families, while low for the children whose mothers were currently breastfed and it decreased significantly with the increase of mother's standard of living index. Mother's age at birth of child and birth order had significant influence on infant mortality and it was lowest for the children having birth interval over 30 months. It is also found that timing of first antenatal check, Tetanus Toxoid (TT) during pregnancy and numbers of antenatal visit had significant influence for both mortality cohorts. Multiple logistic regression analysis, carried out by using the significant variables found in cross tabulation analysis, reveals that mother's education, family size, breastfeeding status, mother's age at birth, birth spacing, complication during birth, type of birth,

³⁷ A.K. Majumder, and S.M. Islam, "Socio-economic and environmental determinants of child survival in Bangladesh," *Journal of Bio-Social Science*, vol.25, No.3 (1993), pp.311–318.

³⁸ A.K. Mozumder, B. Khuda, and T.T. Kane, "Determinants of Infant and Child Mortality in Rural Bangladesh," *Working Paper* no.149 presented at International Centre for Diarrhoeal Disease Research, Bangladesh: Dhaka, Bangladesh (1998).

³⁹ Md. Jamal uddin, and Md. Zakir Hossain, "Predictors of Infant Mortality in a Developing Country," *Asian Journal of Epidemiology*, vol.1, No.1 (2008), pp.1–16.

timing of first antenatal check and TT during pregnancy had significant effect on neonatal mortality. Further, post-neonatal mortality varied significantly by education and occupation of father, family size, breastfeeding status, mother's age at birth, type of birth and TT during pregnancy.

Mass Media played an important role on infant and child mortality in 3rd world countries. Dashtseren (2002) has identified that infant and child mortality were low for the children whose mother read newspaper, watch TV, listen to radio compared with those children whose mother are not access to such medias. Pandey *et al.* (1998) used Indian Family and Health Survey data and investigated that mother exposure to mass media has no effect in neonatal mortality, but statistically significant for post-neonatal mortality and slightly large significant effect for child mortality.⁴⁰

Many interesting studies of human fertility and reproduction have been reported in the literature. A.J. Lotka (1925) devised the intrinsic rate to measure natural increase in human populations; C. Gini (1924) suggested that birth intervals be treated as waiting times; L. Henry (1972) proposed several mathematical formulations for the measurement of human fertility using the assumption that the interval between births is independent of birth order. K. Srinivasan (1966) applied a probability model to the study of inter live birth intervals; J.A. Menken and M.C. Sheps (1974) discussed the distribution of birth intervals from a sampling frame viewpoint.⁴¹

Retherford *et al.* (1989) indicated that economic and nutrition indicators may explain the differential of mortality by birth order.⁴² A mother's poor nutritional status may also have post-natal consequences, like impaired lactation and render her unable to give proper care to her children. Rahman (1998) conducted his study based on longitudinal data from Matlab, Bangladesh. He examines the impact of child mortality on subsequent contraceptive acceptance and continuation. The strong negative impact is found to attend with family size, indicating a "replacement effect." Couples seem to find contraceptive use acceptable if the child who dies is one of a

⁴⁰ A.M. Pandey, K. Choe, N.Y. Luther, D. Sahu, and J. Chand, "Infant and Child Mortality in India," *National Family and Health Survey Subject Reports*, No.11, presented at International Institute for Population Science: Mumbai, India (December, 1998).

⁴¹ M.C. Sheps, and J.A. Menken, "The Distribution of Birth Intervals under a Class of Stochastic Model," *Journal of Population Studies*, vol.17 (1974), pp. 321–331.

⁴² D. Robert. Retherford, D. Minja, Kim Choe, Shyam Thapa, and B. Bhakta. Gubhaju, "To What Extent Does Breastfeeding Explain Birth-interval Effect of Early Childhood Mortality?," *Bangladesh Demography*. vol. 26 (1989), pp.439–440.

large family. Potentially, contraception use could be acceptable for spacing after a child in a small family dies.

Razzaque, A. (1999) examines wife-husband preference for children and subsequent fertility for a period of five years in the treatment and comparison areas of Matlab, Bangladesh. The two data sets used were the In-depth Survey (1984) and the Demographic Surveillance System (1984–89). In the case of wives' preferences for children, subsequent childbearing was 13.8 percent higher than desired in the treatment area and 44.7 percent higher than desired in the comparison area. After controlling for all variables in the model, the likelihood of giving birth was 1.78 times higher for wives who wanted no more children, but whose husbands did want more, compared with couples where neither husband nor wife wanted more children. For couples where the wife wanted more, but the husband did not want more children, the likelihood of giving birth was 0.63 times that of couples where both the husband and wife wanted more children. This finding suggests that to enhance the decline in fertility in these two areas of Matlab, it will be necessary to motivate both wives and husbands to cease childbearing.

Rehman N, Huq SS (2009) showed primarily – amongst the bio-demographic and health seeking services factors, delivery-related maternal health complications, blindness, higher order births, twin births, lower household size and interaction effect of higher order live births and male child are significantly correlated with higher neonatal mortality.⁴³ Neonatal deaths are heavily caused by biological, demographical and maternal experience health hazards during /after delivery. The analysis shows that the causes of deaths after neonatal period are deeply rooted in poverty, regional administrative disparity, lack of breastfeeding, unplanned frequency of births, small interval between births and non-utilization of health seeking services. Education, even maternal and sex differential have no significant effect as what the literature suggested. But the interaction effect of maternal secondary and above education that residing in urban areas has a negative significant association with neonatal mortality. Increased interval between the births significantly reduced the post-neonatal but not the neonatal mortality whereas the relationship between the child's birth order and neonatalis found significantly positive.

⁴³ M. Rehman, and SS. Huq, "Bio-demographic and health seeking behaviour factors influencing neonatal and post-neonatal mortality in Bangladesh: evidence from DHS data," *East Africa Journal of Public Health*, vol.6, No.1 (April, 2009), pp. 77–84.

Shaik and Rahman (1991) examined that mother's occupation has no impact on child mortality particularly in rural area of Bangladesh, but in urban area there is a volatile difference in child mortality between children of employed and unemployed mother.⁴⁴ They were also showed that the effect of mother working status on mortality depends on the structures of the family. Another study examined that mother-working status exerts a significant negative influence on child mortality. But mother education has a grater influence on child survival in Bangladesh than that of father's education (Majumder and Islam, 1993)

Shahidullah M (1994) studied the effect of both total and un-supplemented breastfeeding in conjunction with birth interval on early childhood mortality, using longitudinal data from Matlab, Bangladesh.⁴⁵ A discrete hazard model approach shows that it is not the duration of total breast-feeding but the duration of un-supplemented breast-feeding which increases child survival. Un-supplemented breast-feeding appears as such as crucial determinant of early childhood mortality that its effect could not be substantially attenuated even when important demographic and socio-economic factors were controlled. Each of the covariate-supplementation, previous birth interval and onset of a subsequent conception-has an independent influence on early childhood mortality.

Sastry (1996) argued that community water supply, household toilet facilities and access to health care may be either substitutes or complements to maternal education.⁴⁶ With the exception of household electricity connection, community infrastructure variables emerge as substitutes for maternal education. The study conducted that better conditions of water supply and sanitation are associated with lower mortality for children of less well-educated mothers but with significantly lower mortality for the children of better-educated mothers. Another study in Indonesia conducted by Utomo (1989) had showed that the per-capita income did not have a consistent correlation with infant mortality in Indonesia. But mother education is important factor of child mortality. Mother's standard of living did not make much influence of child mortality. Majumder and Islam (1993) identified that both mothers

⁴⁴ M.M. Shaik, and M.H. Rahman, "Socio-economic Differentials in Infant Mortality in Rural Bangladesh," Proceedings of the Workshop of Dissemination of Current Statistics, Dhaka, (November, 1991).

⁴⁵ M. Shahidullah, "Breast-feeding and child survival in Matlab, Bangladesh" *Journal of Bio-Social Science*, vol.26, No.2 (April, 1994), pp.143–154.

⁴⁶ N. Sastry, "Community Characteristic, Individual and Household Attributes and Child Survival in Brazil," *Demography*, vol. 33, No. 2 (1996), pp.211–229.

and fathers education and household electricity showed a significant positive association with child survival using BFS–1989 data.

Schell CO *et al.*, (2007) observed that in order of importance, GNI/capita, young female illiteracy and income equality predicted 92% of the variation in national IMR whereas public spending on health and poverty rate were non-significant determinants when adjusted for confounding.⁴⁷ In low-income countries, female illiteracy was more important than GNI/capita. Income quality (Gini Index) was an independent predictor of IMR in middle-income countries only. In high-income countries none of these predictors was significant.

The World Fertility Survey data indicated that the survival chances of children widely vary between socio-economic strata, with the educational qualification of the mother being a particularly strong predictor. Caldwell *et al* (1981) documented that children usually have a greater chances of survival when they were born to an uneducated mother in a highly educated society than when they were born to an educated mother in a largely uneducated society. Bhattacharya *et al.* (1988) observed that in a community, male education has no significant role in child mortality when female education is high.⁴⁸ In fact, an independent effect of male education on child mortality has not been observed. If the effect of other characteristics was constant mother's education plays a positive role on child survival for the children ages between 6 and 35 months (Abbas & Kim 1991)

Sabina F R (2006) studied about “Emerging Changes in Reproductive Behaviour among Married Adolescent Girl in an Urban Slum in Dhaka, Bangladesh”. Structural and social inequalities, a harsh political economy and neglect on the part of the state have made married adolescent girls on extremely vulnerable group in the urban slum environment in Bangladesh. The importance placed on newly married girls’ fertility results in high fertility rates and low rates of contraceptive use. Ethnographic fieldwork among married adolescent girls, aged 15–19, was carried out in a Dhaka slum from December 2001 to January 2003, including 50 in-depth interviews and eight case studies from among 153 married adolescent girls, and observations and discussions with family and community members. Cultural and social expectations meant that 128 of the girls had borne children before they were emotionally or

⁴⁷ CO. Schell, M. Reilly, H. Rosling, S. Peterson, and A.M. Ekstrom, “Socio-economic determinants of infant mortality: a worldwide study of 152 low-, middle-, and high-income countries,” *Scand Journal of Public Health*, vol.35, No.3 (2007), pp.288–297.

⁴⁸ B.N. Bhattacharya, C.M. Pandey, and K.K. Singh, “Model for Closed Birth Interval and Some Social Factors,” *Janasamkhyā*, vol. 6 (1988), p.57.

physically ready. Twenty-seven had terminated their pregnancies, of which 11 reported they were forced to do so by family members. Poverty, economic conditions, marital insecurity, politics in the household, absence of dowry and rivalry among family, co-wives and in-laws made these young married women's status is changing in urban slum conditions. When their economical productivity takes priority over their reproductive role, the effects on reproductive decision-making within families may be considerable.

The place of delivery is an important factor of neonatal mortality. According to World Health Organization (1994); 63% of deliveries take place at home while in case Bangladesh, 94% of deliveries take place at home (Bangladesh Maternal Health Service and Maternal Mortality Survey, 2001). Tam (1991) shown that the important determinant of infant mortality is maternal cares such as modern pre-natal and birth delivery.⁴⁹ The survival chance of birth, which was delivered with the assistance of health professional, were significantly high than those which were delivered with the assistance any relatives or friends. In rural area of Bangladesh hospitals facilities for neonatal care are not easily accessible to the rural population, most neonatal deaths take place at home and cause of death is not recorded owing to a deficient vital registration system (Chowdhury *et al.* 2005).

The birth interval model has to be a useful analytical framework for examining the biological and sociological factors determining the levels of fertility in human populations. Ridley and Sheps (1966) have used this model in Monte Carlo simulation studies to examine the effects that variations fecundability, age at marriage, fetal wastage, infant mortality and breastfeeding would have on birth intervals and thus on fertility rates.

TT during pregnancy is very important factor, which has significant affect on neonatal mortality. Many studies indicate that the mother's TT Vaccine status during last pregnancy has statistically significant effect on youngest and penultimate childhood immunization. Mother education also has a significant positive relation with childhood immunization. Islam and Islam, (1993) also indicated that the immunization practice is higher where children belonging to a higher income household.⁵⁰ The BDHS data

⁴⁹ L. Tam, "Intermediate and Under Lying Factors Associated With Infant Mortality in Peru (1984–86)," *Proceedings of the Demographic and Health Surveys*, (World Conference: Washington D.C, USA, 1991).

⁵⁰ M. Nurul Islam, and M. Mazharul Islam, "Biological and Behavioral Determinants of Fertility in Bangladesh: 1975–1989," *Bangladesh Fertility Survey, 1989: Secondary analysis* (National Institute of Population Research and Training (NIPORT): Dhaka, 1993).

collected during 1993–94 also demonstrate that the mother who had received TT vaccine during her pregnancy is more likely to be aware of the childhood immunization (NIPORT, 1994). Stanfield and Galazka (1984) identified that tetanus is one of the major causes of neonatal mortality in developing countries. Among the maternal health care variables, immunization of pregnant women against tetanus has significant effect in reducing neo-natal mortality.

The quantum aspect of fertility is indicated by the proportion of women who have a child within a given period, while the tempo aspect is indicated by the median birth interval; advantages of this methodology have been demonstrated earlier. Viewing human reproduction, Perrin and Sheps (1964) subsequently incorporated the components of the birth interval into a sophisticated stochastic model. In this model, the waiting time to conception, the duration of gestation and post-partum sterility for each of three pregnancy outcomes, foetal loss, still birth or live birth is considered. From a stochastic viewpoint, these underlying factors have been focused by Yerushalmy (1967), Brass (1958) for estimation population fecundability. A considerable body of empirical data has been accumulated of the effect of lactational amenorrhea in lengthening birth intervals. The most extensive investigation of all the components of the birth interval has been carried out by Potter (1965) and his colleagues, utilizing data from the Khanna Study conducted in Panjab between 1955 and 1958. They demonstrated the dominant effect of lactation with prolonged amenorrhea as a factor accounting for the long birth intervals. From the analysis of birth interval variance, it is suggested that menstrual intervals were a larger source of variation than either post-partum amenorrhea or time added by pregnancy wastage.

Chiang (1984) have proposed a fertility table of life table type, which offers a simple description of the childbearing process based on parity specific fertility rates.⁵¹ This fertility table has been widely exercised to analyze the fertility dynamics of various countries; Ram and Pathak (1989) have applied it to study the fertility dynamics in different states of India.

In Bangladesh, the lack of conventional data in the form of vital registration is the main obstacle for studying the demographic issues including child mortality. A number of both at macro and micro level surveys have been conducted in the country during the 1960s, 1970s, 1980s, 1990s and 2000s to overcome this problem.

⁵¹ C.L. Chiang, *The life table and its application* (Malabar, Florida: Robert E. Krieger Publishing Company, 1984), p.31.

Among these looking back surveys, the Bangladesh demographic and health survey conducted at 1993–94, 1996–97, 1999–2000, 2003–04, 2007–08 and the Bangladesh Fertility Survey 1975–76 and 1989 have been playing the great role in various sectors of demographic and health studies. There are a number of studies conducted on the issue of child mortality levels, trends and differentials in Bangladesh based on the BFS and BDHS data.

1.4 Justifications of the Study

It was clearly identified in the review of literature that there exists knowledge gap in this field of study. Although many research studies had been done on mortality and reproductive pattern in Bangladesh till now, systemic and in-depth study on the impact of child mortality on reproductive pattern was very rare. Actual level, trend and behavior of child mortality and reproductive pattern were very important in the context of Bangladesh health policy. There were debates among the statistics in Bangladesh regarding the extent of child mortality and its effect on reproductive pattern in Bangladesh, on whether the impact of child mortality and reproductive pattern had been gradually improving. This study was contributed significantly to fill up the existing knowledge gap and add unexplored knowledge to the existing stock of knowledge. The study findings would be an immense help to the policy makers in formulating an appropriate policies to reduce child mortality and reproductive pattern for Bangladesh as well as academicians and the researchers also be benefited from this study.

1.5 Key definitions of the Study

Crude Birth Rate: Crude Birth Rate (CBR) is the ratio of the total number of births during a given year to the average or mid-year population in that year. Symbolically,

$$CBR = \frac{B}{P} \times K$$

Where, B and P respectively denote the total number of births occurring in a given year and the total average or midyear population in that year and K is a constant, usually 1,000.

General Fertility Rate: General Fertility Rate (GFR) is the ratio of the total number of births during a given year to the average number of women in fertile age group (in the age range 15-49 or sometimes 15-44). GFR is expressed as

$$GFR = \frac{B}{W_{15-49}} \times K$$

Where B and W_{15-49} respectively denote the total number of births occurring in a given year and the average number of women in the reproductive ages in the period concerned and K is a constant, usually 1,000.

General Fertility Rate (GFR) can be expressed by another way that is

$$GFR = \frac{\text{Livebirths}}{\text{Women in age group 15-49}} \times 1,000$$

General Marital Fertility Rate: General Marital Fertility Rate (GMFR) is the ratio of the total number of births during a given year to the average number of married women in fertile age group (in the age range 15-49 or sometimes 15-44). GMFR is expressed as

$$GMFR = \frac{B}{W^m_{15-49}} \times K$$

Where, B and W^m_{15-49} respectively denote the total number of births occurring in a given year and the average number of married women in the reproductive ages in the period concerned and K is a constant, usually 1,000.

General Marital Fertility Rate (GMFR) can be expressed by another way that is

$$GMFR = \frac{\text{Livebirths}}{\text{Married Women in age group 15-49}} \times 1,000$$

Age Specific Fertility Rate: Age Specific Fertility Rate (ASFR) can be calculated separately for each age or for any convenient age groups. ASFR is calculated by the formula:

$$ASFR_x = \frac{B_x}{W_x} \times K$$

Where, B_x and W_x are the births to women aged x and the average number of women aged x respectively.

Age Specific Marital Fertility Rate: Age Specific Marital Fertility Rate (ASMFR) is an improvement over age specific fertility rate in the same sense as general marital fertility rate is over general fertility rate. ASMFR describes the fertility experience of married women by age. The formula for calculation of ASMFRs is

$$ASMFR_x = \frac{B_x}{W^m_x} \times K$$

Where, B_x and W^m_x are the births to women aged x and the average number of married women aged x respectively.

Total Fertility Rate: Total Fertility Rate (TFR) is the expected number of children that a cohort of 1,000 women will bear in their life time, if none of them dies before crossing the age of reproduction. Total Fertility Rate summarizes the pattern of fertility exhibited by the age specific fertility rates and presents a single index of total fertility. It is just a summation of age specific fertility rate (ASFR)s over all ages, that is

$$TFR = \sum_{x=15}^{49} ASFR_x$$

Gross Reproduction Rate: The Gross Reproduction Rate (GRR) is defined as the average number of daughters among a birth cohort of women, which they will bear in their lifetime, passing through the reproductive ages and bearing children according to a fixed schedule of fertility, if they all survive to the end of child bearing period. Thus the GRR indicates how effectively mothers are replacing themselves with daughters who will bear the next generation, GRR can be expressed as

$$GRR = \sum_{x=15}^{49} \frac{B_x}{W_x} \times \frac{B_{fx}}{B_x}$$

Where B_x / W_x is the age specific fertility rate of age x and B_{fx} / B_x is the proportion of female births among the total births at age x of mothers.

Net Reproduction Rate: The Net Reproduction Rate (NRR) indicates that on an average how many daughters would be born to a group of women starting life together and experiencing throughout their life a given schedule of fertility and mortality. It is an estimate of the extent to which a newly born girl infant will live to replace herself with a daughter, taking care of the likelihood of her death before she accomplishes replacement. Thus it is a measure of replacement that considers both the schedule of fertility and the schedule of mortality. In symbols it is defined as

$$NRR = \sum_{x=15}^{49} \frac{B_x}{W_x} \times \left(\frac{B_{fx}}{B_x} \right) \times \frac{L_x}{l_0}$$

Where (L_x / l_0) is the life table survival rate, (B_x / W_x) is the age specific fertility rate of age x and (B_{fx} / B_x) is the proportion of female births among the total births at age x of mothers.

Neonatal mortality: The neonatal period extends from the time of birth to 28 days. The first week of life is called early neonatal, and 8 to 28 days the late neonatal period. Neonatal mortality defines as the baby dies within the first month of life.

Post-neonatal mortality: The post-neonatal period is from 28 to 364 days of age. Post-neonatal mortality measures as the risk of death during the period from 1 month to 1 year of age. The post-neonatal mortality is the difference between infant and neonatal mortality.

Infant mortality: The infancy period includes neonatal and post-neonatal periods. The infant mortality is measured by the probability of dying between the first birth days. It relates the number of death under one year of age to the number of live births during the same time period.

Child mortality: Child mortality is expressed by the probability of dying between the first and fifth birthday. Child mortality is customarily measured by neonatal, post-neonatal, infant and under-five mortality rates. These have significance in terms of typical causes of death but they do not define non-overlapping periods of life.

The reproductive period: The interval between menarche and menopause is termed as reproductive period of a female. Where menarche is the first menstruation and when menstruation ceases finally, the female is said to have attained menopause.

Fertility: Fertility means the natural capability of giving life and fertility rate is the number of child born per woman. Fertility is different from fecundity. Human fertility depends on factors of nutrition, sexual behavior, culture, instinct, timing, economics, way of life and emotions, etc.

Fecundability: Fecund means the ability to conceive and the term fecundability refer to specific meaning as the probability of non-pregnant married women who will conceive per month.

Probability of fetal loss: A proportion of conceptions end in death of the fetus. The probability that any conception will end in the death of the fetus may depend on maternal age, rank order of the pregnancy, interval from the end of the last pregnancy to this conception, and the health of the mother.

Inactive or infecundable period: A conception is followed by a period during which a women is not exposed to risk of pregnancy, that is, a period in which the women are essentially sterile.

Non-susceptible period: The fecundity of a female is temporarily suspended following each conception when menstruation discontinues for some times. This period of non-susceptibility is the sum of two parts: first, gestation period and second, the interval after it's terminative and before the resumption of an ovulation which is known as post partum amenorrhea.

1.6 Feasibility study

The researcher was confident of completing the research successfully by assessing feasibility mentioned below:

- ☐ The researcher was a student of Statistics. He has theoretical orientation in research along with the coursework conducted in IBS could help him to formulate this study.
- ☐ A lot of studies relating to child mortality and reproductive pattern were undertaken in developed and developing countries, particularly in India, Pakistan, Nepal, Bolivia, Mongolia, China, Naigeria, Naiger, Great Britain and USA. Reports of those studies were available in printed form and websites that might be used as reference material and guideline.
- ☐ Guidance and supervision from supervisor and logistic support from Institute of Bangladesh Studies (IBS), University of Rajshahi and intellectual help from the teachers of the Department of Statistics and Department of Population Science, University of Rajshahi was contributed to the sound conveyance of the research.

1.7 Scope of the Study and Limitations

1.7.1 Scope of the study

This study was focus on the child mortality and reproductive pattern which, reflect a country's level of socioeconomic development. It was used for monitoring and evaluating population and health programs and policies. It was find the level, trend and behaviour of child mortality and reproductive pattern of Bangladesh. The study also investigated how reproductive pattern was affected by child mortality.

Furthermore, this study covered about the validity of the result of most of the earlier empirical studies on child mortality and reproductive pattern. This study was reviewed by using various statistical analytical techniques not only observed mortality and fertility condition but also explain the impact of child mortality on reproductive pattern in Bangladesh.

1.7.2 Limitations of the study

Data distribution is a matter of sensitivity in Bangladesh. Updated and reliable data are not always available on issues like mortality and fertility. As a result, there is much dependency on government documents and statistics. The study was conducted on the basis of the available secondary sources of data (BDHS, 2007) which was collected from National Institute for Population Research and Training (NIPORT). NIPORT was responsible for all sampling related questions, because of sampling technique (sampling frame, sampling design, and sampling procedure) had been done by NIPORT. This research sampling technique had not done by the researcher. There were also some constraints for conducting this study. The major constraint was proposed secondary data published every three years later. There were also time and resource constraints.

1.8 Methodology

1.8.1 Nature of the Study

This study was both Explanatory and Evaluation type of research. This study empirically investigated the child mortality and its impact on reproductive pattern through health and family planning programs. The study was to provide a brief description about child mortality and reproductive pattern of Bangladesh and gave suggestions for reduction of child mortality. Finally, the study find the impact of child mortality on the reproductive pattern through existing demographic pictures.

1.8.2 Methods of the Study

To achieve the objectives of the study the following research methods were applied:

A. Percentage Distribution Approach: Reproductive women's age belongs from 15 to 49 which were divided in different group. Child mortality was estimated from those different age groups. From the division of different age groups, it was easier to estimate the probability distribution of each age group of reproductive women. We

also find the overall picture of child mortality and reproductive pattern based on the different determinants in each age group.

B. Chi-square Test: Chi-square test was based on bi-variate distribution. As our research data was bi-variate in nature, so that chi-square test was a technique where it was a way to find out the relation exists or not between an independent variable and dependent variables. From chi-square test, we can take decision about the variables whether it was significant or not. Only significant variables were using in logistic regression analysis for measuring dependent variables contribution.

C. Brass Model Analysis: Brass technique is an indirect technique which was used to estimates infant and child mortality from the proportion dead among children ever born by women classified by age of mother and duration of marriage.

D. Multiple Logistic Regression Analysis: It is an attempt to find out those variables, which is truly related to child mortality differentials. Some characteristics such variable includes mother's education, father's education, partner's occupation, electricity, watching television and listening to radio every week. Certain other characteristics were treated as demographic, sanitation, hygienic and household facilities, main floor material, main roof material, current age of respondent, month of breast-feeding and immunization. Logistic regression technique was employed to identify the contribution of the independent variables on infant and child mortality.

E. Bongaart's Model Analysis: Bongaart's model is an indirect technique for calculating total fertility rate by using proximate determinants. Bongaart's revised the original classification and provided a simple analytical method-according framework, which permits a quantitative assessment of the contribution of proximate determinants to give fertility levels or change. This technique applied for identification of changes in terms of proximate variables which seems to be rewarding on many occasions. The model is necessarily multiplicative in nature and requires data, among others, on proportion married, extent of use effectiveness of contraception, prevalence of induced abortion and lactational infecundability.

F. Path Model Analysis: Path analysis is a standardized multiple regression analysis (using a standardized from of dependent and predictor variables, with mean zero and unit variance) in which a chain of relationships among the variables,

arranged in an orderly manner, is examined through a series of regression equation. Path analysis helped in estimating the magnitude of the linkages between interrelated variables and provides information about the underlying causal process. The technique explored a chain of relationships among the variables by using standardized regression coefficient of a set of regression. However, the fundamental task here is to construct a path diagram in which direction (indicated by arrowheads) should be causally meaningful. This study employed a recursive path model relating to population and development variables.

1.8.3 Variables to be selected

In this study researcher had to find the levels, trends, differentials, causes and effects of child mortality and reproductive pattern. So, researcher selected first the set of independent socio-economic, bio-demographic and maternal health care utilization variables when number of child mortality status was dependent variable. Here researcher need to ensure that the quality of data of independent variable was satisfactory i.e. the data set was reliable, the frequencies were not concentrated to any point or group, the variables were well defined and do not contain a large number of missing observations. All the variables were taken from Bangladesh Demographic and Health Survey (BDHS), 2007 survey. Here 31 explanatory variables were used to explain the dependent variable. For the convenience of our analysis, all the independent variables were not studied their original codes. The researcher had to recode variables, combining one or two variables, create a new variable etc. the selected variables were given below.

A. Dependent Variable

- Neonatal mortality
- Post-neonatal mortality
- Infant mortality
- Child mortality

B. Independent Variables

1. Socio-economic Variables

- Region of residence,
- Place of residence,
- Education of mother,

- Education of father,
- Occupation of mother,
- Occupation of father,
- Electricity,
- Household conditions,
- Household goods,
- Religion,
- Wealth Status,
- Sources of drinking water,
- Sanitation,
- Types of cooking fuel.

2. Bio-demographic Variables

- Sex of child,
- Birth order,
- Breastfeeding status,
- Previous Birth Interval,
- Women age at first marriage,
- Mother age at first birth,
- Household Size.

3. Maternal Health Care Service Utilization Variables

- Place of delivery,
- Timing of first antenatal check during pregnancy,
- TT during pregnancy,
- Number of antenatal visit during pregnancy,
- Exposure of mass media

1.8.4 Models Specification

A. Multiple Logistic Regression Analysis

There are many multivariate statistical techniques exist for analysis of mortality risk over time. The logistic regression model is used in various areas namely epidemiology, medicine, bioassay, dose-response analysis, and consumer choice analysis. Sometimes it is difficult to apply the techniques when the dependent variables are categorized (dichotomous and polytomous). In such situation it is better

to fit linear logistic regression.⁵² For the last two decades the logistic regression model has been used in statistical analysis. Over the time the logistic regression model has become popular due to several reasons. Some of these are summerized below:

- a. The logistic function on which the model is based provides estimates that must lie in the range between zero and one. The model is designed to describe a probability, which is always some number between 0 and 1. In epidemiologic terms, such a probability gives the risk of an individual getting a disease.
- b. The logistic model provides an appealing S-shaped curve to describe the combined effect of several risk factors on the risk for a disease.
- c. The logistic regression model is applicable to the analysis of retrospective as well as prospective data.

Various statistical models exist to dichotomous survival data. It should be stated at the start that a linear probability function estimated by ordinary least square, is inappropriate. Ordinary Least Square (OLS) provided inefficient estimates and imprecise predictions. Especially noticeable with the OLS estimation in the lack of restriction to the unit interval (0,1) with predictions. Another problem particular to mortality data is the preponderance of observations in which a child lives, and therefore the dependent variables are usually 0. Unfortunately, the OLS linear probability function is sensible to extreme splits in the dichotomous dependent variable. The estimates are thus greatly influenced by the nature of the dependent variable.

Among alternative statistical methods for multivariate analysis of dichotomous mortality data are log-linear, logistic, Probit and transformed equation models. Edmonston *et al.* (1981) reviewed the used of various statistical procedure for Bangladeshi mortality data, and reports were generally similar substantive to findings for alternative estimations. This paper reports the results by applying a multivariate logistic estimation. The logistic transformation is an algebraically simple and computationally straightforward method for multivariate prediction of a binary dependent variable. It is often case that the outcome variable is discrete, taking on

⁵² D.R. Cox, "Regression Models and Life Tables," *Journal of Royal Statistical Society*, vol.34. Series-B, (1972), pp.187-202.

two or more possible values. Over the last decade the logistic regression model has become, in many fields, the standard method of analysis in this situation (Hosmer *et al.* 1989).

In simple linear regression we assume that the conditional mean may be expressed as an equation which is linear in x , such that

$$E(y / x) = \alpha + \beta x$$

In the case when the dependent variable y is dichotomous, some well-known cumulative distribution has been used to provide a model for $E(y / x)$. The model that will be used in this situation is logistic distribution.

Many distribution functions have been suggested for use in the analysis of a dichotomous dependent variable. A very interesting and applicable method that does not require any distributional assumptions is Cox's (1970) Linear Logistic Regression method. This method can be used not only to identify risk factors but also to predict the probability of success, e.g. the probability of dying before the child in one year of old, as a function of the risk factors. Cox (1970) discusses some of these distributions. There are two prime reasons for choosing the logistic distribution namely (a) it is an extremely flexible and easily used mathematical function and (b) it provides biologically meaningful interpretation of the coefficients.

(i) the x 's are fixed

(ii) $0 \leq E(y / x) \leq 1$

(iii) $E(y / x) = \frac{\exp(\alpha + \beta x)}{1 + \exp(\alpha + \beta x)}$

(iv) the conditional distribution of y for each value of x are binomial with probability given by the conditional mean, $E(y / x)$

Whenever we wish to relate a set of the independent variables to a dichotomous dependent variable, we are considering a multivariable problem. In the analysis of such a problem, some kind of mathematical model is preferred to deal with the complex interrelationships among several variables. Logistic regression is a mathematical modeling approach that can be used to describe the relationship of several x 's to a dichotomous dependent variable. Truett, Cornfield and Kannel used the logistic regression model in a multivariate analysis for the Framingham heart study data in 1967. Since then, logistic regression model has become the standard method of analysis for modeling the relationship between an outcome (dependent or

response) and a set of independent (predictor or explanatory) variates or set of covariates.

We have a flexible choice for the independent variables x 's, which can represent any collection of dichotomous, categorical and continuous variables or even combinations of such variables of interest. In all cases it will be assumed that there is a predetermined collection of variables, which is being analyzed. The independent variables of the logistic regression model do not require any distributional assumptions. The general logistic regression model expresses a qualitative dependent (outcome) variable as function of various independent (explanatory) variables, both qualitative and quantitative (Cox, 1988). Logistic regression is a natural approach for the study since it requires no assumption about the distribution of the explanatory variables (Cox and Snell, 1988).

The general linear logistic model expresses qualitative dependent variables as a function of a single or several independent variables. Consider the relationship between a dichotomous dependent variable (y) and a single independent variable (x) as

$$y_i = \alpha + \beta x_i + \varepsilon_i, i = 1, 2, 3, \dots, n \quad \dots \dots \dots (9.1)$$

In addition, we assume that $\varepsilon_1, \varepsilon_2, \varepsilon_3, \dots, \varepsilon_n$ are independently normally distributed with the equal variance σ^2 . In a regression model the assumptions involved are given below:

- the x 's are fixed
- the regression of y on x is linear, that is $E(y / x_i) = \alpha + \beta x_i$
- the deviations $y_i - E(y / x_i)$ and the observations $y_1, y_2, y_3, \dots, y_n$ are uncorrelated
- the conditional distributions of y for each value of x are normal
- these distributions have the equal variance σ^2 .

Since y_i can take on only the values 0 and 1, a reasonable probability model for the response is the Bernoulli distribution the random variable y_i takes on the value 1 with probability $P(y_i = 1) = \pi_i$

$$\text{We have } E(y_i / x_i) = \alpha + \beta x_i + E(\varepsilon_i) = \pi_i$$

$$\text{Or, } \alpha + \beta x_i = \pi_i \quad \dots \dots \dots (9.2)$$

which accounts for the linear probability model designation. Again y_i take on only two values, however, then is dichotomous as well: if $y_i = 1$, then

$\varepsilon_i = 1 - (\alpha + \beta x_i) = 1 - \pi_i$, (which occurs with probability π_i). Because the error is dichotomous, it cannot be even approximately normally distributed. Moreover the variance of ε_i is not constant, as we may demonstrate: Recalling that $E(\varepsilon_i) = 0$ and using the relations just noted,

$$V(\varepsilon_i) = E(\varepsilon_i^2) = (1 - \pi_i)^2 \cdot \pi_i + (-\pi_i)^2 \cdot (1 - \pi_i) = \pi_i(1 - \pi_i).$$

The striking of non normality and heteroskedasticity of errors bode ill for ordinary least square estimation of the linear probability model. Goldberger (1964) has proposed a correction for heteroskedasticity employing weighted least square and obtains adhoc estimates from a preliminary OLS regression: that is he takes

$$V(\varepsilon_i) = y_i \cdot (1 - y_i), \text{ or equivalently, } W_i = \frac{1}{\{y_i(1 - y_i)\}} \text{ as weights.}$$

In some problems with an indicator response variable, the relationship between y and x is non linear. Very frequently we find that response function is S-shaped. There are several approaches to fitting such a function. One method involves modelling the response function with the normal cumulative distribution function. This approach is called Probit analysis (Finney, 1971). A second method of analysis is to model the response using the logistic function

$$E(y/x) = \pi_i = \frac{\exp(\alpha + \beta x)}{1 + \exp(\alpha + \beta x)} \quad \dots \dots \dots (9.3)$$

The logistic function (9.3) has asymptotes at 0 and 1, guarantying that the estimated response function lies between zero and one. Fitting the logistic function is usually called logit analysis. Rearranging equation (9.3), we get

$$\log_e \left(\frac{\pi_i}{1 - \pi_i} \right) = \alpha + \beta x_i \quad \dots \dots \dots (9.4)$$

which is known as simple logit regression model. Note that $\log_e \left(\frac{\pi_i}{1 - \pi_i} \right)$ is called logit of π_i , is the log odds that y_i is one rather than zero. If the odds are even, that is if $\pi = 0.5$, then the logit is zero; if $\pi < 0.5$, then the logit is negative; and if $\pi > 0.5$, then the logit is positive.

Fox (1984) suggested the extension of the simple logistic regression model to general linear regression model as:

$$\log_e \left(\frac{\pi_i}{1 - \pi_i} \right) = X_i' B \quad \dots \dots \dots (9.5)$$

where, $X_{(n \times k)}$ be a matrix of full column rank with one row X_i' for all observations and $B_{(k \times 1)}$ be a vector of parameters relating π to X . As in general linear model, X may or may not contain constant regression. But he could not give any direction or basis for choosing such a model in real purposes.

1.8.4.1 Estimation of Parameters

The general linear logistic model is defined as

$$\log_e \left(\frac{\pi_i}{1 - \pi_i} \right) = X_i' B \quad \dots \dots \dots (9.6)$$

Where, $X_{(n \times k)}$ is a matrix of full column and be a vector of parameters.

Since y_i takes on the values one or zero with probabilities π_i and $(1 - \pi_i)$, and if the observation are independent, the joint probability for the observations is given by

$$\begin{aligned} P(y_1, y_2, y_3, \dots, y_n) &= \prod_{i=1}^n \pi_i^{y_i} (1 - \pi_i)^{1-y_i} \\ &= \prod_{i=1}^n \left(\frac{\pi_i}{1 - \pi_i} \right)^{y_i} (1 - \pi_i) \\ &= \prod_{i=1}^n (e^{X_i' B})^{y_i} \left(\frac{1}{1 + e^{X_i' B}} \right) \dots \dots \dots (9.7) \end{aligned}$$

and the log likelihood function is
$$\log L(B) = \sum_{i=1}^n Y_i X_i' B - \sum_{i=1}^n \log_e (1 + e^{X_i' B})$$

The partial derivatives of the log likelihood with respect to B as

$$\begin{aligned} \frac{\partial \log L(B)}{\partial B} &= \sum_{i=1}^n Y_i X_i - \sum_{i=1}^n \left(\frac{e^{X_i' B}}{1 + e^{X_i' B}} \right) X_i \\ &= \sum_{i=1}^n Y_i X_i - \sum_{i=1}^n \left(\frac{1}{1 + e^{X_i' B}} \right) X_i \dots \dots \dots (9.8) \end{aligned}$$

The estimating equations (9.8) have an intuitive justification:

$P_i = \frac{1}{[1+\exp(-X_i' B)]}$ is the fitted value of π_i , and thus estimating equation set

the fitted sum $\sum Y_i X_i$. In matrix form, we may write the estimating equations as $X' P = X' Y$, where $P = (P_1, P_2, P_3, \dots, P_n)$

Note that the similarity of the least squares estimating equations of the general linear model, which may be written as $X' Y' = X' Y$.

1.8.4.2 Wald Statistic for testing the significance of the coefficients

For large sample size, the test that a co-efficient is zero can be based on the Wald statistic, which has a chi-square distribution. When a variable has single degree of freedom, the Wald statistic is just the square of the ratio of the co-efficient to its standard error i.e.

$W = \frac{\beta_i}{S.E(\beta_i)}$, which follows chi-square distribution with 1 degrees of freedom.

Unfortunately, the Wald statistic had a very undesirable property. When the absolute value of the regression co-efficient becomes large, the estimated standard error is too large. This provides a Wald statistic that is too small, leading to fail to reject the null hypothesis that the co-efficient is zero. Therefore whenever we have a large co-efficient, we should not rely on the Wald statistics for hypothesis testing. Instead we should build hypothesis test on the difference between the two likelihood ratio chi-squares (Huck and Donner, 1977).

B. Brass Model

Brass used simple fertility and child mortality models to simulate proportions dead for different fertility patterns to develop conversion factors to adjust an observed proportion dead for the effects of the age patterns of childbearing. Brass developed a procedure to convert $D(i)$ values into estimates of $q(x)$, where $q(x) = 1.0 - l(x)$, the probability of dying between birth and exact age x . the basic form of the estimation equation proposed by Brass is

$$q(x) = K(i) \cdot D(i) \dots \dots \dots (1)$$

Where the multiplier $K(i)$ is meant to adjust for non-mortality factors determining the value of $D(i)$.

C. Bongaart's Model

Bongaart's (1978) expressed TFR as the product of four indices measuring the fertility inhabiting effect of these four indices and the total fecundity (TF). The total fecundity rate is the average number of live births expected among women who during their entire reproductive period, remain married, do not use contraception, do not have any induced abortion and do not breastfeed their children (Bangaart's, 1982). According to Bangaart's model, the total fertility rate (TFR) can be written as

$$TFR = C_m \times C_c \times C_a \times C_i \times TF \dots\dots\dots (1)$$

Where, TFR = Total Fertility Rate,

C_m = The index of proportion married,

C_c = The index of non-contraception,

C_a = The index of induced abortion, and

C_i = The index of lactational infecundability,

TF = Total Fecundity.

Each index indicates the extent to which fertility reduced from maximal level (i.e TF=15.3) 1 by specific proximate determinants. The indices can only take the values between 0 and 1, if there is no fertility inhibiting effect of a given intermediate fertility variables, the corresponding index equals 1 if the fertility inhabiting is complete, the index is 0.

D. Path Model

Path model analysis gives us scope to study the direct and indirect effects of variables. It is not a method for discovering causes, but a method applies to a causal model on the basis of prior knowledge and theoretical consideration.

The assumptions that underlie the application of path analysis are:

- i. the association between the dependent and the explanatory variable is linear;
- ii. the error term has an independent distribution with zero and unit variance (i.e. constant variance);
- iii. the explanatory variables are independent of the error term.

Given the above assumption, the method of path analysis reduces to the system of one or more multiple linear regression analysis. By the help of reduced multiple regression analysis, the path coefficients are estimated. Path coefficients are the

standardized regression coefficients in a system of linear regression equations, including the direct effects of on independent variable on the dependent variable. To estimate the total effect, we use Alwin and Hauser's (1975) methods. The residual path coefficients can also be estimated from the regression equation as square roots of $(1-R^2)$, where R^2 (unadjusted) is the multiple correlation coefficients (square) of the regression equation.

Model specification

In the path diagram, the causal links among the variables are assumed to be a conceptual framework conceived in advanced. It is to be noted that data set has no role to play in deciding either the causal links between the variables or the variables to be included in the path analysis. According to the causal ordering of variables, we may denote the two sets of selected variables into three groups (exogenous, endogenous and dependent) that are given below:

Exogenous Variables	X_1, X_2, X_3, X_4, X_5
Endogenous Variables	X_6, X_7, X_8, X_9
Dependent Variable	X_{10}

The given model is a recursive path model in which each variable is measured to be dependent upon all prior causal variables. Under additional assumption of linearity and additively the system of equation for the model (depend on Total Fertility Rate) can be written as:

$$\begin{aligned}
 X_6 &= P_{61}X_1 + P_{62}X_2 + P_{63}X_3 + P_{64}X_4 + P_{65}X_5 + P_{6s}R_s \\
 X_7 &= P_{71}X_1 + P_{72}X_2 + P_{73}X_3 + P_{74}X_4 + P_{75}X_5 + P_{76}X_6 + P_{7u}R_u \\
 X_8 &= P_{81}X_1 + P_{82}X_2 + P_{83}X_3 + P_{84}X_4 + P_{85}X_5 + P_{86}X_6 + P_{87}X_7 + P_{8v}R_v \\
 X_9 &= P_{91}X_1 + P_{92}X_2 + P_{93}X_3 + P_{94}X_4 + P_{95}X_5 + P_{96}X_6 + P_{97}X_7 + P_{98}X_8 + P_{9w}R_w \\
 X_{10} &= P_{101}X_1 + P_{102}X_2 + P_{103}X_3 + P_{104}X_4 + P_{105}X_5 + P_{106}X_6 + P_{107}X_7 + P_{108}X_8 \\
 &\quad + P_{109}X_9 + P_{10z}R_z
 \end{aligned}$$

Where, P_{ji} 's are path coefficients from X_i to X_j and R_s, R_u, R_v, R_w and R_z are random disturbance terms. This system of equations is known as structural equations. This set of selected variables gives the estimates of path coefficients and helps in understanding the important links between various variables considered in the causal model. Now all the variables are transformed into normal forms by subtracting the respective means and dividing by the respective standard deviation. The regression coefficients thus obtained are the path coefficients.

1.8.5 Sources of Data and Methods of Data Collection

The data for this research had been collected from the Bangladesh Demographic and Health Survey (BDHS) of 2007 which employed a nationally-representative, two-stage sample that was selected from the Integrated Multi-Purpose Master Sample (IMPS). The data which was collected from the BDHS 2007 was published in March, 2009. BDHS 2007 survey was conducted from March 24 to August 11, 2007 under the authority of the National Institute for Population Research and Training (NIPORT) of the Ministry of Health and Family Welfare. The data was collected by interviewing 10,996 ever-married women of ages 15-49 years. The respondents were considered in three groups of women. First group of women had mixed experiences both child losing and not losing. Second group of women had child losing experience. Third group of women did not have any child losing experience before. Another data source for this research was the Bangladesh Demographic and Health Survey (BDHS) of 1993-94 and 2004. The present study covered a period of 18 years, from 1989 to 2007. The secondary sources of data include survey of documents, outcome of recent research works on relevant field, reading materials; books, journals, published and unpublished documents and website information.

1.8.6 Data Analysis and Presentation

Data processing: The collected data were arranged and scrutinized carefully on the basis of the completed questionnaire. The processing steps were: editing, coding, classification and tabulation

Data scanning: The presence of outliers (abnormal points) in data set can affect the interpretation of results (Stevens, 1996). The collected data were scanned carefully in order to remove such outliers from the data set. Informal techniques suggested by Dunn and Clark (1974) were used to identified and removed outliers from the data.

Analysis plan: The collected data were analyzed by applying statistical tools and techniques. In this regard, SPSS software's were mainly employed.

Data presentation: Some suitable data were presented in graphs, charts, maps and pictogram.

Interpretation of results: Results were interpreted within and among the results of relevant study.

The research were conducted by using the following tools and techniques

- ❖ Brass Model analysis
- ❖ Multiple Logistic Regression analysis,

- ❖ Banga's Model analysis,
- ❖ Path Model analysis,

The following tests were also be carried out

- ❖ Dependency test (Chi-square test),

Chi-Square (χ^2) Test

Chi-square (χ^2) test was used mainly for testing hypotheses that specify the nature of one or more distributions as a whole.⁵³ It may also specify that certain attributes or variates are independent. The Chi-square (χ^2) test was also used for testing the equality of a set of variances or correlation coefficients. If O_i ($i=1, 2, \dots, k$), denotes the observed frequency and E_i denotes the corresponding expected frequency, the test statistic χ^2 is defined as $\chi^2_{(f)} = \sum_{i=1}^k \frac{(O_i - E_i)^2}{E_i}$

Where, f denotes the degrees of freedom, the only parameter of the theoretical Chi-square (χ^2) distribution. This parameter is equal to $(k-r)$ where r is the number of independent restrictions imposed on the set of frequencies while calculating the expected series.

1.9 Conceptual Frameworks of the Study

The child mortality model include the causes of death in a setting of multiple disease, the clear distinction between preventive activities affecting morbidity and curative activities affecting case fatality rates, and the separation of the early childhood period into age subgroups with distinct morbidity characteristics. The optimization model also distinguishes between program use (which an economist might view as the demand side of the market for health services) and program availability (which can be viewed as supply), and operates in such a manner as to set intervention levels that tend to equilibrate use and availability. Figure 1.9.1 provided an overview of the model. The basic relationship shown at the bottom of the diagram is the calculation of mortality rates as the product of morbidity (the morbidity rate measures the incidence of disease in the reference population) and case fatality (the fatality rate measures the incidence of the death in the diseased population). The conceptualization of these frameworks would help to understand the linkage between

⁵³ M.G. Mostafa, *METHODS OF STATISTICS* (4th ed.; Dhaka: Karim Press & Publications, 1989), p.279.

infant and child mortality and the social, economic, demographic and environmental characteristics.

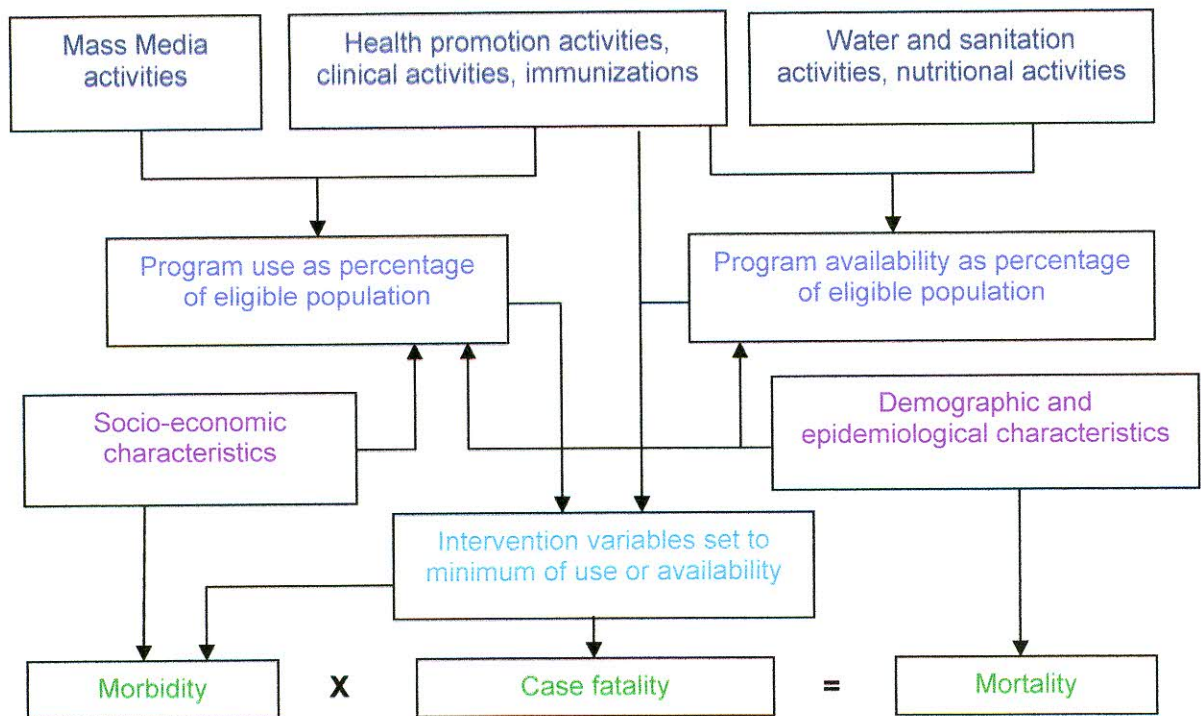


Figure 1.9.1: The Child Mortality Model

Source: Mosley, W. H. and L.C. Chen, "An Analytical Framework for the Study of Child Survival in Developing Countries," *Population and Development Review*, A Supplement to Volume 10 on Child Survival Strategies for Research, (1984), pp. 25–45.

A framework conceptualizing hypothetical mechanisms by which sex-biased health and nutrition behaviour might produce the observed mortality differentials in children was shown in Figure 1.9.2

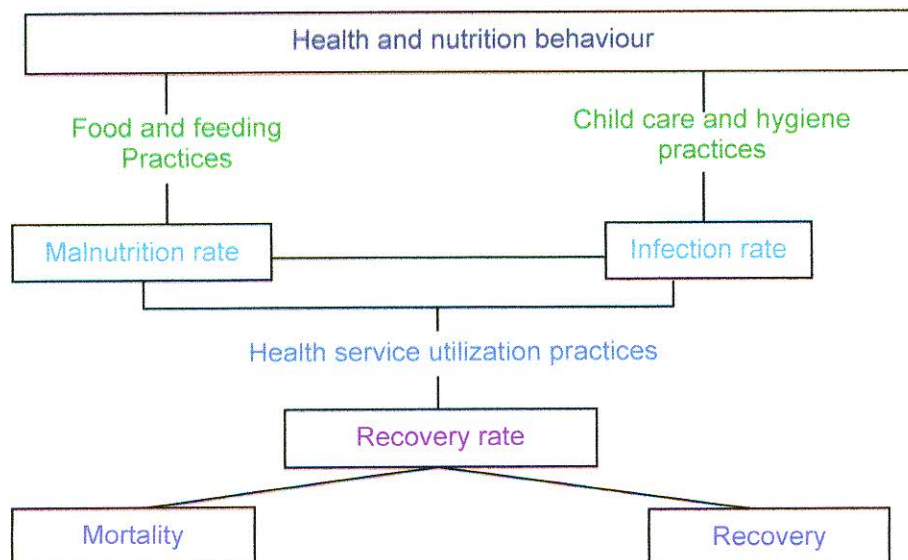


Figure 1.9.2: Framework of Health and Nutritional Determinants of Child Mortality

A framework conceptualizing hypothetical mechanisms by which two groups of mothers (where they had child mortality experience earlier or not) might produce the observed child mortality's impact on reproductive pattern was shown in Figure 1.9.3

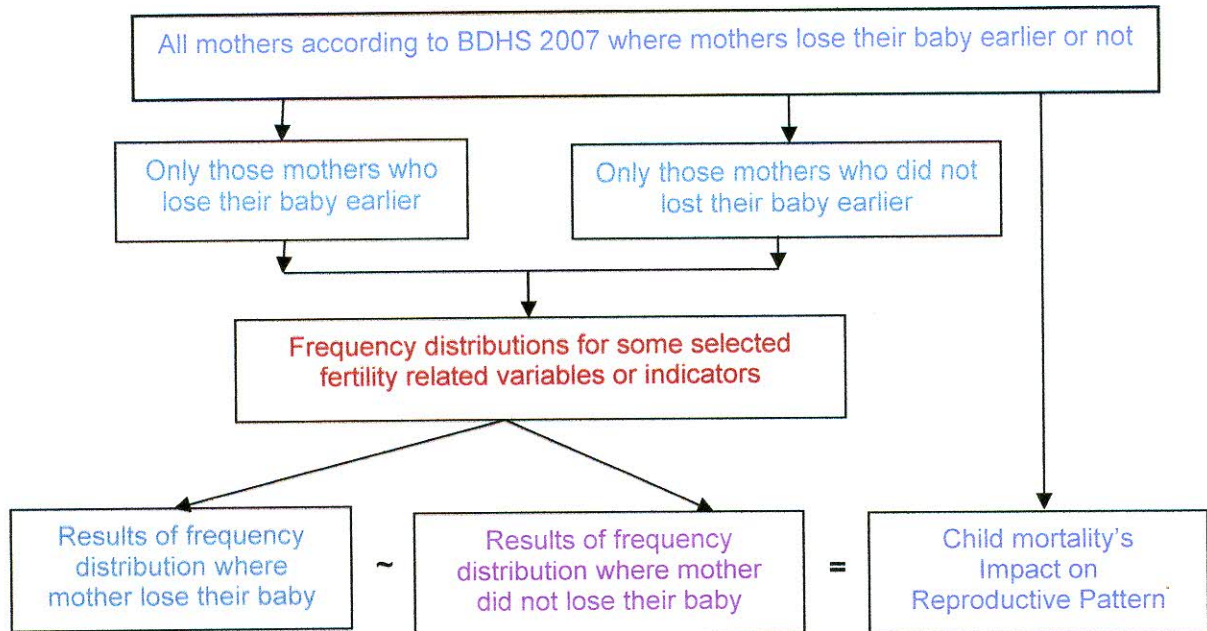


Figure 1.9.3: Framework of Child Mortality's Impact on Reproductive Pattern

1.10 Conclusion

Child mortality and maternal health are important for monitoring progress towards the United Nations millennium development goal to reduce the child mortality. The interlinkage between mortality and socio-economic, bio-demographic and maternal health care variables are tested by applying different statistical analysis. This study was designed to examine the impacts of child mortality on reproductive pattern in Bangladesh. The level, trends and behavior of child mortality and reproductive pattern of Bangladesh were taken under review. Actual picture of child mortality and reproductive pattern were measured in a framework of demographic modelling and different statistical techniques. This study also identified the challenges for reducing the child mortality rate and appropriate reproductive pattern for Bangladesh. Finally, a set of recommendations were formulated based on the findings of this study.

Chapter: Two

Profile of the Respondnet



Chapter: Two

Profile of the Respondents

2.1 Introduction

Frequency distribution is not only a form of tabulation but also a form of condensing and summarizing the long and complex record of categorical quantitative data. It is well known that frequency distribution gives us a clear picture of the pattern of distribution in different groups. The information which is getting from the frequency distribution is essential for the interpretation of research findings and can provide an appropriate indication of the representativeness of the research. Here some important background characteristics i.e., independent variables were considered which were related with mortality status. The selected variables can be classified into different groups. Such as socioeconomic characteristics are: division, residence, education of mother, education of father, occupation of father, has electricity, household goods, housing conditions (main floor material, main wall material and main roof material), religion, wealth index. The demographic characteristics were sex of child, child is alive, birth order number, previous birth interval, age of mother at first birth, age at first marriage, breastfeeding status and number of household members. Behavioral characteristics or maternal health care service utilization variables were place of delivery, timing of first antenatal checking, tetanus injections before pregnancy, tetanus injections before birth, immunization, sanitation & hygienic situation and women's consciousness by reading newspaper, listening radio and watching television and so on. The background characteristics of the study population were essential for interpretation of the study findings and examination of any cause effect relationship among study variable. This chapter examined some important background characteristics which were considered to be important in relation of infant and child mortality and reproductive pattern.

2.2 Organization of the 2007 Bangladesh Demographic and Health Survey

2.2.1 Implementing Organization

The 2007 BDHS survey was conducted from March 24 to August 11, 2007 under the authority of the National Institute for Population Research and Training (NIPORT) of

the Ministry of Health and Family Welfare. The survey was implemented by Mitra and Associates, a Bangladeshi research firm located in Dhaka. Macro International Inc., a private research firm located in Calverton, Maryland, USA, provided technical assistance to the survey as part of its International Demographic and Health Surveys program. The U.S. Agency for International Development (USAID) /Bangladesh provided financial assistance.

2.2.2 Sample Design

The 2007 BDHS employed a nationally representative sample that covers the entire population residing in private dwelling units in Bangladesh. The survey used the sampling frame provided by the list of census enumeration area (EAs) with population and household information from the 2001 Population Census. Bangladesh is divided into six administrative divisions: Barisal, Chittagong, Dhaka, Khulna, Rajshahi, and Sylhet. In turn, each division is divided into Zillas, and each Zilla into Upazilas. Rural areas in an upazila are divided into union parishads (UPs), and Ups are further divided into mouzas. Urban areas in an upazila are divided into wards, and wards are subdivided into mahallas. These divisions allow the country as a whole to be easily divided into rural and urban areas. EAs from the census were used as the Primary Sampling Units (PSUs) for survey, because they could be easily located with correct geographical boundaries and sketch maps were available for each one. An EA, which consists of about 100 households, on average, is equivalent to a mouza in rural areas and to a mahallah in urban areas.

The survey was based on a two-stage stratified sample of households. At the first stage of sampling, 361 PSUs were selected. The selection of PSUs was done independently for each stratum and with probability proportional to PSU size, in terms of numbers of households. The distribution of the sample over different parts of the country was not proportional, because that would have allocated the two smallest divisions, Barisal and Sylhet, too small a sample for statistical precision. Because only a small proportion of Bangladesh's population lives in urban areas, urban areas also had to be over-sampled to achieve statistical precision comparable to that of rural areas. Therefore, it was necessary to divide the country into strata, with different probabilities of selection calculated for the various strata. Stratification of the sample was achieved by separating the sample into divisions and, within divisions, into urban and rural area. The urban areas of each division were further

subdivided into three strata: statistical metropolitan areas (SMAs), municipality areas, and other urban areas. In all, the sample consisted of 22 strata, because Barisal and Sylhet do not have SMAs.

The 361 PSUs selected in the first stage of sampling included 227 rural PSUs and 134 urban PSUs. A household listing operation was carried out in all selected PSUs from January to March 2007. The resulting lists of households were used as the sampling frame for the selection of households in the second stage of sampling. On average, 30 households were selected from each PSU, using an equal probability systematic sampling technique. In this way, 10,819 households were selected for the sample. However, some of the PSUs were large and contained more than 300 households. Large PSUs were segmented, and only one segment was selected for the survey, with probability proportional to segment size. Households in the selected segments were then listed prior to their selection. Thus, a 2007 BDHS sample cluster is either an EA or a segment of an EA.

The survey was designed to obtain 11,485 completed interviews with ever-married women age 10–49. According to the sample design, 4,360 interviews were allocated to urban areas and 7,125 to rural areas. All ever-married women age 10–49 in selected households were eligible respondents for the women's questionnaire. In addition, ever-married men age 15–54 in every second household were eligible to be interviewed.

2.2.3 Questionnaires

The 2007 BDHS used five questionnaires: a Household Questionnaire, a Women's Questionnaire, a Men's Questionnaire, a Community Questionnaire, and a Facility Questionnaire. Their contents were based on the MEASURE DHS Model Questionnaires. These model questionnaires were adapted for use in Bangladesh during a series of meetings with a Technical Task Force (TTF) that included representatives from NIPORT, Mitra and Associates, ICCDR'B: knowledge for Global Lifesaving Solution, the Bangladesh Rural Advancement Committee (BRAC), USAID/Dhaka, and Macro International. Draft questionnaires were then circulated to other interested groups and reviewed by the BDHS Technical Review Committee. The questionnaires were developed in English and then translated and printed in Bangla.

The Household Questionnaire was used to list all the usual members of and visitors to selected households. Some basic information was collected on the characteristics of each person listed, including age, sex, education, and relationship to the head of the household. The main purpose of the Household Questionnaire was to identify women and men who were eligible for individual interviews. In addition, the questionnaire collected information about the dwelling unit, such as the source of water, type of toilets facilities, flooring and roofing materials, and ownership of various consumer goods. The Household Questionnaire was also used to record height and weight measurements of all women age 10–49 and all children below six years of age.

The Women's Questionnaire was used to collect information from ever-married women age 10–49. Women were asked questions on the following topics:

- Background characteristics, including age, residential history, education, religion, and media exposure,
- Reproductive history,
- Knowledge and use of family planning method,
- Antenatal, delivery, postnatal, and newborn care,
- Breastfeeding and infant feeding practices,
- Vaccinations and childhood illnesses,
- Marriage,
- Fertility preferences,
- Husband's background and respondent's work,
- Awareness of AIDS and other sexually transmitted diseases,
- Knowledge of tuberculosis, and
- Domestic violence.

The Men's Questionnaire was used to collect information from ever-married men age 15–54. Men were asked questions on the following topics:

- Background characteristics, including respondent's work,
- Marriage,
- Fertility preferences,
- Participation in reproductive health care,
- Awareness of AIDS and other sexually transmitted diseases,
- Knowledge of tuberculosis, injuries, and tobacco consumption, and

- Domestic violence.

Questions on domestic violence were administered to only one eligible respondent per household, whether female or male. In households with two or more eligible respondents, special procedures were followed to ensure that the selection of the woman or man was random and that these questions were administered in private.

The Community and Facility Questionnaires were administered in each selected cluster during listing. These questionnaires collected information about the existence of development organizations in the community and the availability and accessibility of health services and other facilities. This information was also used to verify information gathered in the Women's and Men's Questionnaires on the type of facilities respondents accessed and the health service personnel they saw.

2.2.4 Training and Fieldwork

Forty-two field staff were trained and organized into six teams to carry out the listing of households and delineation of EAs and to administer the Community and Facility Questionnaires. In addition, six supervisors were deployed to check and verify the work of the listing teams. Listers were also trained in the use of Global Positioning System (GPS) units so that they could obtain locational coordinates for each selected EA and for facilities located within each EA.

The Household, Women's and Men's Questionnaires were pre-tested in February 2007. Fourteen interviewers were trained for the pretest. The questionnaires were pre-tested on 100 women and 100 men in two rural areas in Barisal district and two urban areas in Dhaka. Based on observations in the field and suggestions made by the pretest teams, revisions were made in the wording and translation of the questionnaires.

Training for the main survey was conducted for four weeks from February 25 to March 23, 2007. A total of 128 field staff were recruited based on their educational level, prior experience with surveys, maturity, and willingness to spend up to five months on the project. Training included lectures on how to complete the questionnaires, mock interviews between participants, and field practice. Fieldwork for the BDHS was carried out by 12 interview teams, each consisting of one male supervisor, one female field editor, five female interviewers, two male interviewers, and one logistics staff member. Four quality control teams ensured data quality; each

team included one male and one female data quality control worker. In addition, NIPORT monitored fieldwork with another set of quality control teams. Data quality was also monitored through field check tables generated concurrently with data processing. This permitted the quality control teams to check various data quality parameters. Fieldwork was also monitored through visits by representative from USAID, Macro International, and NIPORT. Fieldwork was implemented in five phases and carried out from March 24 to August 11, 2007.

2.2.5 Data Processing

All questionnaires for the BDHS were periodically returned to Dhaka for data processing at Mitra and Associates. The processing of data collected in the field began shortly after fieldwork commenced. Data processing consisted of office editing, coding of open-ended questions, data entry, and editing inconsistencies found by the computer program. The data were processed by 10 data entry operators and two data entry supervisors working in double shifts using six microcomputers. Data processing commenced on April 16 and ended on August 31, 2007. Data processing was carried out using CSPro, a joint software product of the U.S. Census Bureau, Macro International, and Serpro S.A.

2.2.6 Coverage of the Sample

A total of 10,819 households selected for the survey, 10,461 were found to be occupied. Interviews were successfully completed in 10,400 households, or 99.4 percent of households. A total of 11,178 eligible women age 15–49 were identified in these households and 10,966 were interviewed, for a response rate of 98.4 percent. Eligible men in every second household were selected to yield 4,074 potential male respondents, of whom 92.6 percent or 3,771 were successfully interviewed.

The principal reason for non-response among eligible women and men was their absence from home despite repeated visits to the household. The household and eligible women's response rates were similar to the response rates in the 2004 BDHS. However, the male response rate was lower than in the last survey.

2.3 Socio-economic characteristics

Socioeconomic characteristics have great influences on mortality level. Infant and child mortality levels show substantial differences according to the social and economic characteristics of the population. The selected socioeconomic variables

are associated with place of region, residence, education of mother, education of father, occupation of father, electricity, household goods, religion, wealth index, housing condition (main floor material, main wall material, main roof material), sanitation system, sources of drinking water, type of cooking etc. The frequency distributions of the selected variables were discussed in the following table.

Table 2.3: Frequency distribution of the respondent by selected socio-economic characteristics, BDHS 2007

Variable & Characteristics	Number	Percent (%)
Region/Division		
Barisal	1438	13.1
Chittagong	1943	17.7
Dhaka	2340	22.3
Khulna	1711	15.6
Rajshahi	2080	18.9
Sylhet	1484	13.5
Residence		
Urban	4151	37.8
Rural	6845	62.2
Mother's Education		
No education	3525	32.1
Primary	3268	29.7
Secondary	3345	30.4
Higher	855	7.8
Father's Education		
No education	3602	32.8
Primary	2881	26.2
Secondary	2900	26.4
Higher	1598	14.6
Mother's Occupation		
Housewife	7461	67.9
Worker/Labor	1836	16.7
Professional worker	1263	11.5
Business	178	1.6
Other	250	2.3
Father's Occupation		
Agriculture	2893	26.3
Worker/Labor	4550	41.4
Professional worker	644	5.9
Business	2507	22.8
Other	340	3.1
Household goods		
Has television		
No	6311	57.4
Yes	3776	34.3
Has radio		
No	7496	68.2
Yes	2590	23.6
Has refrigerator		
No	8914	82.1
Yes	1169	10.6

Variable & Characteristics	Number	Percent (%)
Household transport facilities		
Has bicycle		
No	7413	67.4
Yes	2671	24.3
Has motorcycle/scooter		
No	9647	87.7
Yes	440	4.0
Has car/truck		
No	9995	90.9
Yes	92	0.8
Has electricity		
No	4788	43.5
Yes	5300	48.2
Religion		
Islam	9924	90.3
Others	1072	9.7
Main roof material		
Thatch/palm leaf	520	4.7
Tin	8304	75.5
Cement and Others	1264	11.5
Main wall material		
Cane/palm/trunks /Dirt	2071	18.8
Bamboo with mud	1577	14.3
Tin	3406	31.0
Cement and others	3033	27.6
Main floor material		
Earth, sand	7488	68.1
Cement and others	2596	23.6
Wealth index		
Poorest	1775	16.1
Poorer	1995	18.1
Middle	2095	19.1
Richer	2201	20.0
Richest	2930	26.6
Source of drinking water		
Pipe	834	7.6
Tube well or borehole	8892	80.9
Well and protected spring	104	0.9
Rivers/ponds/others	258	2.3
Type of toilet facility		
Toilet with Flush	3104	28.2
Pit latrine	5400	49.1
Hanging toilet and Other	1583	14.4
Type of cooking		
Natural gas/Kerosene	1178	10.7
Wood	5117	46.5
Agricultural crop	2954	26.9
Animal dung and Others	839	7.6

Source: BDHS, 2007

According to BDHS 2007 data, from the table 2.3 we observed that 62.2% of the respondent in rural areas and 37.8% of respondent live in urban areas. So Bangladesh is mainly a rural country with about 62.0 percent of the population were found to live in villages. The result in the above table provided that Dhaka division

contained highest proportion of respondent 22.3% but Rajshahi division was nearly equal to the Dhaka division which proportion of respondent 18.9% and lowest proportion 13.1% respondent were in Barisal division. The other divisions contained 17.7%, 15.6% and 13.5% respectively in Chittagong, Khulna and Sylhet.

Mother's education was strongly associated with higher rates of child survival. The children born to a mother with higher education have by far the lowest rates for all types of child mortality. So, maternal education had been identified as one of the most important socioeconomic determinants of infant and child mortality. Studies showed that the higher the level of maternal education reflects the lower rate of infant and child mortality. Table 2.3 showed that 32.1% mother had no education, 29.7% mother had primary education, 30.4% mother had secondary education and 7.8% mother had higher level of education.

Father's education is also important like mother's education and it is likely that higher education have lowest rates of infant and child mortality. Table 2.3 represented the frequency distribution of the educational level of father of the respondent. Highest proportion of father (34.0%) did not go to school, 28.4% of the father complete primary level, 25.5% and 11.9% had completed secondary and higher education respectively.

Mother's occupation had indirect affect on infant and child mortality. Because of mother's occupation was associated with economic status and health care facilities of a family. From table 2.3 we saw that 67.9% mothers were housewife, 16.7% mothers were laborer or daily worker, 11.5% mothers were professional worker and 3.9% mothers had others occupation.

Father's occupation had direct affect on infant and child mortality. Because of father's occupation was closely associated with other socioeconomic factors and demographic behavior such as income, life style, reproductive behavior, housing condition and health status of the respondent. From table 2.3 we saw that 26.3% fathers were involve with agriculture or agricultural based work, 41.4% fathers were laborer or daily worker, 5.9% fathers were professional worker, 22.8% fathers were businessmen and only 3.1% fathers were involved in others occupation.

Electricity is an addition of modern life and may impact on infant and child mortality. Table 2.3 represented that 48.2% respondent had electricity and 43.5% respondent had no electricity facilities in their houses.

Household goods represent economic solvency of a family. Table 2.3 represents that 68.2% respondent had no radio, 57.4% respondent had no television and 81.1% respondent had no refrigerator. Table 2.3 also represented the frequency distribution of household transportation facilities. The above tables showed that respondent have very poor transportation facilities. 24.3% respondent had bicycle, 4.0% respondent had motorcycle /scooter and only 0.8% respondent had car or truck.

Religion is a factor which has insignificant influence on infant and child mortality. Kabir and Amin (1993) found that mortality rate is slightly higher for non-Muslims than for Muslims. We observed that 90.3% respondents were Muslims, 9.7% respondents were from other religions.

Table 2.3 represented the frequency distribution of housing condition which was measured by main roof materials, main wall materials and main floor materials. The above table 2.3 showed that 4.7% respondent's houses main roof materials were thatch/palm leaf, 75.5% respondent's houses main roof materials were tin and 11.5% respondent's houses main roof materials were cement and others. Again 18.8% respondent's houses main wall materials were cane/palm /trunks/dirt, 14.3% respondent's houses main wall materials were bamboo with mud, and 31.0% respondent's houses main wall materials were tin which is the highest in number and 27.6% respondent's houses main wall materials were cement and other. We also found that 68.1% respondent's houses main floor materials were earth or sand, 23.6% respondent's houses floor materials were cement and others.

Household wealth status not only ensures standard of living but also economic security of a family. A well off family easily fulfill their needs for that reason there is a strong association between infant and child mortality and standard of living of family. Household wealth conditions of the respondents were categorized in five groups. That was poorest, poorer, middle, richer and richest respectively. Table 2.3 represented frequency distribution of household income and household wealth condition. It was observed that 16.1% respondent's families were poorest, 18.1% respondent's families were poorer, 19.1% respondent's families were middle, 20.0% respondent's families were richer and 26.6% respondent's families were richest.

Table 2.3 presents the frequency distribution of the type of cooking. We found that 10.7% respondent used natural gas and kerosene as their fuel for cooking, 46.5% respondent used wood, 26.9% respondent uses agricultural crop and 7.6% respondent used animal dung and others as their fuel for cooking.

In the developing countries, sanitation facilities have been found to be more important than water supply in reducing mortality levels. Improvement of water supply and quality of sanitation are important for decreasing mortality (Sastry, 1996). The above table represented the frequency distribution of sanitation system and sources of drinking water. From the table 2.3 we observed that 7.6% respondents source of drinking water was pipe, 80.9% respondent source of drinking water was tube well or borehole which is highest, 0.9% respondents source of drinking water was well and protected spring and 2.3% respondents source of drinking water were river/dam/lake/Pond/stream /canal/irrigation channel. On the other hand, 28.2% respondent used toilet with flush for their sanitation, 49.1% respondent completed their sanitation by using pit latrine, 14.4% respondent used hanging toilet and others.

2.4 Demographic characteristics

Despite the socioeconomic characteristics, infant and child mortality was affected by demographic factors. Mortality changes can be attributed by demographic variables, because of the demographic characteristics of both mother and child have been found to play an important role in the survival probability of the respondent. Demographic variables were sex of child, child is alive, child's weight at birth, birth order number, previous birth interval, age of mother at first birth, age at first marriage, breastfeeding status and number of household members. The frequency distributions of the selected demographic characteristics were presented in the following table 2.4.

Here table 2.4 showed that the distribution of the sex of child of the represent that boys were higher in number than girls but the difference was very small. The above table also showed that 95.8% respondent's child was alive but 4.2% respondent's child was not alive. Early-age death rates in large areas of Western South Asia, northern states of India to Bangladesh are often very much higher for females, especially in rural areas (Dyson, 1982). In the developing countries like Bangladesh, children treatment cost and treatment attitude varies by sex during illness period. Gender discrimination is a common phenomenon in all day to day life activities.

The birth order number affects one's risk of survival mostly during infancy and the first birth is particularly of much higher mortality risk than higher-order births. Table 2.4 express the frequency distribution relating to birth order number which indicated that respondents of first birth order were 22.1%. While the respondent of second,

third and fourth birth order numbers were 25.2%, 18.5% and 13.8% respectively. But the respondent's five and five plus birth order number was 20.5%.

Table 2.4 represented the frequency distribution of previous birth interval of the respondents. The shortest birth interval (less than two years) carries the greatest risk of mortality and it had indirect effects through such factors as mother's depletion, premature birth and limited family resources. From the table 2.4, it was observed that 18.4% respondent's previous birth interval was less than two years, 54.2% respondent's previous birth interval between 2 to 5 years and 27.3% respondent's previous birth interval was more than 5 years.

Table 2.4: Frequency distribution of the respondent by selected demographic characteristics, BDHS 2007

Variable & Characteristics	Number	Percent (%)
Sex of child		
Male	5254	53.3
Female	4595	46.7
Child is alive		
No	418	4.2
Yes	9431	95.8
Birth order number		
1	2177	22.1
2	2481	25.2
3	1820	18.5
4	1356	13.8
5 and 5+	2015	20.5
Previous birth interval		
< 24 months	1412	18.4
24-60 months	4155	54.2
60+ months	2092	27.3
Month of Breastfeeding		
0 month	59	2.2
1-12 months	238	4.8
12-24 months	605	12.3
24+ months	4024	81.7
Age at first marriage		
<15	6516	59.3
15-19	3534	32.1
19-24	789	7.2
24+	157	1.4
Age of mother at first birth		
<15	2378	24.1
15-19	5083	51.6
19-24	1985	20.2
24+	403	4.1
No. of household members		
<4	3914	35.6
4-6	3629	33.0
6+	3453	31.4

Source: BDHS, 2007

Table 2.4 represented the frequency distribution of the mother's month of breastfeeding status. Breast milk is the best and most essential nutrient food for infant and it prevent any kinds of diseases especially in neonatal and post-neonatal period. A shorter duration of breastfeeding has an indirect effect on infant mortality and thus increases the risk of death during childhood. From the above table, we saw that 1.2% mother did not breastfeed their child, 4.8% mother breastfeed their child from 1 to 12 months, 12.3% mother breastfeed their child from 12 to 24 months and 81.7% mother breastfeed their child more than 2 years.

Women age at first marriage is an important factor for infant and child mortality. Table 2.4 represented the frequency distribution of the women age at first marriage. The percentage distribution of mother age at marriage less than 15 years was 59.3%. 15–19, 19–24 and 24+ years women age at marriage was 32.1%, 7.2% and 1.4% respectively.

There was a U-shape relationship between mortality and mother's age at first birth. Table 2.4 represented the frequency distribution of mother's age at first birth. Percentage distribution of less than 15 years mother's age at first birth was 59.3%, mother whose age lies between 15 to 19 years and give their first birth was 32.1%, 19 to 24 years mother who give their first birth was 7.2%, more than 24 years mother who give their first birth was 1.4%.

Table 2.4 represented the frequency distribution of the number of household members. We saw that 35.6% respondents had below 4 family members, 33.0% respondents had 4 to 6 household members and 31.4% respondents had more than 6 family members.

2.5 Maternal health care service utilization characteristics

Mother's poor health and nutritional status had post-neonatal consequences. Such as mother's lactation and render her unable to give adequate care to her the respondent (Retherford, 1989). Maternal health care service utilization represented various issues of women pregnant status and child health services. Behavioral characteristics or maternal health care service utilization variables are place of delivery, timing of first antenatal checking, tetanus injections before pregnancy, tetanus injections before birth, immunization, and women's consciousness by reading newspaper, listening radio and watching television etc. The frequency distributions of the selected variables were discussed in the following table 2.5.

Table 2.5: Frequency distribution of the respondent by maternal health care service utilization characteristics, BDHS 2007

Variable & Characteristics	Number	Percent (%)
Place of delivery		
Home	3985	80.9
Medical centre/Clinic	940	19.1
Timing of first antenatal check		
<3	1338	43.7
3-5	922	30.1
5+	805	26.3
Tetanus injections before birth		
1 dose	4910	99.7
2 doses	13	0.3
3 doses	3	0.1
Tetanus injections during pregnancy		
1-3 doses	1175	58.1
3-5 doses	671	33.2
5+ doses	178	8.8
Read newspaper or magazine		
No	4483	72.2
Yes	1817	28.8
Listen to the radio		
No	8445	76.8
Yes	2551	23.2
Watch television		
No	4882	44.4
Yes	6113	55.6

Source: BDHS, 2007

In Bangladesh, there is a strong association between child mortality and babies home based place of delivery, because of most of the deliveries took place in presence of relatives and neighbors attendant where essential medical facilities are absent. The above table 2.5 showed that 80.9% respondent's babies were born in home, 19.1% respondents babies were born in different places with medical facilities like government or private hospital, NGO static clinic or upazila health complex etc.

More and better antenatal care services during pregnancy may increase the respondent's chances of survival (Ali Ahmed Howlader and Monir Uddin Bhuiyan). Table 2.5 represented the frequency distribution of the number of first antenatal checking of mother. Here we saw that 43.7% respondents during pregnancy period got less than 3 times first antenatal checking, 30.1% respondents during pregnancy period got 3 to 5 times and 26.3% respondents during pregnancy period got more than 5 times antenatal checking.

Table 2.5 represented the frequency distribution of tetanus injections during pregnancy period. From the table we found that 99.7% respondents got first dose of tetanus injection before birth, 0.2% respondents got second doses of tetanus injection before birth and 0.1% respondents got third doses of tetanus injections before birth. Moreover, we found that 58.1% respondents got 1 to 3 doses of tetanus injections during pregnancy, 33.2% respondents got 3 to 5 doses of tetanus injections during pregnancy and 8.8% respondents got more than 5 doses of tetanus injection during pregnancy.

Newspaper, radio and television are the main types of mass media exposure in Bangladesh. Very important information about health, particularly, reproductive health, is transmitted through these types of mass media. Therefore, access to these will have a positive effect on lowering infant and child mortality. Table 2.5 expressed that 71.2% respondents did not read any newspaper, 76.8% respondents did not listen radio. But 55.6% respondents are watching television.

2.6 Conclusion

In any research background characteristics of the study was very essential for outset of the target population analysis. From the above discussion we got a brief profile of the background characteristics in terms of socioeconomic, demographic and behavioral variables of the target population. We can easily estimate determinant and differentiates of infant and child mortality and its impact on reproductive pattern with respect to socioeconomic, demographic and behavioral characteristics based on these preliminary information.

Chapter: Three

Levels, Trends and Differentials of Infant and Child Mortality



Chapter: Three

Levels, Trends and Differentials of Infant and Child Mortality

3.1 Introduction

This chapter presented levels, trends and differentials in neonatal, post-neonatal, infant, child mortality. The information of infant and child mortality is important not only for demographic assessment of the country's population, but also for the design and evaluation of health policies and programs. Moreover, this information is relevant for understanding population trends—for example, the mortality rates can be used in population projections. Information on child mortality serves the needs of the health sector by identifying population groups that are at high risk. Because the government of Bangladesh is undertaking a number of interventions in order to reduce child mortality in the country. The levels, trends, and differentials in neonatal, post-neonatal, infant and child mortality provide an opportunity to evaluate the performance of such programs. Furthermore, these mortality indicators are useful in assessing the Poverty Reduction Strategy Paper (PRSP), as they reflect socioeconomic development and quality of life.

3.2 Levels and Trends in infant and child mortality

Estimation of levels and trends in neonatal, post-neonatal, infant and child mortality are important both for monitoring and evaluating ongoing health programs and for use in formulating future policies. The levels of infant and child mortality are viewed as basic indicators of the socioeconomic situation, quality of life and general standard of living in a society. In addition the levels of mortality also includes a table which indicating the distribution of children and women according to characteristics of avoidable fertility behavior that place children at greater risk of mortality. That information is useful for designing and monitoring programs designed both to discourage high-risk behavior and to cope with the elevated risks. Furthermore, estimates of the level and trends in infant and child mortality are needed to help set priorities, shape policies, design programs and monitor progress towards the MDG at the national level. These estimates are also needed at the international level to inform funding decisions for activities directed towards reducing child mortality.

Table 3.2: Neonatal, Post-neonatal, Infant, Child and Under 5 years Mortality Rate from 1989 to 2006 based on BDHS

Time Period	Survey name	Neonatal	Post-neonatal	Infant	Child	Under 5 mortality
1989-1993	BDHS 1994	52	35	87	50	133
1992-1996	BDHS 1997	48	34	82	37	116
1995-1999	BDHS 2000	42	24	66	30	94
1999-2003	BDHS 2004	41	24	65	24	88
2002-2006	BDHS 2007	37	15	52	14	65

BDHS 1993-94 survey showed that infant mortality was 87 per thousand. Neonatal mortality rate was 52 per 1000 and post-neonatal mortality rate was 35. This means that the risk of dying in the first month of life was about one and a half times higher than in the subsequent 11 months. Again neonatal mortality was 60% of the infant mortality and deaths in the post-neonatal period was 40% of all infant deaths. Now it also expressed that child mortality was 50. This means that about one in fifty children born in Bangladesh dies before reaching the fifth birthday. On the other hand, under 5 mortality during the five years preceding the survey was 133 per 1000 births which was greater than one and a half times of infant mortality.

BDHS 1996-97 survey indicated that under 5 mortality during the five years preceding the survey was 116 per 1000 births. Again child mortality was 37 per thousand. This means that one in forty children born in Bangladesh dies before reaching the fifth birthday. The infant mortality rate was 82 per 1000 live births. Neonatal mortality rate was 48 per 1000 and post-neonatal mortality rate was 34. This means that the risk of dying in the first month of life is nearly one and a half times greater than in the subsequent 11 months. Again neonatal mortality was 41% of under 5 mortality and deaths in the post-neonatal period was 30% of all under five deaths. Based on previous BDHS 1993-94 survey absolute reduction was 4 per 1000 for neonatal mortality, 1 per 1000 for post-neonatal mortality, 5 per 1000 for infant mortality and 13 per 1000 for child mortality. Similarly based on previous BDHS 1993-94 survey, relative reduction rate was 7.7% for neonatal mortality, 2.9% for post-neonatal mortality, 5.7% for infant mortality and 26.0% for child mortality.

BDHS 2000 survey expressed that infant mortality was 66 per thousand. Neonatal mortality rate was 42 per 1000 and post-neonatal mortality rate was 24. This means that the risk of dying in the first month of life was about two times higher than in the subsequent 11 months. Again neonatal mortality was 64% of the infant

mortality and deaths in the post-neonatal period was 36% of all infant deaths. Now it also expressed that child mortality was 30. This means that about one in thirty children born in Bangladesh dies before reaching the fifth birthday. On the other hand, under 5 mortality during the five years preceding the survey was 94 per 1,000 births which was greater than three times of child mortality. Based on previous BDHS 1997 survey absolute reduction is 6 per 1000 for neonatal mortality, 10 per 1000 for post-neonatal mortality, 16 per 1000 for infant mortality and 7 per 1000 for child mortality. Similarly based on previous BDHS 1997 survey, relative reduction rate is 12.5% for neonatal mortality, 29.4% for post-neonatal mortality, 19.5% for infant mortality and 18.9% for child mortality.

BDHS 2004 showed that infant mortality was 65 per thousand. Neonatal mortality rate was 41 per 1000 and post-neonatal mortality rate was 24. This means that the risk of dying in the first month of life was about two times higher than in the subsequent 11 months. Again neonatal mortality was 63% of the infant mortality and deaths in the post-neonatal period was 37% of all infant deaths. Now it also expressed that child mortality was 24. This means that about one in twenty five children born in Bangladesh die before reaching the fifth birthday. On the other hand, under 5 mortality during the five years preceding the survey was 88 per 1000 births which was more than doubled of neonatal mortality. Based on previous BDHS 2000 survey absolute reduction was 1 per 1000 for neonatal mortality, 1 per 1000 for infant mortality and 6 per 1000 for child mortality. Similarly based on previous BDHS 2000 survey, relative reduction rate was 2.3% for neonatal mortality, 0% for post-neonatal mortality, 1.5% for infant mortality and 20.0% for child mortality.

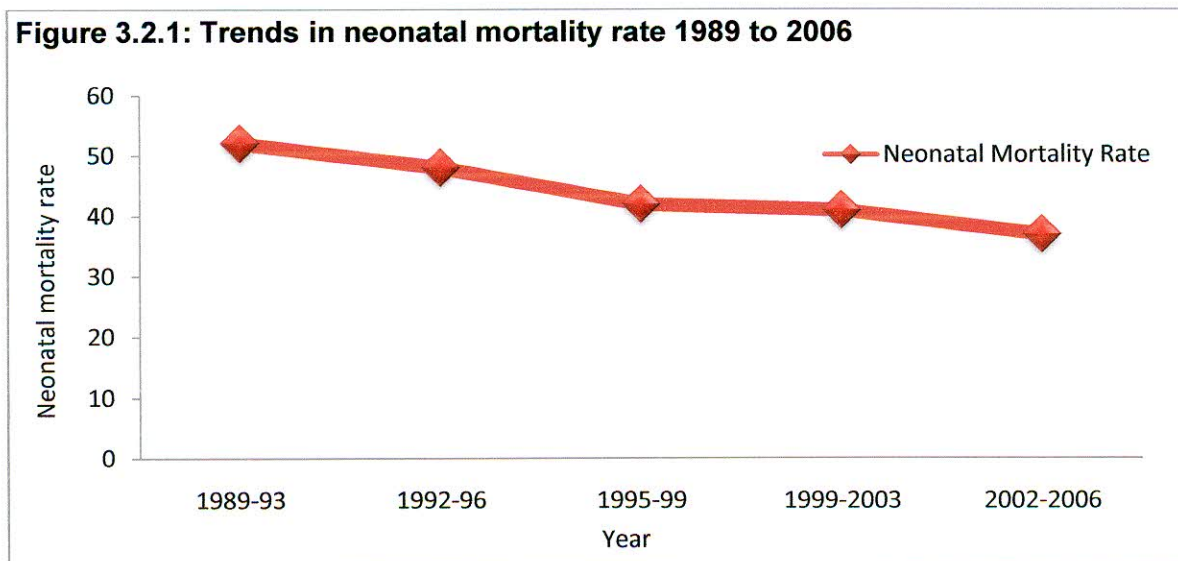
Data from BDHS 2007 expressed that under 5 mortality during the five years preceding the survey was 65 per 1000 births. Again child mortality was 14 per thousand. This means that one in fifteen children born in Bangladesh dies before reaching the fifth birthday. The infant mortality rate was 52 per 1000 live births. Neonatal mortality rate was 37 per 1000 and post-neonatal mortality rate was 15. This means that the risk of dying in the first month of life was nearly two and a half times greater than in the subsequent 11 months. Again neonatal mortality was 57% of under 5 mortality and deaths in the post-neonatal period was 23% of all under five deaths. Based on previous BDHS 2004 survey absolute reduction was 4 per 1000 for neonatal mortality, 9 per 1000 for post-neonatal mortality, 13 per 1000 for infant mortality and 10 per 1000 for child mortality. Similarly based on previous BDHS 2004

survey, relative reduction rate was 9.7% for neonatal mortality, 37.5% for post-neonatal mortality, 20.2% for infant mortality and 41.7% for child mortality.

3.2.1 Trends in neonatal mortality

Neonatal mortality rates obtained for the five years preceding successive Demographic and Health Survey (DHS) conducted in Bangladesh since 1993-94 confirm a declining trend in neonatal mortality. Between the periods 1989-1993 and 2002-2006, declined by about 30% from 52 deaths per 1000 live births to 37 per 1000 and 10% declined from immediate past survey. Absolute declining trends for neonatal mortality were 4, 6, 1 and 4 per 1000 in BDHS 1997, BDHS 2000, BDHS2004 and BDHS 2007 survey based on previous BDHS survey. Similarly relative declining trends for neonatal mortality were 7.7%, 12.5%, 23.0% and 9.7% in BDHS 1997, BDHS 2000, BDHS 2004 and BDHS 2007 survey based on previous BDHS survey.

Figure 3.2.1: Trends in neonatal mortality rate 1989 to 2006

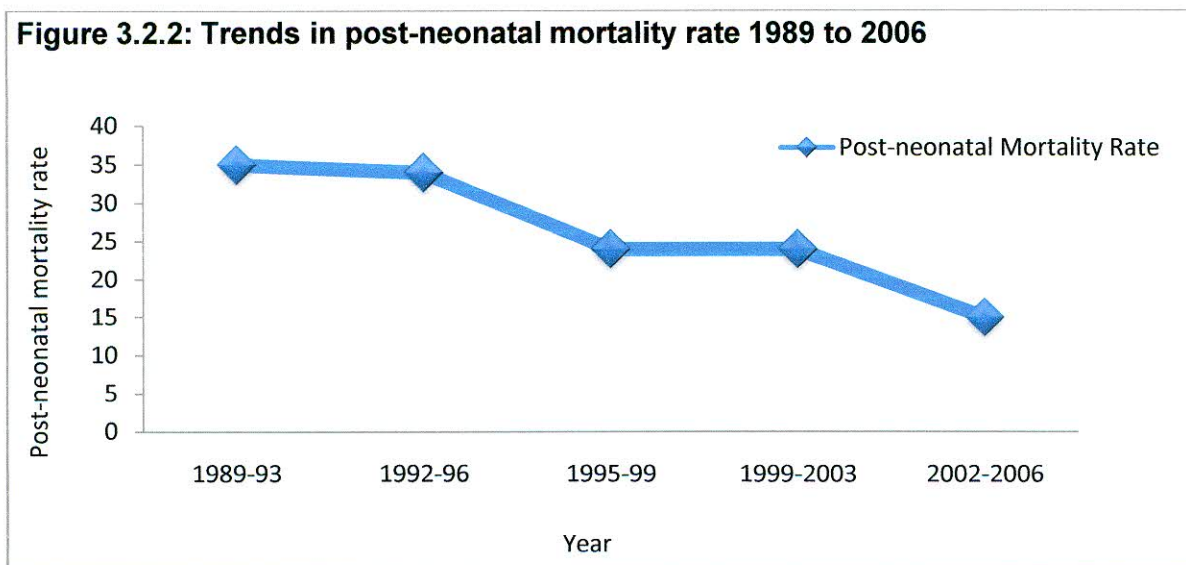


3.2.2 Trends in post-neonatal mortality

Post-neonatal mortality rates obtained for the five years preceding successive Demographic and Health Survey (DHS) conducted in Bangladesh since 1993-94 confirm a declining trend in post-neonatal mortality. Between the periods 1989-1993 and 2002-2006, declined by about 60% from 35 deaths per 1000 live births to 15 per 1000 and it was 38% declined from immediate past survey. Absolute declining trends for post-neonatal mortality were 1, 10, 0 and 9 per 1000 in BDHS 1997, BDHS 2000, BDHS2004 and BDHS 2007 survey based on previous BDHS survey. Similarly relative declining trends for neonatal mortality were 2.9%, 29.4%, 0.0% and 37.5% in

BDHS 1997, BDHS 2000, BDHS 2004 and BDHS 2007 survey based on previous BDHS survey.

Figure 3.2.2: Trends in post-neonatal mortality rate 1989 to 2006



3.2.3 Trends in child mortality

Child mortality rates obtained for the five years preceding successive Demographic and Health Survey (DHS) conducted in Bangladesh since 1993-94 confirm a declining trend in child mortality. Between the periods 1989-1993 and 2002-2006, child mortality rate is declined by about 70% from 50 deaths per 1000 live births to 14 per 1000 and it was 42% declined from last BDHS survey. Absolute declining trends for child mortality were 13, 7, 6 and 10 per 1000 in BDHS 1997, BDHS 2000, BDHS2004 and BDHS 2007 survey based on previous BDHS survey. Similarly relative declining trends for neonatal mortality were 26.0%, 18.9%, 12.0% and 41.7% in BDHS 1997, BDHS 2000, BDHS 2004 and BDHS 2007 survey based on previous BDHS survey.

Figure 3.2.3: Trends in child mortality rate 1989 to 2006

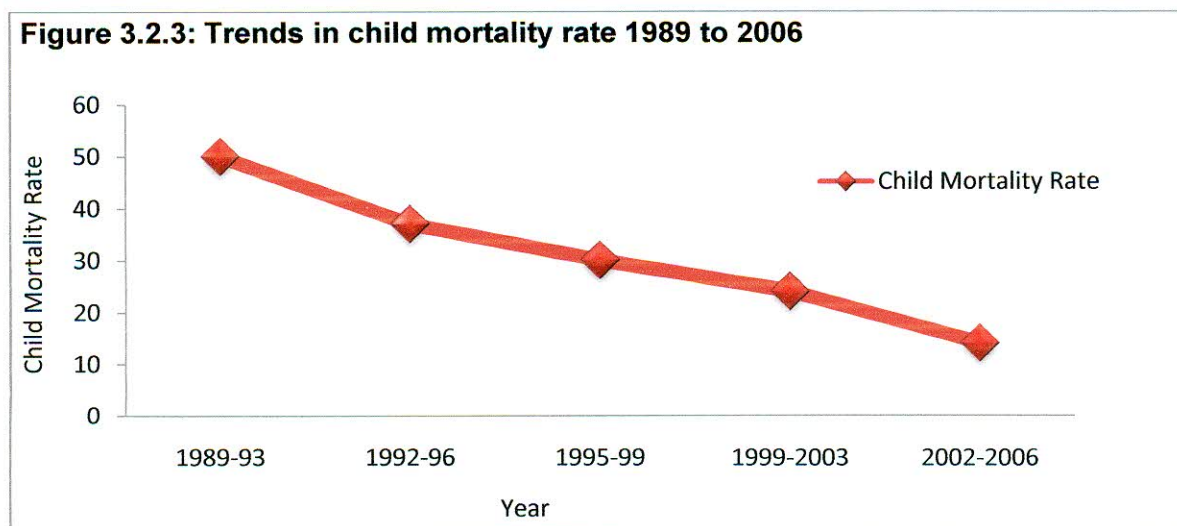
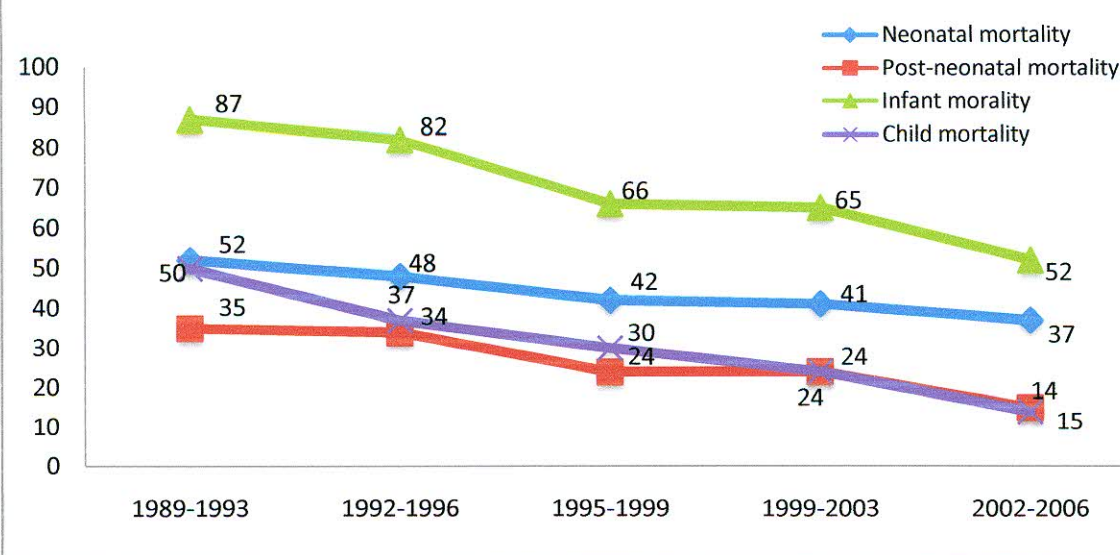


Figure 3.2.3.1: Trends in neonatal, post-neonatal, infant and child mortality 1989 to 2006 based on BDHS



3.2.4 Trends in infant mortality

Infant mortality rates obtained for the five years preceding successive Demographic and Health Survey (DHS) surveys conducted in Bangladesh since 1993-94 but the data collected from the DHS survey since 1979 confirm a declining trend in child mortality. Between the periods 1979-1983 and 2002-2006, infant mortality rate was declined by about 56% from 117 deaths per 1000 live births to 52 per 1000 and it was 20% declined from immediate past survey. From the table it was clear that declining being faster after 1990s.

Table 3.2.4: Infant mortality rates based on BDHS

Time period	Infant mortality rate (per 1000)	Declining Rate (%)
1979-1983 *	117	-
1982-1986 *	117	0
1984-1988 *	112	4.3
1987-1991 *	96	14.3
1989-1993	87	9.4
1992-1996	82	5.7
1995-1999	66	19.5
1999-2003	65	1.5
2002-2006	52	20.0

Source: BDHS and * DHS surveys.

3.2.5 Trends in infant mortality rate for the period of 1975 to 2008

To express the trends in infant mortality rate for the period of 1975 to 2008, two data sets provide much of the recent information on infant mortality. One was the vital registration survey (VRS) data of the Bangladesh Bureau of Statistics (BBS) and the other was the Bangladesh Demographic and Health Survey (BDHS) data. Both suggest dramatic improvements in infant mortality in the 1990s. The VRS data of the BBS represented the longest series on infant mortality rate (IMR) based on a single source. The VRS data show virtually no improvement in infant mortality during 1980-88. In 1988, the IMR still stood at 116, but by 1998 it had dropped to 57. The rate fell even faster during the late 1990s and early 2000s – to 60 by 1997, 53 by 2002, and recently 43 by 2008. The rate was decline in infant mortality in recent years suggested by the BBS data was confirmed by the BDHS data, which also showed the IMR halving from its levels in the last decade.

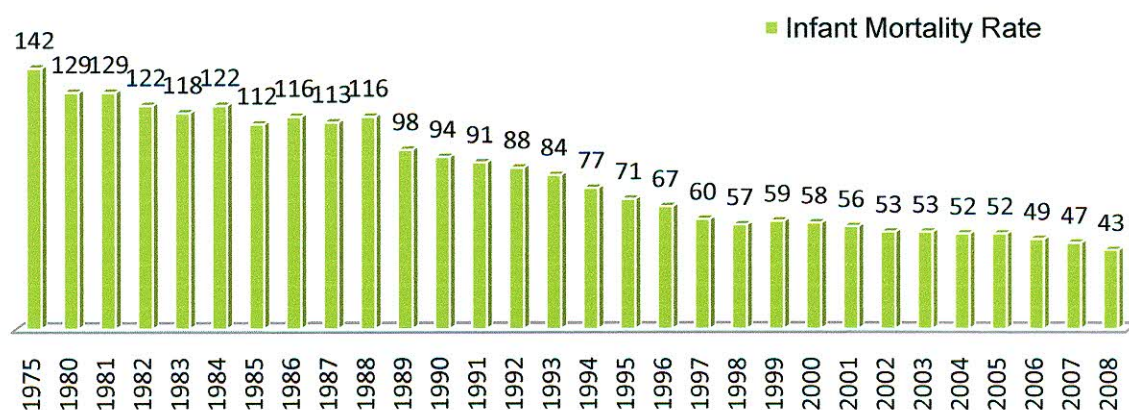
Table 3.2.5: Infant mortality rates from 1975 to 2008

Year	Infant Mortality Rate (per 1000)	Declining Rate (%)
1975	142	-
1980	129	9.2
1981	129	0
1982	122	5.4
1983	118	3.3
1984	122	-3.4
1985	112	8.2
1986	116	-3.6
1987	113	2.6
1988	116	-2.7
1989	98	15.5
1990	94	4.1
1991	91	3.2
1992	88	3.3
1993	84	4.5
1994	77	8.3
1995	71	7.8
1996	67	5.6
1997	60	10.4
1998	57	5.0
1999	59	-3.5
2000	58	1.7
2001	56	3.4

Year	Infant Mortality Rate (per 1000)	Declining Rate (%)
2002	53	5.4
2003 *	53	0
2004 *	52	1.9
2005 *	52	0
2006 *	49	5.8
2007 **	47	4.1
2008 **	43	8.5

Source: Vital Registration System 1980-2002; * Statistical Year Book of Bangladesh 2006 and ** BBS

Figure 3.2.5: Trends in Infant Mortality Rate 1975 to 2008



3.2.6 Trends in Infant Mortality Rate for the period of 1911 to 2008

In order to show the trends in infant mortality rate for the period of 1911 to 2008, data were collected from UNICEF 2001, World Health Organization (WHO), The World Bank (WB), United Nations DESA/Population Division and Bangladesh Bureau of Statistics (BBS). From the table, Infant mortality showed a regular and continuous decline from about 206 per thousand at the beginning of the 1911 to about 94 per thousand at the beginning of the 1990s, and down to 43 per thousand in the most recent period. To understand the differences in the patterns of declining performance in infant mortality, it should be recognized that different factors affecting infant mortality. Infant mortality was dependent on the health of the mother during pregnancy, the length of the birth interval and receipt of services such as antenatal and postnatal care – all factors that were relatively amenable to programmatic intervention.

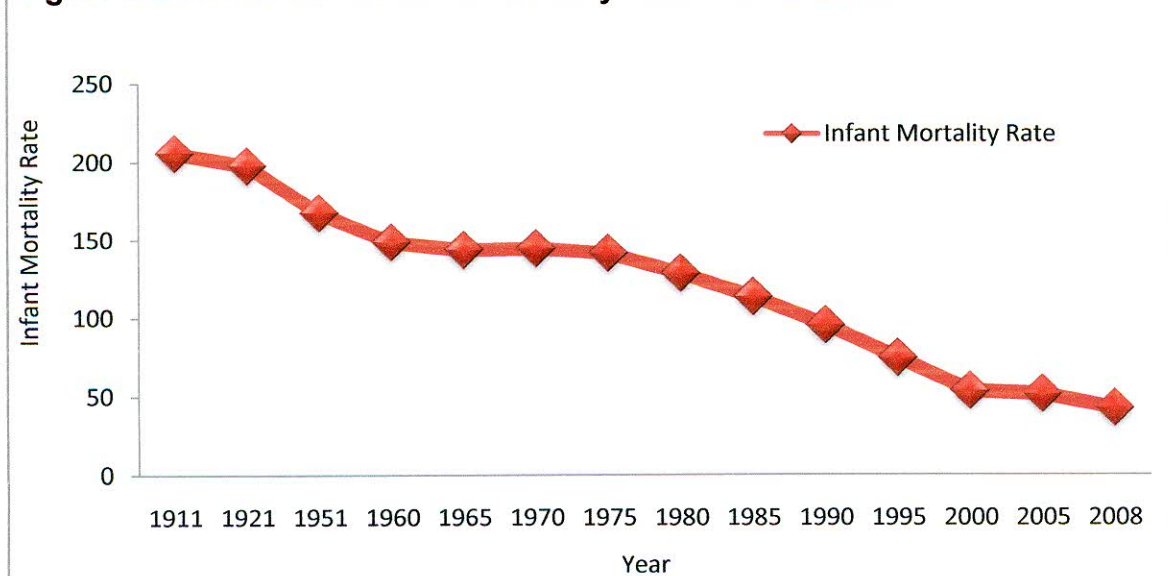
Table 3.2.6: Infant mortality rates from 1911 to 2008

Year	Infant Mortality Rate
1911	206
1921	198
1951	168
1960	149
1965	144
1970	145
1975	142
1980	129
1985	114
1990	96
1995	75
2000	54
2005 *	52
2008 *	43

Source: UNICEF 2001, WHO, The WB, UN DESA/Population Division and * BBS

The historical trends in infant mortality, culled from various sources and surveys, were shown in Figure 3.2.6. The infant mortality rate (IMR) appeared to have dropped sharply in the early 1900s, but barely dropped from 198 infant deaths per 1,000 live births to 145 deaths during the five decades between 1921 and 1971. In the immediate aftermath of Bangladesh's independence, the IMR actually increased to 145. But since then the IMR had fallen secularly and rapidly, reaching a level of 98 by 1989 and 43 in 2008. It was only after 1989 does one see a definitive and a faster trend of decline.

Figure 3.2.6: Trends in infant mortality rate 1911 to 2008



3.2.7 Trends in infant mortality by Divisions based on BDHS

The BDHS data indicate wide variations in infant mortality across divisions, with the division of Sylhet having an infant mortality rate that is nearly three times as high as that in Khulna. Indeed, Sylhet had an infant mortality rate that is more than 50% higher than the division having the second- highest rate of infant mortality (Dhaka and Chittagong). There is greater similarity among the other five divisions in terms of their infant mortality rates. The decline in infant mortality during the 1990s had also varied significantly across divisions. Since Sylhet was carved out of Chittagong in 1998, changes in infant mortality can only be shown for the five divisions that existed in the early 1990s (when Sylhet formed part of Chittagong). From the table 3.2.7 it was indicated that the division having the highest level of infant mortality in 1993-94 is Dhaka division which experienced the slowest rate of infant mortality decline over the following six years. After the extraction of Sylhet division, Chittagong division's infant mortality rate did not decrease. It was increases in 2004 than the previous survey. Rajshahi division expressed the average rate from the beginning of the survey. But Rajshahi division's infant mortality rate decreases in a monotonous way. In contrast, Khulna, which enjoyed the lowest level of infant mortality in 1993-94, experienced a rate of infant mortality declined that was two times as much as that experienced by Dhaka. Thus, regional variations in infant mortality appear to have become more pronounced.

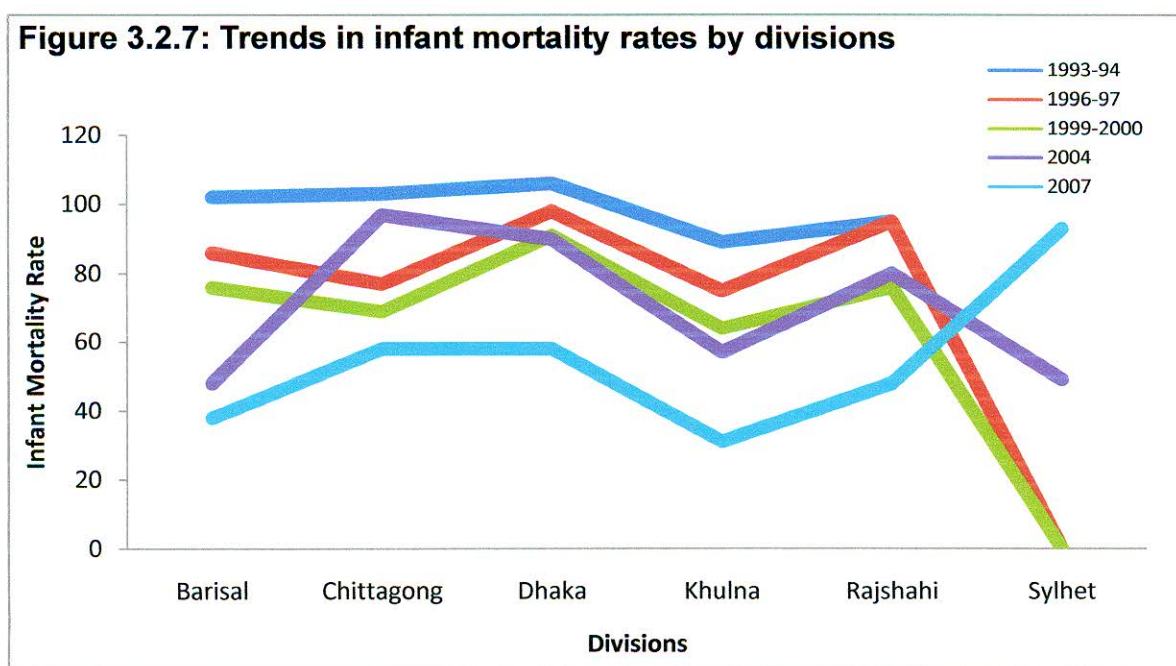


Table 3.2.7: Infant Mortality Rates by Divisions, BDHS

Division	1993-94	1996-97	1999-2000	2004	2007
Barisal	102	86	76	48	38
Chittagong	103	77	69	97	58
Dhaka	106	98	91	90	58
Khulna	89	75	64	57	31
Rajshahi	95	95	76	80	48
Sylhet	-	-	-	49	93

Source: BDHS surveys

3.2.8 International Comparisons

Bangladesh's performance at infant mortality reduction compare to that of other countries in Asia was appreciable. Over the period 1970-2000, infant mortality had fallen by anywhere from 138 to 60 per thousand. It was being the poor performances with compared to South Korea and Sri Lanka. But Bangladesh had done very well managing to reduce its infant mortality rate at a rate comparable to that of Indonesia and much faster than that of India. Indeed, it was surprising that the level of infant mortality was now lower in Bangladesh than in India.

Table 3.2.8: International comparisons of infant mortality rate in Asia.

Country	1970-75	1980-85	1994-2000
South Korea	33	18	8
Sri Lanka	44	25	15
Indonesia	109	75	41
India	130	97	69
Bangladesh	138	114	60

Source: en.wikipedia.org/wiki/list_of_countries_by_infant_mortality

3.3 Differentials in infant and child mortality

This chapter provided the differentials of neonatal, post-neonatal and child mortality. Bivariate analysis had been used for examining the effects of socioeconomic, demographic and maternal health care service utilization variables on infant and child mortality in Bangladesh. Mortality is strongly related with development level of the country. Although infant and child mortality depends on child and mother's demographic characteristics, socioeconomic and maternal health care service factors also have strong influence on their mortality. A few public health program such as immunization, better water supplies and improve sanitation can reduce mortality. The mortality rates, which give an insight view of the mortality pattern, have also been estimated for different characteristics.

Here mortality data analysis was conducted through bivariate analysis. Bivariate analysis is particularly important to check for the mortality differentials with respect to

the different levels of each of the selected independent variables. Studies in mortality differentials are useful in at least three ways. First, such studies provide information for assessing inequality among people with respect to longevity and health. Second, data on mortality differentials help to identify those underprivileged segments of population who experience high mortality levels. Finally, studies on mortality differentials improve our understanding of determinants of mortality and interrelationships.

3.3.1 Socioeconomic differentials in infant and child mortality

Socioeconomic condition of a country has strong impact on infant and child mortality. The socioeconomic condition of people create differential in access of basic necessities which is observed by the experts of international organization that is high mortality of developing countries are associated with among other factors, poverty, ignorance, malnutrition, and poor quality of housing, lack of personal and environmental hygiene and low level of immunity. It is circular relation that socioeconomic development affects the mortality level and in turns mortality level affects socioeconomic and demographic structure of a country. In developing countries, several socioeconomic factors have been identified with have strong relation with the infant and child mortality differentials.

The socioeconomic variables are the major domain of factors influencing on infant and child mortality. Infant and child mortality is affected by community, household and individual characteristics. Household and individual characteristics include: mothers characteristics such as education, place of residence; husband's characteristics such as education, occupation and income; household characteristics such as household facilities, housing condition, having electricity, household assets, types of toilet facilities and sources of drinking water

3.3.1.1 Infant and child mortality by administrative division

Differential in infant and child mortality is prevalent among the geographical regions of Bangladesh. The regional difference occurs primarily due to differential exposure of the individuals to the amenities available for prevention and treatment. The divisions are somewhat different items of their level of socioeconomic development. Variations in infant and child mortality among the six administrative divisions are founded to be insignificant. In Bangladesh a little bit regional differences exists for infant and child mortality rates.

Table 3.3.1.1 (a): Percentage distribution of Neonatal, Post-neonatal, Infant and Child mortality by division, BDHS 2007

Division	Neonatal	Post-neonatal	Infant	Child	No. of Birth
Barisal	22 (10.1%)	14 (14.7%)	36 (11.5%)	15 (14.2%)	791 (12.9%)
Chittagong	36 (16.6%)	15 (15.8%)	51 (16.3%)	23 (21.7%)	1275 (20.7%)
Dhaka	40 (18.4%)	20 (21.1%)	60 (19.2%)	17 (16.0%)	1285 (20.9%)
Khulna	27 (12.4%)	10 (10.5%)	37 (11.9%)	17 (16.0%)	714 (11.6%)
Rajshahi	40 (18.4%)	9 (9.5%)	49 (15.7%)	17 (16.0%)	967 (15.7%)
Sylhet	52 (24.0%)	27 (28.4%)	79 (25.3%)	17 (16.0%)	1118 (18.2%)

Here the above table represented division wise infant and child mortality condition. From the table 3.3.1.1(a) we found that Khulna division represented the lowest neonatal mortality (12.4%), Rajshahi division represented the lowest post-neonatal mortality (9.5%), Barisal division represented the lowest infant and child mortality (11.5% and 14.2% respectively) than all other divisions. Highest neonatal, post-neonatal and infant mortality was (24.0%, 28.4% and 25.3% respectively) in Sylhet division than all other divisions in the country. Among the divisions neonatal mortality was lowest in Khulna division but child mortality condition was very worst in Chittagong division which was near about half (21.7%) of the total child mortality. In that case Dhaka division represented lowest child mortality which was only 16.0%.

Table 3.3.1.1 (b): Estimated Neonatal, Post-neonatal, Infant and Child mortality rate by division.

Division	Neonatal Mortality Rate	Post-neonatal Mortality Rate	Infant Mortality Rate	Child Mortality Rate
Barisal	27.8	17.6	45.5	18.9
Chittagong	28.2	11.7	40.0	18.0
Dhaka	31.1	15.5	46.7	13.2
Khulna	37.8	14.0	51.8	23.8
Rajshahi	41.3	9.3	50.6	17.5
Sylhet	46.5	24.2	70.7	15.2

Here the above table represented estimated neonatal, post-neonatal, infant and child mortality rate by division. From the table 3.3.1.1(b) we found that Sylhet division represented the highest neonatal mortality rate (46.5 per 1000), lowest neonatal mortality rate showed by Barisal division. Lowest post-neonatal mortality rate exists in Rajshahi division (9.3 per 1000), which was about more than double than Sylhet division (24.2 per 1000). For infant mortality rate, 45.5 for Barisal division, 40.0 for Chittagong division, 46.7 for Dhaka division, 51.8 for Khulna division, 50.6 for Rajshahi division and finally 70.7 for Sylhet division. Khulna division shown highest child mortality rate (23.8 per 1000). In that case Dhaka division represent lowest child mortality rate which was 13.2 per 1000.

3.3.1.2 Infant and child mortality by type of place of residence

One of the most frequently measured differentials in mortality was that of residence. Differentials of mortality by urban and rural residence are an important phenomenon widely observed in the developing countries (Ruticka, 1983). In developing countries, living conditions are generally worse in rural areas than in urban areas, and health-care facilities are less readily available and tend to be of poorer quality. These differences usually result in higher infant and child mortality in rural areas than in urban areas. Urban-rural residence in socioeconomic status access to health care and environmental conditions may give rise to mortality variations by residence.

Although most of the people live in rural areas, infant and child mortality rates have declined considerably both in urban and rural areas. By using Bangladesh Fertility Survey (BFS) data, Mojumder and Islam (1993) indicated that child mortality levels in rural areas higher than in the urban areas in Bangladesh. It was established that mortality condition has improved comparatively more in urban areas than in rural areas due to rapid urbanization and progress of science and medicine.

Table 3.3.1.2 (a): Percentage distribution of Neonatal, Post-neonatal, Infant and Child mortality by place of residence, BDHS 2007

Residence	Neonatal	Post-neonatal	Infant	Child	No. of Birth
Urban	74 (34.1%)	24 (25.3%)	98 (31.4%)	34 (32.1%)	2107 (34.3%)
Rural	143 (65.9%)	71 (74.7%)	214 (68.6%)	72 (67.9%)	4043 (65.7%)

Here the above table represented the infant and child mortality situation for both urban and rural areas. Table 3.3.1.2(a) showed that mortality in urban areas was lower than rural areas. Neonatal mortality in urban areas was 34.1% where as this picture in rural areas was 65.9%. Post-neonatal mortality in urban areas was 25.3% where in rural areas was 74.7%. So in total infant mortality in urban areas are 31.4% and in rural areas are 68.6%. Similarly for child mortality case, we see that child mortality in urban areas was 32.1% and in rural areas was 67.9%. So we can finally conclude that child mortality in rural areas was more than doubled than urban areas.

Table 3.3.1.2 (b): Estimated Neonatal, Post-neonatal, Infant and Child mortality rate by place of residence.

Residence	Neonatal Mortality Rate	Post-neonatal Mortality Rate	Infant Mortality Rate	Child Mortality Rate
Urban	35.1	11.3	46.5	16.1
Rural	35.4	17.6	52.9	17.8

The above table represented the estimated neonatal, post-neonatal, infant and child mortality rate for both urban and rural areas. Table 3.3.1.2(b) showed that mortality rate in urban areas were lower than rural areas. Neonatal mortality rate in urban areas was 35.1 per 1000 where as in rural areas it was 35.4 per 1000. Post-neonatal mortality rate in urban areas was 11.3 per 1000 where in rural areas it was 17.6 per 1000. So in total infant mortality in urban areas were 46.5 per 1000 and in rural areas were 52.9 per 1000. Similarly for child mortality rate, in urban areas it was 16.1 per 1000 and in rural areas it was 17.8 per 1000. So we can finally conclude that child mortality rate in rural areas was higher than urban areas.

3.3.1.3 Infant and child mortality by father's education

Among the socioeconomic characteristics, father's education was another influential factor was differentiating the infant and child mortality. Social scientists were very often use level of education as an index for socioeconomic status. Standard of living of a family mainly depends on the father's educational level. Father's education seems to be related to mother's educational status, family income, and household conditions.

Table 3.3.1.3 (a): Percentage distribution of Neonatal, Post-neonatal, Infant and Child mortality by father's education, BDHS 2007

Father's education	Neonatal	Post-neonatal	Infant	Child	No. of Birth
No education	97 (44.7%)	51 (53.7%)	148 (47.4%)	68 (64.2%)	1676 (27.3%)
Primary	67 (30.9%)	29 (30.5%)	96 (30.8%)	24 (22.6%)	1927 (31.3%)
Secondary	49 (22.6%)	14 (14.7%)	63 (20.2%)	14 (13.2%)	2094 (34.1%)
Higher	4 (1.8%)	1 (1.1%)	5 (1.6%)	0 (.0%)	450 (7.3%)

Here the table represented four level of father's education such as no education, primary, secondary and higher education. Among the four education level, lowest mortality rate exists in higher educated father's level. It was observed that neonatal and post-neonatal mortality was highest where father had no education. Infant mortality was 47.4% where father had no education, 30.8% where father had primary education, 20.2% where father had secondary education and only 1.6% where father had higher education. From the table it was clear that about half of the infant mortality occurred where father had no education. In the same way child mortality declined with the increase of father education. Child mortality was 64.2%, 22.6%, 13.2% and none where father had no education, primary education, secondary education and higher education respectively. In this analysis child mortality was zero

for highly educated fathers because there was no mortality occurred in father's higher education group.

Table 3.3.1.3 (b): Estimated Neonatal, Post-neonatal, Infant and Child mortality rate by father's education.

Father's education	Neonatal Mortality Rate	Post-neonatal Mortality Rate	Infant Mortality Rate	Child Mortality Rate
No education	57.8	30.4	88.3	40.0
Primary	37.8	15.0	49.8	12.4
Secondary	23.4	6.7	30.1	6.7
Higher	8.8	2.2	11.1	0

The table 3.3.1.3(b) represented estimated neonatal, post-neonatal, infant and child mortality rate for father's education level. Among the four education level, lowest neonatal mortality rate exists in father's higher education level. It was observed that neonatal and post-neonatal mortality rate was highest where father had no education. Infant mortality was 88.3 per 1000 where father had no education, 49.8 per 1000 where father had primary education, 30.1 per 1000 where father had secondary education and only 11.1 per 1000 where father had higher education. In the same way child mortality declined with the increase of father education. Child mortality rate was 40.0, 12.4, 6.7 and 0 per 1000 where father had no education, primary education, secondary education and higher education respectively.

3.3.1.4 Infant and child mortality by mother's education

In developing countries, mother's educational level, as indicated here by literacy status, tends to have a strong effect on the mortality of young children (Govindasamy and Ramesh 1997; Hobcraft, McDonald, and Rutstein 1984; Mosley and Chen 1984; United Nations 1985; 1991; 1998). Literate mothers usually give birth to healthier babies because they themselves tend to be healthier than mothers who were illiterate. In addition, literate mothers were more likely to provide their children with a healthy environment and nutritious food than were illiterate mothers, even when other conditions were similar. Lastly, literate mothers were likely to have more information about health-care facilities and to have more influence within the family in deciding to take sick children for treatment. These traits were likely to result in lower mortality of children at all ages under five (Caldwell 1994; Cleland and Kaufman 1993; World Bank 1993). Numerous arguments support a direct causal relationship between mother's literacy and infant and child mortality. Some studies indicate that the causal relationship was not clear, but rather that mother's literacy was often just a

good indicator of other socioeconomic factors that affect infant and child mortality directly (Desai and Alva 1998; Hobcraft 1993).

Table 3.3.1.4 (a): Percentage distribution of Neonatal, Post-neonatal, Infant and Child mortality by mother's education, BDHS 2007

Mother's education	Neonatal	Post-neonatal	Infant	Child	No. of Birth
No education	85 (39.2%)	45 (47.4%)	130 (41.7%)	56 (52.8%)	2094 (34.1%)
Primary	65 (30.0%)	20 (21.1%)	85 (27.2%)	21 (19.8%)	1748 (28.4%)
Secondary	45 (20.7%)	27 (28.4%)	72 (23.1%)	24 (22.6%)	1570 (25.5%)
Higher	22 (10.1%)	3 (3.2%)	25 (8.0%)	5 (4.7%)	731 (12.0%)

From the above table showed that different mortality figure in mother's different education level. Among the four education level, lowest mortality rate exists in higher educated mother's level. It was observed that neonatal and post-neonatal mortality was very high where mother had no education. Infant mortality was 41.7% where mother had no education, 27.2% where mother had primary education, 23.1% where mother had secondary education and only 8.0% where mother had higher education. In the same way child mortality declined with the increase of mother education. Child mortality was 52.8%, 19.8%, 22.6% and 4.7% respectively where mothers had no education, primary, secondary and higher education respectively.

Table 3.3.1.4 (b): Estimated Neonatal, Post-neonatal, Infant and Child mortality rate by mother's education.

Mother's education	Neonatal Mortality Rate	Post-neonatal Mortality Rate	Infant Mortality Rate	Child Mortality Rate
No education	40.6	21.5	62.1	26.7
Primary	37.2	11.4	48.6	12.0
Secondary	28.7	17.2	45.9	15.3
Higher	30.1	4.1	34.2	6.8

The above table showed that among the education level of mothers, neonatal and post-neonatal mortality rate take highest value when mother had no education. It was observed that infant mortality rate was 62.1 per 1000 where mother had no education, it was 48.6 per 1000 where mother had primary education, it was 45.9 per 1000 where mother had secondary education and it was 34.2 per 1000 where mother had higher education. Child mortality rate was highest (26.7 per 1000) where mother's had no education and lowest (6.8%) where mother's have higher education.

3.3.1.5 Infant and child mortality by father's occupation

In our societies father was the main income earner and decision maker of a family. So father's occupation plays a vital role in earning income which assures their nutrition, clothing and housing etc. A person whose occupation was the reflection of

the physical environment, also reflect his social milieu, his educational background, his income and his life style. For this reason, occupation was taken as an index of socioeconomic status. Father's occupation related with health and life of a child in a family. So father's occupation was an important predictor on infant and child mortality differentials.

Table 3.3.1.5 (a): Percentage distribution of Neonatal, Post-neonatal, Infant and Child mortality by father's occupation, BDHS 2007

Father's occupation	Neonatal	Post-neonatal	Infant	Child	No. of Birth
Agriculture	62 (28.7%)	32 (33.7%)	94 (30.2%)	30 (28.6%)	1539 (25.2%)
Worker/Laborer	91 (42.1%)	36 (37.9%)	127 (40.8%)	45 (42.9%)	2821 (46.1%)
Professional worker	10 (4.6%)	3 (3.2%)	13 (4.2%)	2 (1.9%)	252 (4.1%)
business	42 (19.4%)	21 (22.1%)	63 (20.3%)	26 (24.8%)	1348 (22.1%)
Other	11 (5.1%)	3 (3.2%)	14 (4.5%)	2 (1.9%)	154 (2.5%)

Table 3.3.1.5 (a) represented the infant and child mortality by father's occupation. It was clear that neonatal mortality was higher for worker/laborer, but it was very low for professional worker. Here post-neonatal mortality was 33.7% for farmer, 37.9% for day laborer/worker, 22.1% for businessmen and it was very low (3.2%) for professional worker father. For infant mortality, it was seen that infant mortality was also very low for professional worker. On the other hand child mortality was 24.8% for businessmen, 42.9% for day laborer, 28.6% for farmer, 1.9% for others and 1.9% for professional worker.

Table 3.3.1.5 (b): Estimated Neonatal, Post-neonatal, Infant and Child mortality rate by father's occupation.

Father's occupation	Neonatal Mortality Rate	Post-neonatal Mortality Rate	Infant Mortality Rate	Child Mortality Rate
Agriculture	42.9	20.8	61.0	19.4
Worker/Labor	32.3	12.8	45.0	15.9
Professional worker	39.7	11.9	51.5	7.9
business	31.1	15.6	46.7	19.2
Other	71.4	19.5	90.9	12.9

Table 3.3.1.5(b) represented the estimated neonatal, post-neonatal, infant and child mortality rate by father's occupation. Neonatal mortality rate was 42.9 per 1000 for farmer, 32.3 per 1000 for worker/laborer, 39.7 per 1000 for professional worker, 31.1 per 1000 for business and 71.4 per 1000 for other. Post-neonatal mortality rate was highest for farmer (20.8 per 1000) and lowest for professional worker (11.9 per 1000). For infant mortality it was seen that infant mortality rate was 61.0 per 1000 for farmer, 45.0 per 1000 for worker/laborer, 51.5 per 1000 for professional worker and

46.7 per 1000 for businessmen. On the other hand child mortality rate was 19.2 per 1000 for businessmen, 15.9 per 1000 for worker/laborer, 19.4 per 1000 for farmer, 12.9 per 1000 for others and only 7.9 per 1000 for professional worker.

3.3.1.6 Infant and child mortality by mother's occupation

Occupation broadly work-status was a considerable influence in the variation of infant and child mortality. In content of Bangladesh, a large portion of the women were housewives but a small portion was engaged with different types of occupation. It may except that mothers (housewives) always stay at home and can take a better care of their babies, so the infant and child mortality of these mothers were comparatively lower. On the contrary the mothers who were engaged with different adequate diet and medicine, they suffer from under nutrition. As a result their newly born babies were not sucked properly and as a consequence they die so after their birth. From various studies it was found that children of working women have higher infant and child mortality than the non-working women.

Table 3.3.1.6 (a): Percentage distribution of Neonatal, Post-neonatal, Infant and Child mortality by mother's occupation, BDHS 2007

Mother's occupation	Neonatal	Post-neonatal	Infant	Child	No. of Birth
Agriculture	156 (71.9%)	48 (50.5%)	204 (65.4%)	61 (57.5%)	4532 (74.0%)
Worker/Labor	27 (12.4%)	22 (23.2%)	49 (15.7%)	21(19.8%)	879 (14.2%)
Professional worker	28 (12.9%)	22 (23.2%)	50 (16.0%)	21(19.8%)	572 (9.3%)
Other	6 (2.8%)	3 (3.2%)	9 (2.9%)	3 (2.8%)	161 (2.5%)

Table 3.3.1.6 (a) represented the infant and child mortality by mother's occupation. It was clear that neonatal mortality was very higher for the mothers who engaged with agriculture based work. But it was 12.4% for worker/laborer, 12.9% for professional worker and 2.8% for others. Here post-neonatal mortality was 50.5% for farmer, 23.2% for day laborer/worker, 23.2% for professional worker and it was very low (3.2%) for others. For infant mortality it was seen that infant mortality was very high for farmers. On the other hand child mortality was 57.5% for farmers, 19.8% for worker/laborer, 19.8% professional worker.

Table 3.3.1.5 (b): Estimated Neonatal, Post-neonatal, Infant and Child mortality rate by mother's occupation.

Mother's occupation	Neonatal Mortality Rate	Post-neonatal Mortality Rate	Infant Mortality Rate	Child Mortality Rate
Agriculture	34.4	10.6	45.0	13.4
Worker/Labor	30.7	25.0	55.7	23.8
Professional worker	48.9	38.4	87.4	36.7
Other	37.2	18.6	55.9	18.6

Table 3.3.1.6(b) represented the estimated neonatal, post-neonatal, infant and child mortality rate by mother's occupation. Neonatal mortality rate was higher for professional worker (48.9 per 1000), but it was low for worker/day laborer (30.7 per 1000). Post-neonatal mortality rate was also highest for professional worker mother (38.4 per 1000) and lowest for farmer (10.6 per 1000). For infant mortality, it was seen that infant mortality rate was highest for professional worker (87.4 per 1000). On the other hand child mortality rate was 13.4 per 1000 for farmer, 23.8 per 1000 for worker/ laborer, 36.7 per 1000 for professional worker and 18.6 per 1000 others.

3.3.1.7 Infant and child mortality by electricity

Electricity was a basic part of nature and it was one of our most widely used forms of energy. Every day, we use electricity to do many functions to make our life easier and comfortable. In the developing countries, housing having electricity was in general indicates of higher socioeconomic status. Use of electricity was an indicator of better living and household environmental conditions also shows the risk of dying was less for those children who live in households with electricity. So households where electricity was available were associated with lower infant and child mortality.

Table 3.3.1.7 (a): Percentage distribution of Neonatal, Post-neonatal, Infant and Child mortality by electricity, BDHS 2007

Has electricity	Neonatal	Post-neonatal	Infant	Child	No. of Birth
No	100 (46.1%)	56 (58.9%)	156 (50.0%)	59 (55.7%)	2949 (53.1%)
Yes	102 (47.0%)	35 (36.8%)	137 (43.9%)	44 (41.5%)	2603 (46.9%)

The above table represented the electricity's impact on infant and child mortality. Neonatal mortality was 46.1% where the electricity facilities were not available but it was 47.0% where the electricity was available. Post-neonatal mortality was 58.9% where the electricity facilities were absent but it was 36.8% where the electricity was present. In total infant mortality was 50.0% which family had no electricity but this rate was 43.9% which family got available electricity facility. In the child mortality, it was 55.7% where the electricity facility was present but it was 44.5% where family had no electricity.

Table 3.3.1.7 (b): Estimated Neonatal, Post-neonatal, Infant and Child mortality rate by electricity.

Has electricity	Neonatal Mortality Rate	Post-neonatal Mortality Rate	Infant Mortality Rate	Child Mortality Rate
No	33.9	18.9	52.9	20.0
Yes	39.1	13.4	52.6	16.9

The above table represented the estimated neonatal, post-neonatal, infant and child mortality rate for electricity's impact. Neonatal mortality rate was 33.9 per 1000 where the electricity facilities were not available but it was 39.1 per 1000 where the electricity was available. Post-neonatal mortality rate was 18.9 per 1000 where the electricity facilities were not present but it was 13.4 per 1000 where the electricity was available. In total infant mortality rate was 52.9 per 1000 which family have no electricity but this rate was 52.6 per 1000 which family gets electricity facility. For the child mortality rate, it was 20.0 per 1000 where the electricity facilities were absent but it was 16.9 per 1000 where the electricity was present.

3.3.1.8 Infant and child mortality by religion

Most of the people of Bangladesh are Islamic minded. In Bangladesh population are mainly classified as Muslim, Hindu, Christian and others. Among the factors, Kabir and Mosleuddin (1986) identified that religion as one of the important covariates of infant mortality in Bangladesh. They founded that infant mortality to Muslim mothers was significantly lower than mortality to mothers belonging to other religions.

Table 3.3.1.8 (a): Percentage distribution of Neonatal, Post-neonatal, Infant and Child mortality by religion, BDHS 2007

Religion	Neonatal	Post-neonatal	Infant	Child	No. of Birth
Islam	203 (93.5%)	82 (86.3%)	285 (91.3%)	98 (92.5%)	5609 (91.2%)
Others	14 (6.5%)	13 (13.7%)	27 (8.7%)	8 (7.5%)	541 (8.8%)

The above table represented the religious impact on infant and child mortality. Neonatal mortality was 93.5% in the Muslim families where as only 6.5% in the non Muslim families. Post-neonatal mortality was 86.3% in the Muslim families where as it was only 13.7% in non Muslim families. In total infant mortality was 91.3 % which families were Muslims but this was 8.7% in the non Muslim families. In the child mortality, we saw that about 92.5% child mortality occurred in Muslim families. In this study, it was observed that around 90% infant and child mortality occurred in Muslim families because of Bangladesh is a Muslim based country.

Table 3.2.1.8 (b): Estimated Neonatal, Post-neonatal, Infant and Child mortality rate by religion.

Religion	Neonatal Mortality Rate	Post-neonatal Mortality Rate	Infant Mortality Rate	Child Mortality Rate
Islam	36.1	14.6	50.8	17.5
Others	25.8	24.0	49.9	14.8

The above table represented neonatal mortality rate was 36.1 per 1000 for Muslim families where as 25.8 per 1000 for non Muslim families. Post-neonatal mortality rate was 14.6 per 1,000 for Muslim families where as it was 24.0 per 1000 in non Muslim families. In total infant mortality rate was 50.8 per 1000 for Muslims and 49.9 per 1000 for non Muslim families. For child mortality rate, it was 17.5 per 1000 for Muslim families where as it was 14.8 per 1000 in non Muslim families.

3.3.1.9 Infant and child mortality by wealth status

Infant and child mortality was strongly associated with the economic status of a household. Infant and child mortality rates were highest where the wealth status was lowest. Several studies expressed that children risk of dying was reduced sharply in the rich families compared with poorest or poorer families. So there was a established observation that wealth index was inversely related to child's risk of dying. Well off families were generally associated with lower mortality risks.

Table 3.3.1.9 (a): Percentage distribution of Neonatal, Post-neonatal, Infant and Child mortality by wealth status, BDHS 2007

Wealth index	Neonatal	Post-neonatal	Infant	Child	No. of Birth
Poorest	39 (18.0%)	19 (20.0%)	58 (18.6%)	20 (18.9%)	1222 (19.9%)
Poorer	40 (18.4%)	20 (21.1%)	60 (19.2%)	18 (17.0%)	1282 (20.8%)
Middle	46 (21.2%)	22 (23.2%)	68 (21.8%)	27 (25.5%)	1153 (18.8%)
Richer	46 (21.2%)	15 (15.8%)	61 (19.6%)	24(22.6%)	1146 (18.6%)
Richest	46 (21.2%)	19 (20.0%)	65 (20.8%)	17 (16.0%)	1347 (21.9%)

The above table represented wealth status impact on infant and child mortality. From the analysis it was clear that neonatal mortality was 18.0% for poorest families, 18.4% for poorer families, 21.2% for middle class families and 42.4% for rich families. Post-neonatal mortality was 41.1% for poor families and it was about 20.0% for richest families. In total infant mortality was 21.8% for middle class families and about 40.4% for rich families. Again infant mortality was 18.6% for poorest families, 19.2% for poorer families, 21.8% for middle class families and about 40.4% for rich families. On the other child mortality was highest in middle class families but it was lowest in rich families than poor families. Child mortality was 18.9% for poorest families, 17.0% for poorer families, 25.5% for middle class families and 22.6% for richer families and 16.0% for richest families. In our study, the results indicated that wealth index status was inversely associated with infant and child mortality.

Table 3.3.1.9(b): Estimated Neonatal, Post-neonatal, Infant and Child mortality rate by wealth status.

Wealth index	Neonatal Mortality Rate	Post-neonatal Mortality Rate	Infant Mortality Rate	Child Mortality Rate
Poorest	31.9	15.5	47.5	16.3
Poorer	31.2	15.6	46.8	14.0
Middle	39.9	19.0	58.9	23.4
Richer	40.1	13.1	53.2	20.9
Richest	34.1	14.1	48.3	12.6

The above table represented the estimated neonatal, post-neonatal, infant and child mortality rate for wealth status. It was clear that neonatal mortality rate was highest (40.1 per 1000) in richer families and lowest (31.9 per 1000) for poorest families. Post-neonatal mortality rate was lowest (13.1 per 1000) for richer families. Infant mortality rate was highest (58.9 per 1000) for middle class families. Child mortality rate was lowest (12.6 per 1000) in richest families.

3.3.1.10 Infant and child mortality by housing condition

Household status was significant determinants of child survival, particularly household condition have significant influences on childhood mortality. As expected children's mortality was consistently higher at all ages for children who live in katcha house than those who live in pacca, half-pacca houses. To understand the housing condition we considered main floor material, main wall material and main roof material of the house.

Table 3.3.1.10 (a): Percentage distribution of Neonatal, Post-neonatal, Infant and Child mortality by housing condition, BDHS 2007

Housing condition	Neonatal	Post-neonatal	Infant	Child	No. of Birth
Main floor material					
Earth, sand	161 (79.7%)	76 (84.4%)	237 (81.2%)	84 (81.6%)	4392 (77.8%)
Cement and others	41 (20.3%)	14 (15.6%)	55 (18.8%)	19 (18.4%)	1155 (22.2%)
Main wall material					
Cane/palm/trunks/Dirt	41 (20.3%)	19 (20.9%)	60 (20.5%)	24 (23.3%)	1164 (21.0%)
Bamboo with mud	46 (22.8%)	19 (20.9%)	65 (22.2%)	23 (22.3%)	1068 (19.2%)
Tin	63 (31.2%)	26 (28.6%)	89 (30.4%)	30 (29.1%)	1936 (34.9%)
Cement and others	52 (25.7%)	27 (29.7%)	79 (27.0%)	26 (25.2%)	1382 (24.9%)
Main roof material					
Thatch /palm leaf	14 (6.9%)	5 (5.5%)	19 (6.5%)	6 (5.8%)	385 (6.9%)
Tin	165 (81.7%)	81 (89.0%)	246 (84.0%)	89 (86.4%)	4637 (83.5%)
Cement and Others	23 (11.4%)	5 (5.5%)	28 (9.6%)	8 (7.8%)	530 (9.6%)

The above table 3.3.1.10 (a) represented the housing materials impact on infant and child mortality. Post-neonatal mortality was 84.4% which house's main floor material was earth where this was only 15.6% which house's main floor material was cement and others. In total infant mortality was 81.2% which house's main floor material was

earth where this was only 18.8% which house's main floor material was cement. Again child mortality was 81.6% which house's main floor material was earth where this was 18.4% which house's main floor material was cement and others. So there was an association between child mortality and house's main floor material which was made by earth or sand.

Again 43.1% infant mortality occurs when house's main wall material was cane, palm, trunks, dirt and bamboo with mud, 31.2% infant mortality occurred where house's main wall material was tin, 27.0% infant mortality occurred where house's main wall material was cement and others. On the other hand 45.6% child mortality occurred when house's main wall material was cane, palm, trunks, dirt and bamboo with mud; 29.1% child mortality occurred when house's main wall material was tin and only 25.2% child mortality occurred when house's main wall material was cement.

Now infant mortality was 84.0% which house's main roof material was tin where this was only 9.6% which house's main roof material was cement and others. Child mortality was 86.4% which house's main roof material was tin where it was 7.8% which house's main roof material was cement and others. From the analysis we see that infant and child mortality was associated with house's main roof material which was made by tin.

Table 3.3.1.10(b): Estimated Neonatal, Post-neonatal, Infant and Child mortality rate by housing condition.

Housing condition	Neonatal Mortality Rate	Post-neonatal Mortality Rate	Infant Mortality Rate	Child Mortality Rate
Main floor material				
Earth, sand	36.7	17.3	53.9	19.1
Cement and others	35.5	12.1	47.6	16.4
Main wall material				
Cane/palm/trunks /Dirt	35.2	16.3	51.5	20.6
Bamboo with mud	43.1	17.7	60.8	21.5
Tin	32.5	13.4	45.9	15.5
Cement and others	37.6	19.5	57.1	18.8
Main roof material				
Thatch/palm leaf	36.4	12.9	49.4	15.6
Tin	35.6	17.5	53.1	19.2
Cement and Others	43.4	9.4	52.8	15.1

The above table 3.3.1.10(b) represented the estimated neonatal, post-neonatal, infant and child mortality rate for housing materials impact. From the table we saw that neonatal mortality rate was 36.7 per 1000 which house's main floor material was earth and 35.5 per 1000 which house's main floor material was cement and other. Again neonatal mortality was 43.1 per 1000 where the houses main wall material

was bamboo with mud and 36.4 per 1000 where the houses main roof material was thatch/palm leaf. Post-neonatal mortality rate was 17.3 per 1000 which house's main floor material was earth, 17.7 per 1000 where the houses main wall materials was bamboo with mud and 12.9 per 1000 where the houses main roof materials was thatch/palm leaf. In total infant mortality rate was 53.9 per 1000 which house's main floor material was earth, 60.8 per 1000 where the houses main wall materials was bamboo with mud and 49.4 per 1000 where the houses main roof materials was thatch/palm leaf. Again child mortality rate was 19.1 per 1000 which house's main floor material was earth, 21.5 per 1000 where the houses main wall materials was bamboo with mud and 15.1 per 1000 where the houses main roof materials was cement and others.

3.3.1.12 Infant and child mortality by the ownership of household goods

The survey collected information on the ownership of selected household goods, which used as an indicator of the economic status of a household. It was expected to have a strong effect on infant mortality and an even stronger effect on child mortality.

Table 3.3.1.11 (a): Percentage distribution of Neonatal, Post-neonatal, Infant and Child mortality by household goods, BDHS 2007

Household goods	Neonatal	Post-neonatal	Infant	Child	No. of Birth
Has radio					
No	161 (74.2%)	67 (70.5%)	228 (73.1%)	72 (67.9%)	4233 (76.2%)
Yes	41 (18.9%)	24 (25.3%)	65 (20.8%)	31 (29.2%)	1259 (23.8%)
Has television					
No	141 (65.0%)	69 (72.6%)	210 (67.3%)	70 (66.0%)	3805 (68.5%)
Yes	61 (28.1%)	22 (23.2%)	83 (26.6%)	33 (31.1%)	1746 (31.5%)

From the above table 3.3.1.11 (a), we observed that neonatal mortality was 74.2% where the household had no radio but it was 18.9% where household had radio. Post-neonatal mortality was 70.5% where household had no radio but it was 25.3% where household had radio. In total infant mortality was 73.1% which families had no radio but this was 20.8% which families had radio. In the child mortality, we see that child mortality was 67.9% where household had no radio on the other hand this was 29.2% which family had radio. Similarly television had the same influence on infant and child mortality like radio. 67.3% infant mortality occurred which family had no television but 26.6% infant mortality occurred which families had television. Again 66.0% child mortality occurred which family had no television but 31.1% child mortality occurred which families had television.

Table 3.3.1.11 (b): Estimated Neonatal, Post-neonatal, Infant and Child mortality rate by the ownership of household goods.

Household goods	Neonatal Mortality Rate	Post-neonatal Mortality Rate	Infant Mortality Rate	Child Mortality Rate
Has radio				
No	38.0	15.8	53.8	17.0
Yes	32.5	19.0	51.6	24.6
Has television				
No	37.1	18.1	59.9	18.3
Yes	34.9	12.6	47.5	18.9

From the above table 3.3.1.12(b), neonatal mortality rate was 38.0 per 1000 where the household had no radio but it was 32.5 per 1,000 where household had radio. Child mortality rate was 17.0 per 1000 where household had no radio but it was 24.6 per 1000 where household had radio. Similarly television had the same influence on infant and child mortality like radio. Infant mortality rate (59.9 per 1000) occurred which family had no television but infant mortality rate (47.5 per 1000) occurred which families had television.

3.3.1.12 Infant and Child mortality by sanitation

There was a substantial difference in mortality differentials by using various types of toilet facilities. Access to a flush or pit toilet was potentially a very important determinant of infant and child mortality in developing countries. Children in households that lack such access could have higher exposure than other children to diseases such as tetanus and digestive disorders (Puffer and Serrano 1978; United Nations 1985). An attached bathroom or toilet was an important household hygienic facility. The faecal contamination was another important factor that can cause children's morbidity and mortality. Infant and child mortality were lower for children who live in households that have attached bathrooms and toilets.

Table 3.3.1.12 (a): Percentage distribution of Neonatal, Post-neonatal, Infant and Child mortality by sanitation, BDHS 2007

Type of toilet facility	Neonatal	Post-neonatal	Infant	Child	No. of Birth
Toilet with Flush	56 (27.7%)	24 (26.4%)	80 (27.3%)	22 (21.4%)	1498 (27.0%)
Pit latrine	108 (53.5%)	42 (46.2%)	150 (51.2%)	65 (63.1%)	2956 (53.2%)
Hanging toilet and Other	38 (18.8%)	25 (27.5%)	63 (21.5%)	16 (15.5%)	1098 (19.8%)

In table 3.3.1.12 (a) we found type of toilet facilities impact on neonatal, post-neonatal, infant and child mortality rate. Neonatal mortality was 53.5% where sanitation system was pit latrine with or without slab; it was 27.7% where sanitation system has flush and it was 18.8% where the sanitation system had hanging toilet

and others. Infant mortality was 51.2% where sanitation system was pit latrine with or without slab; it was 26.4% where sanitation system had flush and it was 27.5% where the sanitation system had hanging toilet and others. On the other hand, child mortality was 63.1% where sanitation system had pit latrine with or without slab; it was 21.4% where sanitation system had flush and it was only 15.5% where the sanitation system had hanging toilet and others.

Table 3.3.1.12(b): Estimated Neonatal, Post-neonatal, Infant and Child mortality rate by sanitation.

Type of toilet facility	Neonatal Mortality Rate	Post-neonatal Mortality Rate	Infant Mortality Rate	Child Mortality Rate
Toilet with Flush	37.4	16.0	53.4	14.7
Pit latrine	36.5	14.2	50.7	21.9
Hanging toilet and Other	34.6	22.7	57.3	14.5

From table 3.3.1.12(b), estimated neonatal, post-neonatal, infant and child mortality rate for sanitation system. Neonatal mortality rate was highest (34.6 per 1000) where sanitation system was hanging toilet and others, it was 37.4 per 1000 where sanitation system was flush and it was 36.5 per 1000 where the sanitation system was pit latrine. Infant mortality rate was 50.7 per 1000 where sanitation system was pit latrine with or without slab; it was 53.4 per 1000 where sanitation system was flush and it was 57.3 per 1000 where the sanitation system was hanging toilet or latrine and others. On the other hand, child mortality rate was 21.9 per 1000 where sanitation system was pit latrine with or without slab; it was 14.7 per 1000 where sanitation system was flush and it was only 14.5 per 1000 where the sanitation system was hanging toilet or latrine and others.

3.3.1.13 Infant and child mortality by cooking fuel

For the purpose of this analysis electricity, gas, biogas, coal, charcoal, and kerosene are considered clean cooking fuels. Unclean fuels are wood and dung. The type of cooking fuel used in a household could affect infant and child mortality in two ways. First, if children spend a great deal of time where cooking takes place, the use of a cooking fuel that emits harmful smoke could elevate their risk of respiratory disease and hence mortality (Mishra and Retherford 1997). If this was an important hazard, then the effect of cooking fuel on infant and child mortality should be substantial, even after controlling for other socioeconomic variables. Secondly, the type of cooking fuel used may be an indicator of a household's general economic status. If

this was the case, then we would expect to see a strong relationship between the type of cooking fuel used and infant and child mortality.

Table 3.3.1.13 (a): Percentage distribution of Neonatal, Post-neonatal, Infant and Child mortality by cooking fuel, BDHS 2007.

Type of cooking fuel	Neonatal	Post-neonatal	Infant	Child	No. of Birth
Natural gas/Kerosene	13 (6.4%)	9 (9.9%)	22 (7.5%)	9 (8.7%)	552 (10.0%)
Wood	105 (52.0%)	47 (51.6%)	152 (51.9%)	55 (53.4%)	2900 (52.2%)
Agricultural crop	67 (33.2%)	23 (25.3%)	90 (30.7%)	27 (26.2%)	1679 (30.2%)
Animal dung and Others	17 (8.4%)	12 (13.2%)	29 (9.9%)	12 (11.7%)	421 (7.6%)

In table 3.3.1.13 (a) we found cooking fuel's impact on neonatal, post-neonatal, infant and child mortality. Infant mortality was 51.9% when the using cooking fuel was wood, it was 30.7% when the using cooking fuel was agricultural crop, it was 9.9% when using cooking fuel was animal dung and others and it was only 7.5% when using cooking fuel was natural gas/kerosene. On the other hand, child mortality was 53.4% when the using cooking fuel was wood, it was 26.2% when the using cooking fuel was agricultural crop, it was 11.7% when using cooking fuel was animal dung and others, it was only 8.7% when cooking fuel was natural gas/kerosene.

Table 3.3.1.13(b): Estimated Neonatal, Post-neonatal, Infant and Child mortality rate by cooking fuel.

Type of cooking fuel	Neonatal Mortality Rate	Post-neonatal Mortality Rate	Infant Mortality Rate	Child Mortality Rate
Natural gas/Kerosene	23.5	16.3	39.8	16.3
Wood	36.2	16.2	52.4	18.9
Agricultural crop	39.9	13.7	53.6	16.1
Animal dung and Others	40.3	28.5	68.8	28.5

In table 3.3.1.13(b) we found the estimated neonatal, post-neonatal, infant and child mortality for cooking fuel's impact. Neonatal mortality rate was 36.2 per 1000 when the using cooking fuel was wood, it was 39.9 per 1000 when the using cooking fuel was agricultural crop, it was 40.3 per 1000 when using cooking fuel was animal dung and others and only 23.5 per 1000 neonatal mortality rate exists when using cooking fuel was natural gas/ kerosene. Again Infant mortality rate was 39.8 per 1000 when the using cooking fuel was natural gas/kerosene, it was 52.4 per 1000 when the using cooking fuel was wood, it was 53.6 per 1000 when using cooking fuel was agricultural crop and 68.8 per 1000 when using cooking fuel was animal dung and others.

3.3.1.14 Infant and child mortality by source of drinking water

Source of drinking water was an influential indicator in the variation of infant and child mortality. One can easily understand that the pure sources of drinking water decrease infant and child mortality. Unsafe drinking water was considered to be a major cause for diarrhea among the children and every year many children die from diarrhea. Existing study was going on to investigate whether such relationship was associated or not.

Table 3.3.1.14 (a): Percentage distribution of Neonatal, Post-neonatal, Infant and Child mortality by source of drinking water, BDHS 2007

Source of drinking water	Neonatal	Post-neonatal	Infant	Child	No. of Birth
Pipe	11 (5.4%)	9 (9.9%)	20 (6.8%)	6 (5.8%)	371 (6.7%)
Tube well or borehole	184 (91.1%)	80 (87.9%)	264 (90.1%)	95 (92.2%)	4937 (89.0%)
Well and protected spring	1 (0.5%)	1 (1.1%)	2 (0.7%)	1 (1.0%)	83 (1.5%)
Rivers/ponds/others	6 (3.0%)	1 (1.1%)	7 (2.4%)	1 (1.0%)	156 (2.8%)

In table 3.3.1.14(a), we found neonatal, post-neonatal, infant and child mortality for the sources of drinking water. Neonatal mortality was 91.1% where the sources of drinking water was tube well or borehole, this was very low only 0.5% where sources of drinking water was well and protected spring, it was 5.4% where sources of drinking water was pipe and it was 3.0% where the sources of water was river, dam, lake, ponds, stream, canal or irrigation channel. In case of child mortality, this was 92.2% where sources of drinking water was tube well or borehole and it was only 5.8% where the sources of drinking water was pipe. So we find that infant and child mortality was less when the source of drinking water was tap. So it was found that tap water was safer and more hygienic than water from other sources.

Table 3.3.1.14(b): Estimated Neonatal, Post-neonatal, Infant and Child mortality rate by source of drinking water.

Source of drinking water	Neonatal Mortality Rate	Post-neonatal Mortality Rate	Infant Mortality Rate	Child Mortality Rate
Pipe	29.6	24.2	53.9	16.1
Tube well or borehole	37.3	16.2	53.5	19.2
Well and protected spring	12.0	12.0	24.1	12.0
River/ponds	38.5	6.4	44.8	6.4

In table 3.3.1.14(b), we found estimated neonatal, post-neonatal, infant and child mortality for the sources of drinking water. Neonatal mortality rate was highest 38.5 per 1000 when sources of drinking water was river, dam, lake, ponds, stream, canal or irrigation channel and neonatal mortality rate was lowest 12.0 per 1000 when

sources of drinking water was well and protected spring. Again post-neonatal mortality rate was lowest (12.0 per 1000) when the sources of drinking water was well and protected spring. In case of child mortality rate, this was 16.1 per 1000 where sources of drinking water was pipe, it was 19.2 per 1000 where sources of drinking water was tube well or borehole, it was 12.0 per 1000 where sources of drinking water was well and protected spring and it was only 6.4 per 1000 where the sources of drinking water was river, dam, lake, ponds, stream, canal or irrigation channel.

3.3.2 Demographic differentials in infant and child mortality

Different factors are found to influence infant and child mortality. Besides socioeconomic characteristics, demographic variables of child and mother have been found to affect mortality. Some of these were sex of child, mother's age at birth, women age at first marriage, birth order, breastfeeding, previous birth interval, mother's perception of the size of the child at birth, number of house hold members. This part of the study was going on to examine differentials in early childhood mortality by demographic characteristics of the child and mother.

3.3.2.1 Infant and child mortality by sex of child

Many investigations expressed that females had higher mortality than male at most ages except during the first month of life. In Bangladesh, it was also found that female mortality higher than male. Socially women in Bangladesh enjoy lower status than men. Daughters in this society traditionally cannot get equal opportunities than male. Contrary to the above findings Mitra (1979) indicated a consistent pattern of sex differentials in child mortality according to which female children are exposed to have lower risk of death than male children both in rural and urban areas infant and child mortality, that was mortality during the first year after birth was higher for male than for females in most available death for different countries and different historical properties.

Table 3.3.2.1 (a): Percentage distribution of Neonatal, Post-neonatal, Infant and Child mortality by sex of child, BDHS 2007

Sex of child	Neonatal	Post-neonatal	Infant	Child	No. of Birth
Male	118 (54.4%)	44 (46.3%)	162 (51.9%)	51 (48.1%)	2279 (50.1%)
Female	126 (45.6%)	51 (53.7%)	150 (48.1%)	55 (51.9%)	2269 (49.9%)

In the above table 3.3.2.1(a), we saw that male mortality was higher than female mortality in all cases. Neonatal mortality was 54.4% for male where as 45.6% for female child. Again infant mortality was 51.9% for male child where it was 48.1% for female child. Finally child mortality was 48.1% for male children where it was 51.9% for female children.

Table 3.3.2.1 (b): Estimated Neonatal, Post-neonatal, Infant and Child mortality rate by sex of child.

Sex of child	Neonatal Mortality Rate	Post-neonatal Mortality Rate	Infant Mortality Rate	Child Mortality Rate
Male	51.7	19.3	71.0	22.3
Female	55.5	22.4	66.1	24.2

The table 3.3.2.1(b) represented the estimated neonatal, post-neonatal, infant and child mortality rate for sex of child. Neonatal mortality rate was 51.7 per 1000 for male and 55.5 per 1000 for female child. Post-neonatal mortality rate was 19.3 per 1000 for male child and 22.4 per 1000 for female child. In total infant mortality rate was 71.0 per 1000 for male and 66.1 per 1000 for female child. Finally child mortality rate was 22.3 per 1000 for male child and 24.2 per 1000 for female child. So we saw that most of the cases male child mortality was lower than female child mortality.

3.3.2.2 Infant and child mortality by birth order number

Usually the relationship between birth order and mortality at early ages takes a U-shaped form. Mortality was high for first-born children and births of very high orders. Because of first-order births are more likely to have a difficult birth process than later births. For that reason it increases the risk of neonatal mortality. In addition, first-born children are likely to be raised by parents with limited skills and experience, possibly increasing the risk of infant and child mortality. Births of very high order may have mothers who are physically depleted at the time of conception and throughout pregnancy. Thus they are more likely than other children to suffer from conditions associated with high mortality risk such as fetal growth retardation and low birth weight. High-order births are born in those families where already have a number of young children who compete for resources and parental care. The effects of first order birth are likely to be strongest during the neonatal period, while the effects of high-order birth are likely to be strongest at older ages.

Table 3.3.2.2 (a): Percentage distribution of Neonatal, Post-neonatal, Infant and Child mortality by birth order number, BDHS 2007.

Birth order number	Neonatal	Post-neonatal	Infant	Child	No. of Birth
1	54 (24.9%)	18 (18.9%)	72 (23.1%)	19 (17.9%)	1543 (25.2%)
2	28 (12.9%)	11 (11.6%)	39 (12.5%)	19 (17.9%)	1772 (28.9%)
3	32 (14.7%)	16 (16.8%)	48 (15.4%)	14 (13.2%)	1135 (18.5%)
4	32 (14.7%)	14 (14.7%)	46 (14.7%)	24 (22.6%)	728 (11.9%)
5+	71 (32.7%)	36 (37.9%)	107 (34.3%)	30 (28.3%)	955 (15.5%)

In table 3.3.2.2 (a) we found neonatal, post-neonatal, infant and child mortality with respect to birth order. Neonatal mortality was 24.9% for first birth order, 12.9% for second birth order, 14.7% for third birth order, 14.7% for fourth birth order and 32.7% for fifth or fifth plus birth order number. Post-neonatal mortality was 18.9% when birth order number was first; 11.6% when birth order number was second; 16.8% when birth order number was third; 14.7% when birth order number was fourth and 37.3% when birth order number was fifth and above. In total infant mortality was about 23.1% for first order birth. On the other hand child mortality was 17.9% when birth order number was first; 17.9% when birth order number was second; 13.2% when birth order number was third; 22.6% when birth order number was fourth and it was 28.3% when birth order was fifth and above.

Table 3.3.2.2 (b): Estimated Neonatal, Post-neonatal, Infant and Child mortality rate by birth order number.

Birth order number	Neonatal Mortality Rate	Post-neonatal Mortality Rate	Infant Mortality Rate	Child Mortality Rate
1	34.9	11.7	46.7	12.3
2	15.8	6.2	22.0	10.7
3	28.1	14.1	42.2	12.3
4	43.9	19.2	63.2	32.9
5+	74.3	37.6	112.0	31.4

In table 3.3.2.2(b), we found estimated neonatal, post-neonatal, infant and child mortality with respect to birth order. Neonatal mortality rate was 34.9 per 1000 for first birth order, 15.8 per 1000 for second birth order, 28.1 per 1000 for third birth order, 43.9 per 1000 for fourth birth order and 74.3 per 1000 for fifth and above birth order number. Infant mortality rate was 46.7 per 1000 when birth order number was first; 22.0 per 1000 when birth order number was second; 42.2 per 1000 when birth order number was third; 63.2 per 1000 when birth order number was fourth and 112.0 per 1000 when birth order number was fifth and above. Again child mortality rate was 12.3 per 1000 for first birth order, 10.7 per 1000 for second birth order, 12.3 per 1000 for third birth order, 32.9 per 1000 for fourth birth order and 31.4 per 1000 for fifth or fifth plus birth order number.

3.3.2.3 Infant and child mortality by previous birth interval

There are different effects of previous birth interval on neonatal mortality which was large and statistically significant in the developing countries. Short birth intervals are associated with an increased risk of dying. Retherford and others (1989) observed an association between short birth interval and increase mortality even after controlling for other demographic and socioeconomic variables. In Bangladesh, neonatal mortality was very high for children born within 24 months of the previous birth as for children born after a longer interval. The effect of previous birth interval was especially high for neonatal mortality. The effects of previous birth interval on post-neonatal mortality are similar.

Table 3.3.2.3 (a): Percentage distribution of Neonatal, Post-neonatal, Infant and Child mortality by previous birth interval, BDHS 2007

Previous birth interval	Neonatal	Post-neonatal	Infant	Child	No. of Birth
< 24 months	47 (28.8%)	26 (33.8%)	73 (30.4%)	24 (27.6%)	1043 (22.8%)
24-60 months	77 (47.2%)	37 (48.1%)	114 (47.5%)	52 (59.8%)	2580 (56.3%)
60+ months	39 (23.9%)	14 (18.2%)	53 (22.1%)	11 (12.6%)	961 (20.9%)

In table 3.3.2.3 (a) we found previous birth interval's impact on neonatal, post-neonatal, infant and child mortality. Neonatal mortality rate was significantly very high (47.2%) when previous birth interval lies between two to five years, it was 28.8% when previous birth interval was below two years and it was 23.9% when previous birth interval was above five years. Infant mortality for previous birth interval was high (47.5%) in two to five years group due to neonatal and post-neonatal mortality. From this analysis, it was indicated that 59.8% child mortality occurs when previous birth interval lies between 2 to 5 years and only 12.6% child mortality occurs when previous birth interval was more than five years.

Table 3.3.2.3 (b): Estimated Neonatal, Post-neonatal, Infant and Child mortality rate by previous birth interval.

Previous birth interval	Neonatal Mortality Rate	Post-neonatal Mortality Rate	Infant Mortality Rate	Child Mortality Rate
< 24 months	45.0	24.9	69.9	23.0
24-60 months	29.8	14.3	44.2	20.1
60+ months	40.1	14.6	55.2	11.4

The table 3.3.2.3(b) represented the estimated neonatal, post-neonatal, infant and child mortality rate for previous birth interval. Neonatal mortality rate was 45.0 per 1000 for below 24 months previous birth interval, 29.8 per 1000 for 24 to 60 months

previous birth interval and 40.1 per 1000 for above 60 months previous birth interval. Infant mortality for previous birth interval was high due to neonatal mortality. From the analysis it was observed that 23.0 per 1000 child mortality rate occurs when previous birth interval was below 24 months, 20.1 per 1000 child mortality rate occurs when previous birth interval lies between 24 to 60 months and 11.4 per 1000 child mortality rate occurs when previous birth interval more than 5 years.

3.3.2.4 Infant and child mortality by breastfeeding

Breastfeeding statistics and child mortality rates were good indicators of the status of child health. Breastfeeding was nearly universal. About 98 percent of infants are still breastfed at the end of their first year of life. Even though the level of breastfeeding was high, supplementation begins at an early age with water and other liquids. In Bangladesh, infant and child nutrition condition improved due to the promotion of breastfeeding programs. Breastfeeding could potentially be a confounding factor since it affects both child survival and the length of the birth interval. Children with short preceding birth interval are less likely than others to have ever been breastfed (Retherford, 1989). Only 50 percent of 0–3 month-old infants and 25 percent of 4–6 month-old infants are exclusively breastfed. Among infants age 10–12 months, lack of supplementation was a problem; 20 percent receive only breast milk (Mitra *et al.*, 1997). It was well known that the practice of breastfeeding can greatly reduce the morbidity and mortality due to these causes. In poor hygienic environments, bacteria, parasites and viruses can easily be transmitted to infants through the process of feeding by bottle. Latter sometimes child infected repeated episodes of infections, particularly diarrhea, may leave a child weak and undernourished. Breastfeeding also an indirect effect on the postpartum fecundity of mothers (Kennedy, 1990).

Table 3.3.2.4 (a): Percentage distribution of Neonatal, Post-neonatal, Infant and Child mortality by breastfeeding, BDHS 2007

Months of breastfeeding	Neonatal	Post-neonatal	Infant	Child	No. of Birth
0 month	40 (39.2%)	1 (2.9%)	41 (29.9%)	0 (0.0%)	76 (1.2%)
1-12 months	12 (11.8%)	31 (88.6%)	43 (31.4%)	3 (20.0%)	277 (4.5%)
12-24 months	0 (0.0%)	1 (2.9%)	1 (0.7%)	11 (73.3%)	675 (11.0%)
24+ months	50 (49.0%)	2 (5.7%)	52 (38.0%)	1 (6.7%)	5122 (83.3%)

In table 3.3.2.4 (a) we found breastfeeding impact on neonatal, post-neonatal, infant and child mortality. Neonatal mortality was 39.2% when breastfeeding period was

zero months and it was 49.0% when breastfeeding period was more than 24 months or 2 years. Post-neonatal mortality was 88.6% when breastfeeding period lies between 1 to 12 months and it was 5.7% when breastfeeding period was more than 24 months or 2 years. In total infant mortality was 29.9% where breastfeeding period was zero months and it was 38.0% when breastfeeding period was more than 24 months or 2 years. On the other hand child mortality was 73.3% when breastfeeding period lies between 12 to 24 months and it was 6.7% where breastfeeding period was more than 24 months or 2 years.

Table 3.3.2.4 (b): Estimated Neonatal, Post-neonatal, Infant and Child mortality rate by breastfeeding.

Months of breastfeeding	Neonatal Mortality Rate	Post-neonatal Mortality Rate	Infant Mortality Rate	Child Mortality Rate
0 month	526.3	13.1	539.4	0
1-12 months	43.3	111.9	155.2	10.8
12-24 months	0	1.4	1.5	16.3
24+ months	9.7	0.4	10.1	0.0

The table 3.3.2.4(b) represented estimated neonatal, post-neonatal, infant and child mortality for breastfeeding. Neonatal mortality rate was 526.3 per 1000 when breastfeeding period was zero months and it was nil when breastfeeding period was between 12 to 24 months. Neonatal mortality rate was zero because there were no neonatal deaths in 12-24 months group. On the other hand infant mortality rate was 539.4 per 1000 when breastfeeding period was zero months. Again child mortality rate 10.8 per 1000 when breastfeeding period lies between 1 to 12 months and it was 16.3 per 1000 where breastfeeding period was 12 to 24 months. Child mortality rate was nil when breastfeeding period was 0 month and more than 24 months. Child mortality rate was zero because there was no child death in that group.

3.3.2.5 Infant and child mortality by mother's age at first birth

Children born to mothers under 20 or over 30 years old are likely to have elevated risks of mortality. Very young mothers may experience difficult pregnancies and deliveries because of their physical immaturity. They are also likely to have limited knowledge and confidence in caring for infants and young children. Women over 30 years may also experience age-related problems during pregnancy and delivery. Thus we expect a U-shaped relationship between mother's age at first birth and infant and child mortality.

Table 3.3.2.5 (a): Percentage distribution of Neonatal, Post-neonatal, Infant and Child mortality by mother's age at first birth, BDHS 2007

Mother's age at first birth	Neonatal	Post-neonatal	Infant	Child	No. of Birth
<15	53 (24.4%)	19 (20.0%)	72 (23.1%)	36 (34.0%)	1338 (21.7%)
15-19	112 (51.6%)	58 (61.1%)	170 (54.5%)	49 (46.2%)	3275 (53.2%)
19-24	43 (19.8%)	14 (14.7%)	57 (18.3%)	18 (17.0%)	1287 (20.9%)
24+	9 (4.1%)	4 (4.2%)	13 (4.2%)	3 (2.8%)	255 (4.2%)

In table 3.3.2.5 (a) we found neonatal, post-neonatal, infant and child mortality with respect to mother age at first birth. Neonatal mortality was 51.6% when mother age lies between 15 to 19 years and it was only 4.1% when mother age more than 24 years. Post-neonatal mortality rate was 20.0% when mother age less than 15 years and it was only 4.2% when mother age more than 24 years. In total infant mortality was about 54.5% when mother age lies between 15 to 19 years and it was 18.3% when mother age lies between 19 to 24 years. Again child mortality was 34.0% when mother age was below 15 years, it was 46.2% when mother age lies between 15 to 19 years, it was 17.0% when mother age lies between 19 to 24 years and it was 2.8% when mother's age was more than 24 years.

Table 3.3.2.5 (b): Estimated Neonatal, Post-neonatal, Infant and Child mortality rate by mother's age at first birth.

Mother's age at first birth	Neonatal Mortality Rate	Post-neonatal Mortality Rate	Infant Mortality Rate	Child Mortality Rate
<15	39.6	14.2	53.8	26.9
15-19	34.2	17.7	51.9	14.9
19-24	33.4	10.8	44.3	13.9
24+	35.2	15.6	50.9	11.7

The table 3.3.2.5 (b) represented estimated neonatal, post-neonatal, infant and child mortality with respect to mother age at first birth. Neonatal mortality rate was 39.6 per 1000 when mother age was below 15 years, it was 34.2 per 1000 when mother age lies between 15 to 19 years, it was 33.4 per 1000 when mother age lies between 19 to 24 years and it was 35.2 when mother's age was more than 24 years. Post-neonatal mortality rate was 14.2 per 1000 when mother age was below 15 years, it was 17.7 per 1000 when mother age lies between 15 to 19 years, it was 10.8 per 1000 when mother age lies between 19 to 24 years and it was 15.6 when mother's age was more than 24 years. Again child mortality rate was 26.9 per 1000 when mother age was below 15 years, it was 14.9 per 1000 when mother age lies between

15 to 19 years, it was 13.9 per 1000 when mother age lies between 19 to 24 years and it was 11.7 when mother's age was more than 24 years.

3.3.2.6 Infant and child mortality by woman age at first marriage

In Bangladesh, fertility rate was very high because of marriage was taken place at comparatively early ages, as compared with the people who marry at late stage. It was well known fact that where age at marriage was low, fertility was high there. So age at marriage was influential factors for infant and child mortality. At present mortality was gradually decreasing because of the age at marriage was increasing. In rural areas, infant and child mortality was quite high for all categories of age at marriage groups compared to urban areas.

Table 3.3.2.6 (a): Percentage distribution of Neonatal, Post-neonatal, Infant and Child mortality by woman age at first marriage, BDHS 2007

Age at first marriage	Neonatal	Post-neonatal	Infant	Child	No. of Birth
<15	134 (61.8%)	63 (66.3%)	197 (63.1%)	75 (70.8%)	3409 (55.5%)
15-19	70 (32.3%)	28 (29.5%)	98 (31.4%)	22 (20.8%)	2214 (36.0%)
19-24	13 (6.0%)	4 (4.2%)	17 (5.4%)	8 (7.5%)	442 (7.2%)
24+	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (0.9%)	77 (1.3%)

In table 3.3.2.6 (a) we find women age at first marriage impact on neonatal, post-neonatal, infant and child mortality. Neonatal mortality was 61.8% when women age at first marriage was below 15, it was 32.3% when women age at first marriage between 15 to 19 years, it was 6.0% when women age at first marriage was between 19 to 24 years, it was nil when women age at first marriage was 24 and above. Post-neonatal mortality was 66.3% when women age at first marriage was below 15; it was 29.5% when women age at first marriage lies between 15 to 19 years, only 4.2% when women age at first marriage was between 19 to 24 years. In total infant mortality was 63.1% when women age at first marriage was below 15, it was 31.4% when women age at first marriage lies between 15 to 19 years, only 5.4% when women age at first marriage was between 19 to 24 years and it was nil when women age at first marriage was more than 24 years. On the other hand child mortality was 70.8% when women age at first marriage was below 15, it was 20.8% when women age at first marriage lies between 15 to 19 years and 7.5% when women age at first marriage lies between 19 to 24 years and it was 0.9% when age at first marriage was more than 24 years. In women age at first marriage was more than 24 years group

neonatal, post-neonatal and infant mortality was zero because there was no mortality found this age group.

Table 3.3.2.6 (b): Estimated Neonatal, Post-neonatal, Infant and Child mortality rate by age at first marriage.

Age at first marriage	Neonatal Mortality Rate	Post-neonatal Mortality Rate	Infant Mortality Rate	Child Mortality Rate
<15	39.3	18.4	57.5	22.0
15-19	31.6	12.6	44.2	9.9
19-24	29.4	9.0	38.5	18.1
24+	0	0	0	12.9

The table 3.3.2.6 (b) represented estimated neonatal, post-neonatal, infant and child mortality rate for age at first marriage. Neonatal mortality rate was 39.3 per 1000 when women age at first marriage was below 15, it was 31.6 per 1000 when women age at first marriage between 15 to 19 years, it was 29.4 per 1000 when women age at first marriage between 19 to 24 years and it was nil when women age at first marriage was more than 24 years. Again child mortality rate was 22.0 per 1000 when women age at first marriage was below 15, it was 9.9 per 1000 when women age at first marriage between 15 to 19 years, it was 18.1 per 1000 when women age at first marriage between 19 to 24 years and it was 12.9 per 1000 when women age at first marriage was more than 24 years.

3.3.2.7 Infant and child mortality by household size

Household size was an important factor for infant and child mortality. A mother can give excess time to her baby if the household size was small or members of household are not large.

Table 3.3.2.7 (a): Percentage distribution of Neonatal, Post-neonatal, Infant and Child mortality by household size, BDHS 2007

Household size (no. of members)	Neonatal	Post-neonatal	Infant	Child	No. of Birth
<4	103 (47.5%)	42 (44.2%)	145 (46.5%)	53 (50.0%)	1737 (28.2%)
4-6	61 (28.1%)	27 (28.4%)	88 (28.2%)	26 (24.5%)	2061 (33.5%)
6+	53 (24.4%)	26 (27.4%)	79 (25.3%)	27 (25.5%)	2352 (38.3%)

In table 3.3.2.7(a) we found the infant and child mortality for number of household members. Infant mortality was 47.5% when the number of household members was below 4, it was 28.1% when the number of household members was 4 to 6 and it was 24.4% which family has more than 6 members. On the other hand, child mortality was 50.0% when the number of household members was less than four, it

was 24.5% when the number of household members was four to six and it was 25.5% which family has more than six members.

Table 3.3.2.7 (b): Estimated Neonatal, Post-neonatal, Infant and Child mortality rate by household size.

Household size (no. of members)	Neonatal Mortality Rate	Post-neonatal Mortality Rate	Infant Mortality Rate	Child Mortality Rate
<4	59.3	24.1	83.4	30.5
4-6	29.6	13.1	42.7	12.6
6+	22.5	11.1	33.6	11.5

The table 3.3.2.7(b) represented estimated neonatal, post-neonatal, infant and child mortality for number of household members. Neonatal mortality rate was 59.3 per 1000 when the number of household members were below 4, it was 29.6 per 1000 when the number of household members were 4 to 6 and it was 22.5 per 1000 which family have more than 6 members. Post-neonatal mortality rate was lowest (11.1 per 1000) when numbers of household members was more than six. Infant mortality rate was highest (83.4 per 1000) when household members were 4 to 6. Again child mortality rate was 30.5 per 1000 when the number of household members were below 4, it was 12.6 per 1000 when the number of household members were 4 to 6 and it was 11.5 per 1000 which family have more than 6 members.

3.3.3 Maternal Health Care Service Utilization differentials in infant and child mortality

Maternal health care service utilization programs should provide families that have experienced an infant or child death with intensified maternal and child health support to avoid further mortality. Such support should include basic antenatal care, guidance on home care of well babies, immunizations, and treatment of common childhood illnesses such as diarrhoea and respiratory infections. This section presents the various issues of importance to mother and child health care services: antenatal care, TT during pregnancy, place of delivery, immunization, and their treatment. Though maternal health care service utilization variables may have direct influence on neonatal mortality but it has strong indirect influence in reducing post-neonatal and child mortality. Because the mothers who sought antenatal care during pregnancy, they are well aware about utilization of existing health facilities and they can properly utilize such facilities when needed for their child. For that reasons, it was very much needed to examine the differentials of infant and child mortality on maternal health care service utilization variables.

3.3.3.1 Infant and child mortality by place of delivery

It was important to increase the proportion of births delivered in a safe and clean environment and under the supervision of health professionals because of proper medical attention and hygienic condition during delivery can reduce the risk of complications and infections that may cause death of the mother and the baby. For that reason an important element in reducing health risks for mothers and children was to increase the proportion of babies are delivered in hospital or clinic. In Bangladesh, it was widely prevalent practice of traditional delivery at home. Neonatal mortality was high for those children whose mothers were delivered at home. Possible reason was that the reverse causation effects where the mass practice of home delivery, women are rushed to institutional setting for delivery. As a result of complications arising that cannot be managed by the traditional birth attendants or relatives. Such type of unnecessary delays leads to create more complications in delivery resulting in neonatal deaths.

Table 3.3.3.1 (a): Percentage distribution of Neonatal, Post-neonatal, Infant and Child mortality by place of delivery, BDHS 2007

Place of delivery	Neonatal	Post-neonatal	Infant	Child	No. of Birth
Home	78 (76.5%)	32 (94.1%)	110 (80.9%)	11 (73.3%)	5057 (82.2%)
Any medical facility	24 (23.5%)	2 (5.9%)	26 (19.1%)	4 (26.7%)	1090 (17.3%)

In table 3.3.3.1 (a) we found the infant and child mortality for the place of delivery. Neonatal mortality was 76.5% where the place of delivery was respondent's home; it was 23.5% where the place of delivery with any medical facilities. Post-neonatal mortality was 94.1% where the place of delivery with medical facilities. Again infant mortality was 80.9% where the place of delivery was respondent's home; it was 19.1% where the place of delivery with medical facilities such as government hospital, private hospital or clinic. On the other hand, child mortality rate was 73.3% where the place of delivery was respondent's home; it was 26.7% where the place of delivery gets medical or institutional support.

Table 3.3.3.1 (b): Estimated Neonatal, Post-neonatal, Infant and Child mortality rate by place of delivery.

Place of delivery	Neonatal Mortality Rate	Post-neonatal Mortality Rate	Infant Mortality Rate	Child Mortality Rate
Home	15.4	6.3	21.7	2.1
Any medical facility	22.0	1.8	23.8	3.6

In table 3.3.3.1(b), we found estimated neonatal, post-neonatal, infant and child mortality for the place of delivery. Infant mortality rate was 21.7 per 1000 where the

place of delivery was at home; it was 23.8 per 1000 where the place of delivery was any hospital or medical center. On the other hand, child mortality rate was 2.1 per 1000 where the place of delivery was at home, it was 3.6 per 1000 where the place of delivery was any hospital or medical center.

3.3.3.2 Infant and child mortality by antenatal check

The World Health Organization (WHO) recommends that pregnant women make at least four antenatal care visits, beginning during the first trimester of the pregnancy. One study revealed that urban women are two and a half times more likely than rural women to have made four or more antenatal visits. On average, women residing in urban areas make about one more visit than rural women. The place where a woman receives antenatal care varies according to mother's age at birth and the child's birth order. Women under age 20 at the time of birth are more likely to receive antenatal checking from the public sector compared with other women. Moreover, women in the lower wealth condition are more likely to seek antenatal checking from the public sector than the private sectors.

Table 3.3.3.2 (a): Percentage distribution of Neonatal, Post-neonatal, Infant and Child mortality by antenatal check, BDHS 2007

Timing of antenatal check	Neonatal	Post-neonatal	Infant	Child	No. of Birth
< 3	17 (29.3%)	8 (57.1%)	25 (34.7%)	6 (66.7%)	1572 (42.0%)
3-5	22 (37.9%)	2 (14.3%)	24 (33.3%)	3 (33.3%)	1159 (30.0%)
5+	19 (32.8%)	4 (28.6%)	23 (31.9%)	0 (0.0%)	1015 (28.0%)

The above table 3.3.3.2(a) shows that antenatal visits plays significant role on infant and child mortality. Neonatal mortality was 29.3% when timing of antenatal check was below three, it was 37.9% when timing of antenatal check was lies 3 to 5 and it was 32.8% when timing of antenatal check was more than 5. Post-neonatal mortality was highest (57.1%) when timing of antenatal check was less than 3. Infant mortality was 34.7% when timing of antenatal check was below three and no child mortality occurs when timing of antenatal check were more than five.

Table 3.3.3.2 (b): Estimated Neonatal, Post-neonatal, Infant and Child mortality rate by antenatal check.

Timing of antenatal check	Neonatal Mortality Rate	Post-neonatal Mortality Rate	Infant Mortality Rate	Child Mortality Rate
< 3	10.8	5.1	15.9	3.8
3-5	18.9	1.7	20.7	2.5
5+	18.7	3.9	22.6	0

The above table 3.3.3.2 (b) shows estimated neonatal, post-neonatal, infant and child mortality rate for the antenatal visits. Neonatal mortality rate was 10.8 per 1000 when antenatal checking was less than 3; it was 18.9 per 1000 when antenatal checking was lies between 3 to 5 times and it was 18.7 per 1000 when antenatal checking was more than 5 times. Infant mortality rate was 15.9 per 1000 when timing of antenatal check was below three and child mortality rate was nil when timing of antenatal check were more than five. Because there was no child mortality occurred in 5+ antenatal checking groups.

3.3.3.3 Infant and child mortality by tetanus injections before birth

Bangladesh was still a long way from full immunization coverage for every child, with vaccination rates standing at fewer than two in every three children. Because of people in the remotest areas, accessing vaccines can be difficult. After a five year absence, polio has returned to Bangladesh. Diseases such as measles still leave children disabled. Bangladesh was also at the verge of neonatal tetanus elimination with only 1.2 neonatal deaths per 1000 live births (target was less than 1 per 1000 live births).

Table 3.3.3.3 (a): Percentage distribution of Neonatal, Post-neonatal, Infant and Child mortality by tetanus injections before birth, BDHS 2007

Tetanus injections before birth	Neonatal	Post-neonatal	Infant	Child	No. of Birth
1	29 (11.3%)	10 (14.3%)	39 (12.0%)	3 (8.6%)	894 (19.7%)
2	38 (14.8%)	8 (11.4%)	46 (14.1%)	4 (11.4%)	1315 (28.9%)
3+	189 (73.8%)	52 (74.3%)	241 (73.9%)	28 (80.0%)	2339 (51.4%)

In table 3.3.3.3 (a) we found the infant and child mortality for tetanus injections before birth. Infant mortality was 12.0% where mother takes 1 dose of tetanus injections before birth, it was 11.4% where mother took 2 doses of tetanus injection and it was 74.3% where mother took more than 3 doses of tetanus injection. Again it was observed that 80% child mortality occurs where mother complete more than 3 doses of tetanus injection before birth.

Table 3.3.3.3 (b): Estimated Neonatal, Post-neonatal, Infant and Child mortality rate by tetanus injections before birth.

Tetanus injections before birth	Neonatal Mortality Rate	Post-neonatal Mortality Rate	Infant Mortality Rate	Child Mortality Rate
1	32.4	11.2	43.6	3.3
2	28.9	6.1	34.9	3.0
3+	80.8	22.2	103.0	12.0

The above table 3.3.3.3(b) shows estimated neonatal, post-neonatal, infant and child mortality rate for tetanus injections before birth. Neonatal mortality rate was 32.4 per 1000 when mother takes first dose of tetanus injection before birth, it was 28.9 per 1000 when mother took two doses of tetanus injection before birth and it was 80.8 per 1000 when mother took more than three doses of tetanus injection before birth. Post- Neonatal mortality rate was 11.2 per 1000 when mother takes first dose of tetanus injection before birth, it was 6.1 per 1000 when mother took two doses of tetanus injection before birth and it was 22.2 per 1000 when mother took more than three doses of tetanus injection before birth.

3.3.3.4 Infant and child mortality by tetanus injections during pregnancy

In developing countries where a high proportion of delivery were conducted at home or in places where unhygienic condition prevail, tetanus injection was a leading cause of neonatal deaths. Tetanus injections are given to pregnant women to prevent neonatal tetanus. A total of five doses give life time protection. It was remembered that a woman may require only one or no tetanus injection during pregnancy if she has been vaccinated before.

Table 3.3.3.4 (a): Percentage distribution of Neonatal, Post-neonatal, Infant and Child mortality by tetanus injections during pregnancy, BDHS 2007

Tetanus injections during pregnancy	Neonatal	Post-neonatal	Infant	Child	No. of Birth
1-3	85 (83.3%)	29 (82.9%)	114 (83.2%)	13 (86.7%)	2568 (75.9%)
3-5	12 (11.8%)	2 (5.7%)	14 (10.2%)	0 (0.0%)	388 (11.5%)
5+	5 (4.9%)	4 (11.4%)	9 (6.6%)	2 (13.3%)	427 (12.6%)

In table 3.3.3.4(a) we found the infant and child mortality for tetanus injections before birth. Neonatal mortality was 83.3% when mother take 1-3 doses of tetanus injections during pregnancy, it was 11.8% when mother took 3 to 5 doses of tetanus injection during pregnancy and it was 4.9% when mother took five or more than five doses of tetanus injection during pregnancy. Post-neonatal mortality was 82.9% when mother take 1-3 doses of tetanus injections during pregnancy, it was 5.7% when mother took 3 to 5 doses of tetanus injection during pregnancy and it was 11.4% when mother took five or more than five doses of tetanus injection during pregnancy. Again infant mortality was 83.2% when mother take 1-3 doses of tetanus injections during pregnancy. For child mortality, it was 86.7% where mother took 1-3

doses of tetanus injection during pregnancy; it was 13.3% when mother took more than five doses of tetanus injection during pregnancy.

Table 3.3.3.4 (b): Estimated Neonatal, Post-neonatal, Infant and Child mortality rate by tetanus injections during pregnancy.

Tetanus injections during pregnancy	Neonatal Mortality Rate	Post-neonatal Mortality Rate	Infant Mortality Rate	Child Mortality Rate
1-3	33.1	11.3	44.4	5.1
3-5	30.9	5.2	36.1	0
5+	11.7	9.4	21.1	4.7

The above table 3.3.3.4(b) shows estimated neonatal, post-neonatal, infant and child mortality rate for tetanus injections during pregnancy. Infant mortality rate was 44.4 per 1000 when tetanus injections during pregnancy lies between 1 to 3 times, it was 30.9 per 1000 when tetanus injections during pregnancy lies between 3 to 5 times and it was 11.7 per 1,000 when tetanus injections during pregnancy was more than five doses.

3.3.3.5 Infant and child mortality by mother's exposure to mass media

Other things being equal, a mother's exposure to radio and television may reduce the mortality of her children because women who are exposed to mass media are likely to have access to information on health-care services and ways of enhancing maternal and child health. Mother's exposure to mass media may also act as an indicator of the economic status of the household. In this analysis, a woman was considered to be exposed to mass media if she listens to radio or watches television at least once a week.

Table 3.3.3.5 (a): Percentage distribution of Neonatal, Post-neonatal, Infant and Child mortality by mother's exposure to mass media, BDHS 2007

Mother's exposure to mass media	Neonatal	Post-neonatal	Infant	Child	No. of Birth
Read newspaper or magazine					
No	74 (77.9%)	31 (83.8%)	105 (79.5%)	22 (81.5%)	2203 (76.7%)
Yes	21 (22.1%)	6 (16.2%)	27 (20.5%)	5 (18.5%)	671 (23.3%)
Listen to the radio					
No	170 (78.3%)	74 (77.9%)	244 (78.2%)	84 (79.2%)	3513 (77.2%)
Yes	47 (21.7%)	21 (22.1%)	68 (21.8%)	22 (20.8%)	1035 (22.8%)
Watch television					
No	107 (49.3%)	55 (57.9%)	162 (51.9%)	57 (53.8%)	2220 (48.8%)
Yes	110 (50.7%)	40 (42.1%)	150 (48.1%)	49 (46.2%)	2328 (51.2%)

Table 3.3.3.5 (a) showed that media exposure plays an important role to reduce infant and child mortality. Infant mortality was 79.5% when mother do not read newspaper or magazine but it was 20.5% when mother read newspaper or magazine. On the other hand child mortality was 81.8% when mother do not read

newspaper or magazine but it was 18.5% when mother read newspaper or magazine. Again infant mortality was 78.2% when mother do not listen radio but 21.8% when mother listen radio. On the other hand child mortality rate was 79.2% when mother do not listen radio but it was 20.8% when mother listen radio. Finally, infant mortality was 51.9% when mother do not watching television but it was 48.1% when mother watching television. On the other hand child mortality was 53.8% when mother do not watching television but it was 46.2% when mother watching television.

Table 3.3.3.5 (b): Estimated Neonatal, Post-neonatal, Infant and Child mortality rate by mother's exposure to mass media

Mother's exposure to mass media	Neonatal Mortality Rate	Post-neonatal Mortality Rate	Infant Mortality Rate	Child Mortality Rate
Read newspaper or magazine				
No	33.6	14.1	47.7	9.9
Yes	31.3	8.9	40.2	7.5
Listen to the radio				
No	48.4	21.0	69.4	23.9
Yes	45.4	20.2	65.7	21.2
Watch television				
No	48.2	24.8	72.9	25.6
Yes	47.3	17.2	64.4	21.1

Table 3.3.3.5(b) shows estimated neonatal, post-neonatal, infant and child mortality for mother's exposure to mass media. Infant mortality rate was 47.7 per 1000 when mother did not read newspaper or magazine but 40.2 per 1000 when mother read newspaper or magazine. Again infant mortality rate was 69.4 per 1000 when mother did not listen radio but 65.7 per 1000 when mother listen radio. Finally infant mortality rate was 72.9 per 1000 when mother did not watching television but it was 64.4 per 1000 when mother watching television. On the other hand, child mortality rate was 25.6 per 1000 when mother did not watching television but it was 21.1 per 1000 when mother watching television.

3.4 Conclusion

Infant and child mortality rate was moderately high in Bangladesh, varying widely from characteristic to characteristic. The study examined the neonatal, post-neonatal and child mortality differentials by some selected socio-economic, bio-demographic & maternal health care variables using bivariate analysis. The result showed that post-neonatal and infant mortality highest occurred in Sylhet division and child mortality occurred highest in Chittagong divisions. Infant and child mortality in urban areas were about two times lower than rural areas. Parent's education has significant effect

on infant and child mortality. Parents having no or primary education faced higher level of infant and child mortality. Occupation of father was found significant for post-neonatal and child mortality. Electricity and household goods were very much associated with low infant and child mortality. Household annual income or wealth status of the families was inversely associated with infant and child mortality. This study indicated that the neonatal, post-neonatal and child mortality rates were significantly lower for high standard of living of mothers. Pit latrine users have higher infant and child mortality where toilet with flush has very low mortality. A significant portion of infant and child died when source of drinking water was tube well or borehole.

For demographic variables, in every stage of child mortality, the baby faced higher risk than the mother. Infant and child mortality was very high in first birth order of a mother, because mothers were physically depleted at the time of conception and throughout pregnancy. Again, both neonatal and post-neonatal mortality was observed highest for the children whose previous birth interval was greater than 24 months. Further, the study indicated that breastfeeding status has played significant role to reduce infant and child mortality. Neonatal mortality was very high when mother did not breastfeed her baby, on the other hand post neonatal mortality was high when mother breastfed her baby from 1 to 12 months only. The study identified that 15-19 age group mother's age at the birth of the child has significant influence on neonatal and post-neonatal mortality. The neonatal and infant mortality was found higher in small families (<4 members).

Among the maternal health care variables, this study indicated that 90% neonatal mortality occurred when place of delivery was home. Besides all types of child mortality have highest risk when place of delivery was at home, whether it was very low when baby born in hospital. Timing of first antenatal check during pregnancy, Tetanus injections during pregnancy and numbers of antenatal visit during pregnancy was significant for all the three mortality cohorts. In particular the lowest infant and child mortality was observed for mother's exposure to mass media.

Chapter: Four

Estimation of Child Mortality:

An Application of Indirect Techniques



Chapter: Four

Estimation of child mortality: Application of Indirect Techniques

4.1 Introduction

Indirect estimation is necessary to estimate a demographic parameter that is difficult to measure directly from some indicator that can be accurately recorded and is largely, but not exclusively determined by the parameter of interest. The effects of confounding variables on the indicator are then allowed for, so that the parameter of interest can be estimated. The most widely used example, due to Brass, estimates infant and child mortality from the proportion dead among children ever born by women classified by age. Brass used simple fertility and child mortality models to simulate proportions dead for different fertility patterns to develop conversion factors to adjust an observed proportion dead for the effects of the age patterns of childbearing. The proportions of children ever born who have died are indicators of child mortality and can yield robust estimates of childhood mortality. Specifically, the proportions of children dead classified by the mother's five-year age group or duration of marriage can provide estimates of the probabilities of dying between birth and various childhood ages.

4.2 Rationale of Brass Model

Brass¹ was the first to develop a procedure for converting proportions dead of children ever born reported by women in age groups 15–19, 20–24, etc. into estimates of the probability of dying before attaining certain exact childhood ages. Following the notation in the literature and using the symbol $D(i)$ to denote the proportion dead among children ever born to women in successive five-year age groups (where $i=1$ signifies age group 15–19; $i=2$ denotes 20–24; etc.), Brass developed a procedure to convert $D(i)$ values into estimates of $q(x)$, where $q(x) = 1.0 - l(x)$, the probability of dying between birth and exact age x . the basic form of the estimation equation proposed by Brass is

$$q(x) = K(i) \cdot D(i) \dots \dots \dots (1)$$

¹ William Bras, "Uses of census or survey data for the estimation of vital rates," paper prepared for the African Seminar on Vital Statistics, Addis Ababa, 14–19 December, 1964.

Where the multiplier $K(i)$ is meant to adjust for non-mortality factors determining the value of $D(i)$.

Brass found that the relation between the proportion of children dead, $D(i)$, and a life-table mortality measure, $q(x)$, is primarily influenced by the age pattern of fertility, because it is this pattern that determines the distribution of the children of a group of women by length of exposure to the risk of dying. He developed a set of multipliers to convert observed values of $D(i)$ into estimates of $q(x)$, the multipliers being selected according to the value of $P(1)/P(2)$ —a good indicator of fertility conditions at younger ages—where $P(i)$ is the average parity or average number of children ever born reported by women in age group i . Brass estimated the $K(i)$ multipliers by using a third-degree polynomial of fixed shape but variable age location to represent fertility², the logit system generated by the general standard to provide the mortality element, and a growth rate of 2 per annum to generate a stable age distribution for females.

An important assumption made in the development of this method is that the risk of dying of a child is a function only of the age of the child and not of other factors, such as mother's age or the child's birth order. In practice, it appears that children of young mothers experience mortality risks well above average. For this reason, the estimate of the infant mortality rate $q(1)$ (the probability of dying before age 1) that can be derived from reports of women aged 15–19 frequently suggests heavier child mortality than estimates derived from reports of older women. Therefore, mortality estimates based on the reports of women age 15–19 are generally disregarded because the numbers of children born and dead are usually small.

Trying to increase the flexibility of Brass original method, Sullivan³ computed another set of multipliers by using least-squares regression to fit equation (1) to data generated from observed fertility schedules and the Coale-Demeny life tables⁴. Trussell⁵ estimated a third set of multipliers by the same means but using data

² William Brass, *Methods for Estimation Fertility and Mortality from Limited and Defective Data* (Chapel Hill, North Carolina, Carolina Population Center, Laboratories for Population Statistics, 1975).

³ Jeremiah M. Sullivan, "Models for the estimation of the probability of dying between birth and exact ages of early childhood," *Population Studies*, vol. XXVI, No.1 (March, 1972), pp.79–97.

⁴ Ansley J. Coale and Paul Demeny, *Regional Model Life Tables and Stable Populations* (Princeton, New Jersey, Princeton University Press, 1966).

⁵ T. James Trussell, "A re-estimation of the multiplying factors for the Brass technique for determining childhood survivorship rates," *Population Studies*, vol. XXIX, No.1 (March, 1975), pp. 97–108.

generated from the model fertility schedules developed by Coale and Trussell⁶. The general theory on which these methods are based is essentially the same, but they arrive at somewhat different multipliers because the data bases used in each case are different. Since the Sullivan variant has no obvious advantages over that proposed by Trussell, whereas the latter is based on a wider range of cases, the Trussell procedure is described here. It must be mentioned, however, that the multipliers presented are a more recent and more satisfactory version of those originally proposed by Trussell in 1975.

It is important to take note that this method of estimation is based on the assumption that fertility and childhood mortality have remained constant in the recent past. If, for example, fertility has been changing, the ratios of average parities obtained from a cross-sectional survey will not replicate accurately the experience of any cohort of women and will not provide a good index of the distribution on time of the births to the women of each age group. The problem caused by declining fertility can be avoided when data for true cohorts are available (from censuses or surveys taken five or 10 years apart). In this case, an estimation method specifically designed for cohorts experiencing fertility change should be used.

Preston and Palloni⁷ propose an alternative approach to estimate the time location of births, which circumvents all the problems associated with changing fertility. This approach is closely related to the "own-children" procedure for estimating fertility from an age distribution. If it is possible to link, within households, the records of mothers and their surviving children, it becomes possible to tabulate surviving children according both to their own age and to that of their mothers. Given an age pattern of mortality, say, from one of the Coale-Demeny regional model life tables, the combination of the proportion of children dead and the age distribution of the surviving children of women from some particular age group uniquely determines a level of mortality. The age distribution of surviving children is used to define the age distribution of children ever born without recourse to fertility models. In an actual application, the choice between the age distribution of surviving children and the ratio of consecutive parities to estimate the real distribution of births over time depends

⁶ Ansley J. Coale and T. James Trussell, "Model fertility schedules: Variations in the age structure of childbearing in human populations," *Population Index*, vol. 40, No. 2 (April, 1974), pp. 185–258.

⁷ Samuel H. Preston and Alberto Palloni, "Fine-tuning Brass-type mortality estimates with data on ages of surviving children," *Population Bulletin of the United Nations*, No.10 (United Nations publication, Sales No. E.78.XIII.6), (1977), pp. 72–87.

upon data availability and upon a rough assessment of the likelihood each approach has of yielding the best possible estimate. In cases where age-reporting is good and most children live with their mothers, the approach suggested by Preston and Palloni may be the better, particularly if fertility is changing. In cases where age-reporting or completeness of enumeration is poor, or where a sizeable proportion of children do not live with their mothers or cannot be properly linked to them because of poor information, the parity-ratio approach is very likely to be better.

Probably a more widespread problem is posed by declining mortality. The procedures outlined above all assume that a constant pattern and level of mortality have prevailed in the recent past of the population under study. In most countries, however, mortality has been declining. Feeney⁸ was the first to examine the effects of changing mortality on the performance of the child-mortality estimation procedure. Using infant mortality as an index of mortality level in a one-parameter logit life-table system, he calculated the proportions of children dead that would be observed if infant mortality were changing linearly through time. On the basis of these simulated cases, he showed that for plausible annual rates of change in infant mortality, the $q(1)$ values estimated from data on children ever born and surviving for different age groups of mother could be matched with the $q(1)$ values prevalent during a set of years before the survey; and that this empirical finding. Feeney (1980) developed an estimation procedure to establish the set of years to which infant mortality rates estimated from data on children ever born and children surviving refer. This procedure was developed from data generated by using a one-parameter logit life-table system derived from the general standard and the Brass fertility polynomial.⁹ The use of $q(1)$, infant mortality, as an indicator of mortality level and as the estimated parameter makes the underlying age pattern of mortality important to the results, since similar overall levels of mortality (life tables with the same expectation of life at birth, for example) can be associated with markedly different infant mortality rates. As a result, the Feeney method is likely to yield biased $q(1)$ estimates when the mortality pattern in early childhood of the population under study does not resemble that embodied by the general standard. For this reason, Feeney's original method is not described in detail.

⁸ Griffith Feeney, "Estimating infant mortality rates from child survivorship data by age of mother," *Asian and Pacific Centus Newsletter*, vol. 3, No.2 (November, 1976), pp.12-16; and Griffith Feeney, "Estimating infant mortality trends from child survivorship data," *Population Studies*, vol. XXXIV, No.1 (March, 1980), pp. 109-128.

⁹ W. Brass, *Methods for Estimating Fertility and Mortality from Limited and Defective Data*.

It is fairly straightforward to apply Feeney's approach to data generated with other mortality models. Coale and Trussell¹⁰ carried out this calculation by assuming that period mortality changes can be modeled as movements through successively higher (or lower) levels of a set of model life tables, so that cohort life tables may be obtained by chaining together the mortality rates experienced by true cohorts living through the different periods. In this case, it can also be shown empirically that the child mortality estimate of the Brass type obtained from data for women in age group i , for example, is equal to the corresponding value prevalent during some particular period $t(x)$ years before the survey, and that this period is, for most practical purposes, invariant with respect to the speed of mortality change, so long as the rate of change is roughly constant over time.

4.3 Estimation of Child Mortality

The estimation procedures presented in this chapter had one characteristic in common: here used data on children ever born and surviving. Estimation of child mortality was calculated by two ways. These were as follows:

1. Estimation of child mortality using data classified by age
2. Estimation of child mortality using data classified by duration of marriage

4.4 Estimation of child mortality using data classified by age

In this section, the most recent version of the original Brass estimation procedure was presented (Trussell's method). Estimates of $q(1)$, $q(2)$, $q(3)$, $q(5)$, $q(10)$, $q(15)$ and $q(20)$, as well as of the periods to which they refer in cases where a smooth change in mortality can be assumed, were obtained from data on children ever born and surviving classified by age of mother. Fertility patterns were assumed to remain constant.

4.4.1 Computational procedure

The steps of the computational procedure were described below:

Step 1: Calculation of average parity per woman. Parity $P(1)$ referred to age group 15–19, $P(2)$ to 20–24 and $P(3)$ to 25–29. In general,

¹⁰ Ansley J. Coale and T. James Trussell, "Estimating the time to which Brass estimates apply", annex I to Samuel H. Preston and Alberto Palloni, "Fine-tuning Brass-type mortality estimates with data on ages of surviving children", *Population Bulletin of the United Nations*, No. 10–1977, pp. 87–89.

$$P(i) = CEB(i) / FP(i)$$

Where, CEB(i) denoted the number of children ever born by women in age group i; and FP(i) was the total number of women in age group i, irrespective of their marital status.

Following the usual convention, variable i referred to the different five-year age groups consider. Thus, the value i = 1 represents age group 15–19, i = 2 group 20–24 and so on. The treatment of women whose parity was not stated, in general if the El-Badry technique for estimating true non-response cannot be applied, women of unstated parity should be included in the female population denominator when calculating average parity, since childless women were often misclassified as cases of non-response.

Step 2: Calculation of proportion of children dead for each age group of mother. The proportion of children dead, D(i), was defined as the ratio of reported children dead to reported children ever born, that was

$$D(i) = CD(i) / CEB(i)$$

Where, CEB(i) denoted the number of children ever born by women in age group i; and CD(i) was the number of children dead reported by women in age group i.

Step 3: Calculation of multipliers. Manual_X (Indirect Techniques for Demographic Estimation) (Table 47) represented the estimation equations and the necessary coefficients to estimate the multipliers, K(i), according to the Trussell variant of the original Brass method¹¹. A different set of coefficients was provided for each of the four different families of model life tables in the Coale-Demeny system. Here out of four different families of model life tables using West model for calculating multipliers. The estimation equations were as follows:

$$K(i) = a(i) + b(i) (P(1)/P(2)) + c(i) (P(2)/P(3))$$

Step 4: Calculation of probabilities of dying and of surviving. Estimates of the probability of dying, q(x), were obtained for different values of exact age x as the product of the reported proportions dead, D(i), and the corresponding multipliers, K(i).

¹¹ Manual_X, *INDIRECT TECHNIQUES FOR DEMOGRAPHIC ESTIMATION* (New York: United Nations, 1983), p. 77.

$$q(x) = K(i).D(i)$$

Note that the value of x is not generally equal to that of i , because x is related in broad terms, to the average age of the children of women in age group i . Once $q(x)$ is estimated, its complement $l(x)$, the probability of surviving from birth to exact age x , is readily obtained as

$$l(x) = 1.0 - q(x)$$

Step 5: Calculation of reference period. As explained earlier, when mortality was changing smoothly, the reference period, $t(x)$, was an estimate of the number of years before the survey date to which the child mortality estimates, $q(x)$, obtained in the previous step refer. The value of $t(x)$ was also estimated by means of an equation whose coefficients were estimated from simulated cases by using linear regression. The equation used in this case is presented in Manual_X (Indirect Techniques for Demographic Estimation) (Table 48) together with a set of values for its coefficients¹². The estimation equation was given below.

$$t(x) = a(i) + b(i) (P(1)/P(2)) + c(i) (P(2)/P(3))$$

4.4.2 Estimation of child mortality using BDHS 2007 data classified by age

The data shown in table 4.1 were gathered by a survey carried out in Bangladesh Demographic and Health Survey (BDHS) between March and August 2007. They are used to illustrate the method just described. However, before proceeding with the estimation of child mortality, a quick check of the consistency of the data presented was carried out by computing the sex ratios of the number of children ever born. Column (7) of table 4.1 showed these ratios. They were computed by dividing the number of male children ever born by the corresponding number of female children. The sex ratios given in column (7) of table 4.1 fluctuate somewhat by age of mother but showed no systematic trend, and the overall sex ratio was acceptably close to the expected value of 1.05. Furthermore, since some variation of the sex ratios by age was expected because of the relatively small sample being considered, it was concluded that this test shows no clear deficiency in the data.

¹² Ibid, p. 78. .

Table 4.1: Children ever-born and children surviving by sex and age of mother, BDHS 2007

Age group	Total number of women	Male children		Female children		Sex ratio of children ever-born
		Ever-born	Dead	Ever-born	Dead	
15–19	3,019	451	44	456	27	0.9890
20–24	2,537	1633	118	1577	125	1.0355
25–29	2,018	2473	199	2176	178	1.1365
30–34	1,670	2799	301	2471	250	1.1327
35–39	1,573	3345	379	2677	367	1.2495
40–44	1,216	2787	434	2474	385	1.1265
45–49	1,038	2894	541	2300	448	1.2583
Total	13,071	16,382	2,016	14,131	1,780	1.1593

Step 1: Calculation of average parity per women. Average parities $P(1)$, $P(2)$ and $P(3)$ were calculated by dividing the number of children ever born of each sex (appearing in columns (3) and (5) of table 4.1) by the total number of women (column (2) of that table). Thus, for example, $P_m(1)$, the mean number of male children ever born by women age 15–19 was

$$P_m(1) = 451 / 3019 = 0.1494$$

The complete sets of $P_m(i)$ and $P_f(i)$ values were shown in columns (3) and (4) of table 4.2. Note that the values of $P(i)$ for both sexes combined are just the sum of $P_m(i)$ and $P_f(i)$, the mean number of male and female children, respectively, born to women of age group i .

Table 4.2: Average parity per women by sex of child and age of mother, BDHS 2007

Age group	Index (i)	Average parity per women		
		Males $P_m(i)$	Females $P_f(i)$	Both sexes $P_t(i)$
15–19	1	0.1494	0.1510	0.3004
20–24	2	0.6437	0.6216	1.2653
25–29	3	1.2255	1.0783	2.3038
30–34	4	1.6760	1.4796	3.1556
35–39	5	2.1265	1.7018	3.8283
40–44	6	2.2919	2.0345	4.3264
45–49	7	2.7881	2.2158	5.0039

Step 2: Calculation of proportion of children dead for each age group of mother. The values of this proportion, $D(i)$, were computed from table 4.1 by dividing the number of children dead of each sex, given in column (4) and (6), by the children

ever born of the corresponding sex, shown in column (3) and (5). Thus, $D_m(1)$, the proportion of male children dead among those ever born to women age 15–19 was

$$D_m(1) = 44 / 451 = 0.0976$$

To calculate the $D(i)$ values for both sexes combined, the deaths had to be added and then divided by the total number of children ever born (sum of males and females). Hence, $D_t(1)$ for both sexes would be

$$D_t(1) = (44 + 27) / (451 + 456) = 0.0783$$

Table 4.3 showed a complete set of the proportions of children dead.

Table 4.3: Proportions of children dead, by sex of children and age of mother, BDHS 2007

Age group	Index (i)	Proportion of children dead		
		Males $D_m(i)$	Females $D_f(i)$	Both sexes $D_t(i)$
15–19	1	0.0976	0.0592	0.0783
20–24	2	0.0723	0.0793	0.0757
25–29	3	0.0805	0.0818	0.0811
30–34	4	0.1075	0.1012	0.1046
35–39	5	0.1133	0.1371	0.1239
40–44	6	0.1557	0.1556	0.1557
45–49	7	0.1869	0.1948	0.1904

Step 3: Calculation of multipliers. The multipliers, $K(i)$, required to adjust the reported proportion dead, $D(i)$, for the effects of the age pattern of child bearing were calculated from the ratios $P(1)/P(2)$ and $P(2)/P(3)$ by using the equation and the coefficients list in table 47 in Manual_X (Indirect Techniques for Demographic Estimation). Thus,

$$K(i) = a(i) + b(i) (P(1)/P(2)) + c(i) (P(2)/P(3))$$

It was assumed that the West family of model life tables was an adequate representation of mortality in Bangladesh, so values of $a(i)$, $b(i)$ and $c(i)$ were taken from the bottom pane of table 47 in Manual_X (Indirect Techniques for Demographic Estimation). Given the values of $P(1)$, $P(2)$ and $P(3)$ shown in table 4.2, values of $K(i)$ can be calculated for each sex and for both sexes combined. The full set of $K(i)$ values was shown in table 4.4. As an example, the multiplier for the male children of women age 20–24 ($i = 2$)

$$K_m(2) = 1.2563 + (-0.5381) (0.2321) + (-0.2637) (0.5253) = 0.9929$$

Table 4.4: Trussell's Multipliers for child mortality estimation, West Model, BDHS 2007

Age group	Index (i)	Multipliers K(i) for		
		Males	Females	Both sexes
15-19	1	0.9157	0.9242	0.9198
20-24	2	0.9929	0.9741	0.9838
25-29	3	0.9804	0.9606	0.9707
30-34	4	1.0019	0.9835	0.9930
35-39	5	1.0241	1.0055	1.0151
40-44	6	1.0132	0.9944	1.0041
45-49	7	1.0050	0.9866	0.9960
P(1) / P(2)		0.2321	0.2429	0.2374
P(2) / P(3)		0.5253	0.5745	0.5492

Step 4: Estimation of probabilities of dying and of surviving. Estimates of $q(x)$, the probability of dying between birth and exact age x , were now calculated by multiplying the $K(i)$ values appearing in table 4.4 by the corresponding proportions dead, $D(i)$, given in table 4.3. A complete set of $q(x)$ estimates was shown in table 4.5. As an example, the value of $q_f(5)$ was obtained as follows:

$$q_f(5) = K_f(5) \cdot D_f(5) = 1.0055 \times 0.1371 = 0.0995$$

Since every $q(x)$ value was the probabilistic complement of the probability of surviving, $l(x)$, the latter value can be obtained by subtracting the former from 1.0. Thus

$$l_f(5) = 1.0 - 0.0995 = 0.9005$$

In table 4.5, every $q(x)$ value was accompanied by its corresponding $l(x)$ value.

Table 4.5: Estimates of probabilities of dying and of surviving by sex, derived from child survival data classified by age of mother, West Model, BDHS 2007

Age group	Age (x)	Probabilities of dying, $q(x)$ and of surviving, $l(x)$					
		Males		Females		Both sexes	
		$q(x)$	$l(x)$	$q(x)$	$l(x)$	$q(x)$	$l(x)$
15-19	1	0.0894	0.9106	0.0547	0.9453	0.0720	0.9280
20-24	2	0.0718	0.9282	0.0138	0.9862	0.0745	0.9255
25-29	3	0.0789	0.9211	0.0786	0.9214	0.0787	0.9213
30-34	5	0.1077	0.8923	0.0995	0.9005	0.1039	0.8961
35-39	10	0.1160	0.8840	0.1379	0.8621	0.1258	0.8742
40-44	15	0.1548	0.8452	0.1547	0.8453	0.1563	0.8437
45-49	20	0.1878	0.8122	0.1922	0.8078	0.1896	0.8104

Table 4.5 represented the estimate of probabilities of dying and of surviving by sex, derived from child survival data classified by age of mother, West Model. In age group 15-19, the probability of dying was 0.0894 for male, 0.0547 for female and 0.0720 for both sexes. On the other hand, probability of surviving was 0.9106 for male, 0.9453 for female and 0.9280 for both sexes. In this age group male children's probability of dying

was greater than female children. Again in age group 25–29, the probability of dying was 0.0789 for male, 0.0786 for female and 0.0787 for both sexes. But probability of surviving was 0.9211 for male, 0.9214 for female and 0.9213 for both sexes. In this age group probability of dying and surviving for both sexes are almost equal. Now in age group 45–49, the probability of dying was 0.1878 for male, 0.1922 for female and 0.1896 for both sexes. But probability of surviving is 0.8122 for male, 0.8078 for female and 0.8104 for both sexes. So Probability of dying was increasing and probability of surviving was decreasing for both male and female children with the increasing of mother ages.

Step 5: Calculation of reference period. Since mortality was not likely to have remained constant in Bangladesh until 2007, it was useful to know the reference period $t(x)$, of each $q(x)$ estimate. The values of the ratios $P(1)/P(2)$ and $P(2)/P(3)$ that are needed to estimate $t(x)$ had already been computed in step 3. The form of the estimation equation and the values of the coefficients needed to estimate $t(x)$ were obtained from table 48 in Manual_X (Indirect Techniques for Demographic Estimation), again assuming a West mortality pattern. The value $t_m(3)$ was computed below:

$$t_m(3) = 1.5305 + (2.5528).(0.2321) + (4.8962).(0.5253) = 4.6950$$

Thus, the estimated $q_m(3)$ Value of 0.0789 was similar to that corresponding to the period life table in operation 4.6950 years before the date of the survey, which might itself be regarded as the average date of interview. Since the survey took place between March and August 2007, in rough terms $q_m(3)$ referred to third quarter of 2002. The complete set of estimated $t(x)$ values was presented in table 4.6

Table 4.6: Estimates of the reference period to which the estimated probabilities of dying refer, West Model, BDHS 2007

Age group	Age (x)	Parameter estimate	Reference Period, $t(x)$		
			Males	Females	Both sexes
15–19	1	$q(1)$	1.3397	1.3017	1.3216
20–24	2	$q(2)$	2.7540	2.8288	2.7907
25–29	3	$q(3)$	4.6950	4.9635	4.8255
30–34	5	$q(5)$	6.9139	7.4008	7.1503
35–39	10	$q(10)$	9.3108	10.0160	9.6528
40–44	15	$q(15)$	11.8835	12.7342	12.2961
45–49	20	$q(20)$	14.7426	15.5740	15.1457

Table 4.7 showed the levels, as derived from the West model life tables by interpolating between the value of tables 236, 237 and 238.¹³ The level consistent with the estimated $q(2)$ for female was calculated here. According to table 4.5, $q_f(2)$ was equal to 0.0138 and the corresponding $l(2)$ was 0.9862. Since only $l(x)$ values were tabulated in table 236 in annex VIII of Manual_X (Indirect Techniques for Demographic Estimation) (females, model West), this last value was used for interpolation purposes. In column labeled " $l(2)$ " in table 236, the two values that enclose the observed $l(2)$ are $l_{23}(2) = 0.98377$ and $l_{24}(2) = 0.99061$ (the $l(2)$ values at levels 23 and 24, respectively). Therefore, the interpolation factor θ was

$$\theta = (0.9862 - 0.98377) / (0.99061 - 0.98377) = 0.3553$$

and because the distance between levels 23 and 24 was just one, the level consistent with $q_f(2)$ is 23.3553 or 23.4 when rounded. All other values shown in table 4.7 were obtained in a similar way.

Table 4.7: Mortality level in the West Model life Tables consistent with the childhood mortality estimates, $q(x)$, BDHS 2007

Age (x)	Males		Females		Both sexes	
	West mortality level	Reference date	West mortality level	Reference date	West mortality level	Reference date
1	16.7419	2006.2	18.5287	2006.2	17.5878	2006.2
2	19.0174	2004.7	23.3553	2004.7	18.3527	2004.7
3	18.8609	2002.8	17.9226	2002.5	18.4252	2002.7
5	17.4895	2000.6	17.1142	2000.1	17.3462	2000.3
10	17.6380	1998.2	15.6840	1997.5	16.7202	1997.8
15	16.1335	1995.6	15.3527	1994.8	15.6791	1995.2
20	15.2772	1992.8	14.4067	1991.9	14.8517	1992.4

Results and Discussion

The levels displayed in table 4.7 shows that, the estimates of $q(i)$ imply relatively high mortality but child mortality had been falling. Furthermore, the estimates of level were fairly consistent for the two sexes, indicating that child mortality differentials by sex

¹³ Ibid, pp. 269–271.

were rather similar to those embodied in the West model life tables. From the table, we observed that West mortality level highest for both male and female children in 20–24 and 25–29 age groups. So 20 to 29 years mothers' child mortality level takes highest value. From the previous discussion, we got mothers fertility also highest in those age groups. From the age specific fertility rate (ASFR) of 2007, 173 per 1000 live births was in 20–24 age group and 127 per 1000 live births was in 25–29 age group. So, more fertility exists where more mortality occurs. Again in age group 40–44 and 45–49 mortality levels were lowest. From age specific fertility rate (ASFR) of 2007, 10 per 1000 live births was in 40–44 age group and 1 per 1000 live births in 45–49 age group. So, less fertility exists where less mortality occurs. Hence we can conclude that where there was more mortality, there was more fertility.

4.5 Estimation of child mortality using data classified by duration of marriage

In this section, a variant of the original Brass method that may be applied to data classified by duration of marriage is presented. Estimates of $q(2)$, $q(3)$, $q(5)$, $q(10)$, $q(15)$, $q(20)$ and $q(25)$, as well as of the periods to which they refer in cases where a smooth change in mortality can be assumed, are obtained from data on children ever born and surviving classified by the mother's marriage duration. Marital fertility patterns are assumed to remain constant. In certain cultures, women appear to be more likely to state duration of marriage correctly than to give correct information about their age, so the estimation procedure based on data classified by duration of marriage may be preferred. However, the use of data classified by duration is not recommended in countries where consensual unions are frequent and relatively unstable.

4.5.1 Estimation of child mortality using BDHS 2007 data classified by duration of marriage

Data on the number of children ever born and children surviving obtained during a survey carried out in Bangladesh Demographic and Health Survey (BDHS) between March and August 2007 were tabulated not only by age of mother but also by the time elapsed since her first union. The data classified by duration are summarized in table 4.8. These data were used to illustrate the duration-based procedure for estimating mortality in childhood.

Table 4.8: Children ever-born and children surviving by sex of child and marriage duration of mother, BDHS 2007

Duration group	Ever married women	Male children		Female children		Sex ratio of children ever-born
		Ever-born	Dead	Ever-born	Dead	
0-4	2032	693	46	658	33	1.0694
5-9	2020	1791	135	1675	131	1.0699
10-14	1726	2369	201	2128	178	1.1133
15-19	1607	2763	281	2461	241	1.1227
20-24	1380	3013	352	2433	333	1.2384
25-29	1106	2675	422	2307	406	1.1595
30+	1125	3078	580	2483	474	1.2396
Total	10,996	16,382	2,017	14,145	1,796	1.1582

The sex ratios of the number of children ever born were shown in Column (7) of table 4.8. They were computed by dividing the number of male children ever born by the corresponding number of female children. The sex ratios given in column (7) of table 4.8 were not exactly constant, but, except for that referring to duration group 0-4, they all fall acceptably close to the expected figure. The large deviation shown by the sex ratio of the children born to women married only a few years is probably due to the relatively small number of cases considered. Survival probabilities estimated from the data corresponding to this duration group might be subject to similar biases and should be treated with reserve.

Table 4.9: Average parities by sex of children and marriage duration of mother, BDHS 2007

Duration group	Index (i)	Average parity per women		
		Males $P_m(i)$	Females $P_f(i)$	Both sexes $P_t(i)$
0-4	1	0.3410	0.3238	0.6649
5-9	2	0.8866	0.8292	1.7158
10-14	3	1.3725	1.2329	2.6054
15-19	4	1.7194	1.5314	3.2508
20-24	5	2.1833	1.7630	3.9463
25-29	6	2.4186	2.0859	3.5045
30+	7	2.7360	2.2071	4.9431

Table 4.9 represented average parities by sex of children and marriage duration of mother. Average parities were computed by each of the entries in columns (3) and (5) (male and female children ever born, respectively) of table 4.9 was divided by the corresponding entry in column (2), the number of ever-married women.

Table 4.10: Proportions of children dead, by sex of children and marriage duration of mother, BDHS 2007

Duration group	Index (i)	Proportion of children dead		
		Males $D_m(i)$	Females $D_f(i)$	Both sexes $D_t(i)$
0-4	1	0.0664	0.0502	0.0585
5-9	2	0.0754	0.0782	0.0767
10-14	3	0.0848	0.0836	0.0843
15-19	4	0.1017	0.0979	0.0999
20-24	5	0.1168	0.1369	0.1258
25-29	6	0.0744	0.1760	0.1662
30+	7	0.1884	0.1835	0.1895

Table 4.10 represented proportions of children dead, by sex of children and marriage duration of mother. This proportion, $D(i)$, was computed by dividing the number of children dead (column (4) for males, column (6) for females) by the number of children ever born (column (3) for males, column (5) for females). When both sexes were considered, the number of male and female dead children had to be calculated by adding the figures in column (4) and (6) and then dividing by the sum of male and female children ever born (columns (3) and (5)).

Table 4.11: Trussell's Multipliers for the proportions of children dead tabulated by duration of marriage, assuming a West mortality pattern, BDHS 2007

Duration group	Index (i)	Multipliers $K(i)$ for		
		Males	Females	Both sexes
0-4	1	1.1481	1.1482	1.1481
5-9	2	1.0109	1.0067	1.0089
10-14	3	1.0200	1.0106	0.9155
15-19	4	1.0410	1.0277	1.0347
20-24	5	1.0266	1.0119	1.0196
25-29	6	1.0163	1.0016	1.0093
30+	7	1.0223	1.0069	1.0150
P(1) / P(2)		0.3845	0.3905	0.3875
P(2) / P(3)		0.6460	0.6726	0.6586

Table 4.11 represented Trussell's Multipliers for the proportions of children dead tabulated by duration of marriage assuming a West mortality pattern. The coefficients needed to compute the multipliers, $K(i)$, were given in table 56 of Manual_X (Indirect Techniques for Demographic Estimation)¹⁴. The estimation equation had the following form:

¹⁴ Ibid, p. 82.

$$K(i) = a(i) + b(i) (P(1)/P(2)) + c(i) (P(2)/P(3))$$

Table 4.12: Estimates of probabilities of dying and of surviving by sex, derived from child survival data classified by duration of marriage, West Model, BDHS 2007

Duration group	Age (x)	Probabilities of dying, q(x) and of surviving, l(x)					
		Males		Females		Both sexes	
		q (x)	l (x)	q (x)	l (x)	q (x)	l (x)
0–4	2	0.0762	0.9238	0.0576	0.9424	0.0672	0.9328
5–9	3	0.0762	0.9238	0.0787	0.9213	0.0774	0.9226
10–14	5	0.0865	0.9135	0.0845	0.9155	0.0772	0.9228
15–19	10	0.1059	0.8941	0.1006	0.8994	0.1034	0.8966
20–24	15	0.1199	0.8801	0.1385	0.8615	0.1283	0.8717
25–29	20	0.0756	0.9244	0.1763	0.8237	0.1677	0.8323
30+	25	0.1926	0.8074	0.1848	0.8152	0.1923	0.8077

Table 4.12 represented the estimate of probabilities of dying and of surviving by sex, derived from child survival data classified by duration of marriage, West Model. In the duration of marriage 0–4, the probability of dying was 0.0762 for male, 0.0576 for female and 0.0672 for both sexes. On the other hand, probability of surviving was 0.9238 for male, 0.9424 for female and 0.9328 for both sexes. In this duration of marriage, male children's probability of dying was greater than female children. Again in the duration of marriage 5–9, the probability of dying was 0.0762 for male, 0.0787 for female and 0.0774 for both sexes. But probability of surviving was 0.9238 for male, 0.9213 for female and 0.9226 for both sexes. In this duration of marriage probability of dying and surviving for both sexes were near about equal. Now in the duration of marriage 25–29, the probability of dying was 0.0756 for male, 0.1763 for female and 0.1677 for both sexes. But probability of surviving was 0.9244 for male, 0.8237 for female and 0.8323 for both sexes. For 25–29 years duration of marriage, male children's probability of dying was lower than female children. But probability of dying is increasing and probability of surviving was decreasing for both male and female children with the increasing of marriage duration.

Table 4.13: Estimates of the reference period to which the estimated probabilities of dying refer, West Model, BDHS 2007.

Duration group	Age (x)	Parameter estimate	Reference Period, t(x)		
			Males	Females	Both sexes
0–4	2	q(2)	1.3400	1.3424	1.3431
5–9	3	q(3)	3.5818	3.6128	3.5957
10–14	5	q(5)	5.8632	5.9682	5.8863
15–19	10	q(10)	8.3845	8.6175	8.4179
20–24	15	q(15)	11.1767	11.5371	11.2254
25–29	20	q(20)	14.3294	14.7429	14.3967
30+	25	q(25)	17.2816	17.6545	17.3500

Table 4.13 estimated the reference period to which the estimated probabilities of dying according to West Model. Since mortality was very likely to have changed recently in Bangladesh, the estimation of the reference period, $t(x)$, was appropriate. For this purpose, one requires the values of $P(1)/P(2)$ and $P(2)/P(3)$, which had already been calculated in table 4.11. The equation used to estimate $t(x)$ and appropriate coefficients appear in table 57 of Manual_X (Indirect Techniques for Demographic Estimation)¹⁵. The estimation equation had the following form:

$$t(x) = a(i) + b(i) (P(1)/P(2)) + c(i) (P(2)/P(3))$$

Table 4.14: Mortality levels in the West Model Life Tables consistent with the duration-based estimates of child mortality, BDHS 2007.

Age (x)	Males		Females		Both sexes	
	West mortality level	Reference date	West mortality level	Reference date	West mortality level	Reference date
2	18.7155	2006.2	19.0777	2006.2	18.8760	2006.2
3	19.0317	2003.9	17.9162	2003.9	18.5101	2003.9
5	18.7740	2001.6	17.4878	2001.5	18.8969	2001.6
10	18.1575	1999.1	17.5670	1998.9	17.8674	1999.0
15	17.7874	1996.3	16.0798	1996.0	16.9757	1996.2
20	16.4397	1993.2	15.0355	1992.8	15.7667	1993.1
25	15.8688	1990.2	15.4188	1989.8	15.5082	1999.1

Results and Discussion

Table 4.14 showed that child mortality level had been falling with the increasing of duration of marriage. From the table, we observed that in West model, for male children mortality level highest in 5–9 years duration of marriage and for female children mortality level highest in 0–4 year's duration of marriage. For the both sexes, with increasing tendency in duration of marriage, there was a decreasing tendency in child mortality level. The estimated mortality levels showed a fairly coherent trend and reasonable consistency by sex. The average of the duration-based mortality levels was somewhat higher (by about half a level) than that obtained when the data were classified by age, but the reference period of the duration-based estimates was somewhat more recent, for any given value of x . Therefore, although the overall duration-based estimates indicate lower mortality than do the age estimates, their differences were very moderate.

¹⁵ Ibid, p. 83.

4.6 Conclusion

As in the case of the age-based analysis, the child survival data of the survey conducted by BDHS in 2007, when classified by duration of marriage appear to be of acceptable quality. The child mortality levels were calculated by Brass indirect technique showed that the estimates of children probability of dying imply relatively high mortality. The sex ratios at birth of children ever born were close the expected value of 1.05, the average parities increase monotonically and proportions of children dead also increase. Children probability of dying was increases and probability of surviving was decreased with the rises of both age of mother and duration of marriage. The estimated child mortality levels fairly consistent for the two sexes and indicated child mortality had been falling. Finally from the analysis we identified that child mortality were high in those age groups (20–24, 25–29) where fertility rates were also high. Again child mortality levels were low where fertility rates were also low.

Chapter: Five

Factors Affecting Infant and Child Mortality



Chapter: Five

Factors Affecting Infant and Child Mortality

5.1 Introduction

An infant's survival during the first month of life has been found to be closely associated with mother's health and nutritional status during pregnancy. Moseley and Chan have developed a theoretical framework in which they treat available health care and nutritional status of mothers and children as proximate variables, through which social, economic and demographic factors affect child mortality. Galway *et al.* showed that malnourished mother's tend to produce infant with low birth weights who have a higher than average risk of infant mortality. On the other exogenous health-care variable, which Moseley and Chan characterize as environmental contamination adversely affect child survival. They include mother's exposure to postpartum infections and family's lack of access to safe drinking water, sanitary toilets or disease prevention measure such as inoculation programs. The introduction of sanitary toilet facilities has been found to reduce infant mortality in Philippines and in Malaysia. Improved water supply and sanitation proved to be significant factors in the decline of infant mortality in Malaysia among mother who were not breast-feeding.

Gubhaju (1989) showed that first-born children of very young women are at especial risk of infant mortality because of mother's physical immunity. A mother's experience of losing a child is strongly associated with her greater risk of subsequent infant and child mortality. Galway *et al* indicated that a higher risk of infant and child mortality was also observed among older women, especially after age 35. Social and economic factors have been found to be affecting family's socio-economic status, the mother's work pattern, her education, the parent's sex preference and their place of residence. Higher family income can generally be taken as an indicator of better nutrition and greater access to health facilities, which improved an infant's chances of survival.

The previous chapter observed that there was a complex set of relationship among the various socio-economic, demographic, maternal health care service utilization characteristics by using Bivariate analysis, that was directly or indirectly affects infant and child mortality. Bivarite analysis just described but it was

sometimes difficult to interpret because variable may cover in way which makes them appear all to be related to could mortality differentials. So it was quite impossible for bivariate analysis to interpret the qualification or testing the strength of interrelationship between two variables. To examine the net effects of all the predictor variables, it was essential to need multivariate analysis. There were various statistical methods of multivariate analysis for evaluating the effects of infant and child mortality. Multivariate logistic regression was an important tool for that type of data analysis where dependent variable was dichotomous. We should use multivariate logistic regression technique to identify the contribution of the independent variables on child and infant mortality.

In multivariate logistic regression, the effect of independent variables had been estimated. For the large number of covariates in an analysis, there might found multicollinearity problem. In the previous chapter, we found some covariates which were significant in cross-tabulation analysis. We considered these covariates in this analysis. But to avoid the problem of serious multicollinearity we had removed some variables that were strongly associated with each other and assumed to have a little impact on mortality. Current pregnancy, current contraceptive method or contraceptive use and intention, fertility preference, age at sterilization, tetanus infection before birth, currently breastfeeding or month of breastfeeding, ideal number of children, index of birth history and numbers of antenatal visit during pregnancy correlated each others. So, in logistic regression analysis those variables had been removed.

5.2 Determinants of mortality

This chapter presented the results of the multivariate logistic regression models which were run by using the Statistical Package for the Social Science (SPSS). This study aimed at showing the effect of the selected socio-economic, demographic and maternal health care service utilization variables on risk of dying of children born in the previous years. Multivariate logistic regression models were ran in order to controlling for sex of child, mother's age at birth, birth interval, mother's current place of residence, mother's education, father's education, father's employment, use of electricity, fastest way of requesting assistance in an emergency and whether the mother reads a newspaper, listens to the radio and watches television. Earlier it was mentioned that neonatal mortality was more likely to be affected by endogenous

factors while infant mortality was more likely to be affected by exogenous factors. Endogenous infant mortality was approximately equivalent to neonatal death (Wrigley, 1977). Therefore, separate groups were presented for neonatal, post-neonatal, infant and child mortality.

The considered groups and the dependent variables were given below:

For Socio-economic Characteristics

- Group 1:** 1, if neonatal mortality occurred, and
0, if neonatal mortality does not occur.
- Group 2:** 1, if post-neonatal mortality occurred, and
0, if post-neonatal mortality does not occur.
- Group 3:** 1, if infant mortality occurred in infertile period of life, and
0, if infant mortality does not occur in infertile period of life.
- Group 4:** 1, if child mortality occurred between 1 to 5 years of life, and
0, if child mortality does not occur between 1 to 5 years of life.

For Demographic Characteristics

- Group 1:** 1, if neonatal mortality occurred, and
0, if neonatal mortality does not occur.
- Group 2:** 1, if post-neonatal mortality occurred, and
0, if post-neonatal mortality does not occur.
- Group 3:** 1, if infant mortality occurred in infertile period of life, and
0, if infant mortality does not occur in infertile period of life.
- Group 4:** 1, if child mortality occurred between 1 to 5 years of life, and
0, if child mortality does not occur between 1 to 5 years of life.

For Maternal health care and service utilization Characteristics

- Group 1:** 1, if neonatal mortality occurred, and
0, if neonatal mortality does not occur.
- Group 2:** 1, if post-neonatal mortality occurred, and
0, if post-neonatal mortality does not occur.
- Group 3:** 1, if infant mortality occurred in infertile period of life, and
0, if infant mortality does not occur in infertile period of life.
- Group 4:** 1, if child mortality occurred between 1 to 5 years of life, and
0, if child mortality does not occur between 1 to 5 years of life.

Table 5.2.1: Data coding of socio-economic variables or characteristics

Variable & Characteristics	Type	Categories
Region/Division	Categorical	1 = Barisal 2 = Chittagong 3 = Dhaka 4 = Khulna 5 = Rajshahi 6 = Sylhet
Residence	Categorical	1 = Urban 2 = Rural
Mother's Education	Categorical	1 = No education 2 = Primary 3 = Secondary 4 = Higher
Father's Education	Categorical	1 = No education 2 = Primary 3 = Secondary 4 = Higher
Mother's Occupation	Categorical	1 = Housewife 2 = Worker/Laborer 3 = Professional worker 4 = Others
Father's Occupation	Categorical	1 = Agriculture 2 = Worker/Laborer 3 = Professional worker 4 = Business 5 = Others
Has electricity	Categorical	1 = No 2 = Yes
Household goods Has television Has radio Has refrigerator	Categorical	1 = No 2 = Yes 1 = No 2 = Yes 1 = No 2 = Yes
Religion	Categorical	1 = Islam 2 = Others
Main roof material	Categorical	1 = Thatch/palm leaf 2 = Tin 3 = Cement and others
Main wall material	Categorical	1 = Thatch/palm leaf 2 = Bamboo with mud 3 = Tin 4 = Cement and others
Main floor material	Categorical	1 = Earth, sand 2 = Cement and others
Wealth index	Categorical	1 = Poorest 2 = Poorer 3 = Middle 4 = Richer 5 = Richest
Source of drinking water	Categorical	1 = Pipe 2 = Tube well or borehole 3 = Well and Protected spring 4 = Rivers/ponds/Others
Type of toilet facility	Categorical	1 = Toilet with Flush 2 = Pit latrine 3 = Hanging toilet and others
Type of cooking	Categorical	1 = Natural gas and kerosene 2 = Wood 3 = Agricultural crop 4 = Animal dung and others

Source: BDHS, 2007

Table 5.2.2: Data coding of demographic variables or characteristics

Variable & Characteristics	Type	Categories
Sex of child	Categorical	1 = Male 2 = Female
Birth order number	Categorical	1 = 1 2 = 2 3 = 3 4 = 4 5 = 5 and 5+
Previous birth interval	Categorical	1 = < 24 months 2 = 24—60 months 3 = 60+ months
Duration of Breastfeeding	Categorical	1 = <1 month 2 = 1—12 months 3 = 13—24 months 4 = 24+ months
Age at first marriage	Categorical	1 = <15 years 2 = 15—19 years 3 = 19—24 years 4 = 24+ years
Age of mother at first birth	Categorical	1 = <15 years 2 = 15—19 years 3 = 19—24 years 4 = 24+ years
No. of household members	Categorical	1 = <4 members 2 = 4—6 members 3 = 6+ members

Source: BDHS, 2007

The value was used to identify the significant effects to assess the relative importance of the selected variables in the group. The significance level showed how significantly a particular logistic regression estimates differs from that of the reference category. The odds ratio had a clear interpretation and was straightforward. An odds ratio of greater than 1.00 suggested as increased likelihood of the event occurring (i.e. mortality), while an odds ratio less than 1.00 indicated a decreased likelihood of the event occurring. A value of 1.00 indicated no greater or lesser risk than the average.

Table 5.2.3: Data coding of maternal health care and service utilization variables or characteristics

Variable & Characteristics	Type	Categories
Place of delivery	Categorical	1 = Home 2 = Any medical facility
Timing of first antenatal check	Categorical	1 = < 3 times 2 = 3—5 times 3 = 5+ times
Tetanus injections before pregnancy	Categorical	1 = 1—3 doses 2 = 3—5 doses 3 = 5+ doses
Read newspaper or magazine	Categorical	1 = No 2 = Yes
Listen radio	Categorical	1 = No 2 = Yes
Watch television	Categorical	1 = No 2 = Yes

Source: BDHS, 2007

In this section Table 5.3.1 to 5.6.3 represent the estimates of logistic coefficient, standard error of these estimates. Wald chi-square, significance probability and relative odds calculated for each category of the categorical variables. We consider level of significance at 1%, 5% and 10% level for socio-economic, demographic and maternal health care service utilization characteristics of all mortality cohorts.

5.3 Group 1: Socio-economic, demographic and maternal health care service utilization characteristics for neonatal mortality

In logistic regression of group 1, it was included that neonatal mortality was dependent variable and the selected socio-economic, demographic and maternal health care service utilization characteristics were the same as independent variable. According to the fitted group as shown in Table 5.3.1 to 5.3.3, 13 independent variables out of 31 independent variables were statistically significant at 1%, 5% and 10% level of significant. These significant variables of neonatal mortality were division, father's education, main roof materials, main wall materials, main floor materials, wealth status, sex of child, birth order number, age of mother at first birth, duration of breastfeeding, place of delivery, timing of first antenatal check and tetanus injection before pregnancy. The rest of the independent variables were statistically insignificant on neonatal mortality.

Table 5.3.1: Logistic regression estimates for the socio-economic characteristics with neonatal mortality as the dependent variables in Bangladesh, BDHS-2007

Variable & Characteristics	Estimated Coefficients (B)	S.E. of estimates (B)	Wald Chi-square (Statistic)	Significant (P-value)	Odds ratio
Region/Division					
Barisal	-	-	-	-	1.000
Chittagong	-0.453	0.298	2.317	0.128	0.636
Dhaka	-0.565	0.264	4.580	0.032 **	0.568
Khulna	0.109	0.266	0.167	0.683	1.115
Rajshahi	-0.174	0.291	0.357	0.550	0.840
Sylhet	0.578	0.275	4.421	0.036 **	1.782
Residence					
Urban	-	-	-	-	1.000
Rural	0.134	0.204	0.431	0.512	1.143
Mother's Education					
No education	-	-	-	-	1.000
Primary	-0.726	0.794	0.837	0.360	0.484
Secondary	-0.567	0.798	0.505	0.478	0.567
Higher	-0.357	0.773	0.213	0.644	0.700
Father's Education					
No education	-	-	-	-	1.000
Primary	0.890	0.509	3.060	0.080 ***	2.435
Secondary	0.693	0.501	1.910	0.167	2.000
Higher	1.056	0.488	4.678	0.031 **	2.875
Father's Occupation					
Agriculture	-	-	-	-	1.000
Worker/Laborer	-0.478	0.838	0.326	0.568	0.620
Professional worker	-0.397	0.833	0.227	0.634	0.673
Business	0.600	0.915	0.429	0.512	1.822
Others	-0.367	0.838	0.192	0.662	0.693
Mother's Occupation					
Housewife	-	-	-	-	1.000
Worker/Laborer	0.283	0.373	0.574	0.449	1.326
Professional worker	0.448	0.433	1.070	0.301	1.565
Others	-0.014	1.803	0.000	0.994	0.986
Has electricity					
No	-	-	-	-	1.000
Yes	-0.899	0.904	0.989	0.320	0.407
Household goods					
Has television					
No	-	-	-	-	1.000
Yes	0.304	0.262	1.349	0.246	1.355
Has radio					
No	-	-	-	-	1.000
Yes	-0.068	0.199	0.116	0.733	0.934
Has refrigerator					
No	-	-	-	-	1.000
Yes	0.747	0.460	2.639	0.104	2.111

Variable & Characteristics	Estimated Coefficients (B)	S.E. of estimates (B)	Wald Chi-square (Statistic)	Significant (P-value)	Odds ratio
Religion					
Islam	-	-	-	-	1.000
Others	0.400	0.273	2.152	0.142	1.492
Main wall material					
Thatch/palm leaf	-	-	-	-	1.000
Bamboo with mud	0.320	0.311	1.060	0.303	1.377
Tin	0.249	0.313	0.635	0.026 **	1.283
Cement and others	-0.222	0.287	0.597	0.440	0.801
Main floor material					
Earth and sand	-	-	-	-	1.000
Cement and others	0.060	0.430	0.020	0.042 **	1.492
Main roof material					
Thatch/palm leaf	-	-	-	-	1.000
Tin	-0.248	0.531	0.219	0.640	0.780
Cement and others	0.093	0.413	0.050	0.022 **	1.097
Wealth index					
Poorest	-	-	-	-	1.000
Poorer	-1.116	0.592	3.559	0.059 ***	0.328
Middle	-0.876	0.543	2.604	0.107	0.416
Richer	-0.851	0.491	3.010	0.083 ***	0.427
Richest	-0.548	0.427	1.651	0.199	0.578
Type of toilet facility					
Toilet with Flush	-	-	-	-	1.000
Pit latrine	-0.071	0.308	0.053	0.818	0.932
Hanging toilet and other	-0.074	0.207	0.128	0.721	0.929
Source of drinking water					
Pipe	-	-	-	-	1.000
Tube well or borehole	-0.322	0.661	0.238	0.626	0.724
Well and Protected spring	-0.034	0.471	0.005	0.942	0.966
Rivers/ponds/Others	0.129	0.900	0.020	0.886	1.137
Type of cooking					
Natural gas and kerosene	-	-	-	-	1.000
Wood	0.260	0.593	0.192	0.661	1.297
Agricultural crop	0.203	0.342	0.351	0.553	1.225
Animal dung and others	0.206	0.344	0.360	0.548	1.229

* is significant at 1%; ** is significant at 5% and *** is significant at 10% level of significance

The regression coefficient for administrative divisions of Chittagong, Dhaka, Khulna, Rajshahi and Sylhet were -0.453, -0.565, 0.109, -0.174 and 0.578 respectively. It was clear that except Khulna and Sylhet divisions all other divisions had negative coefficient which had less experience to neonatal mortality, on the other hand Khulna and Sylhet divisions had positive coefficient which had more experience to neonatal mortality. So the regression coefficient for Chittagong, Dhaka and Rajshahi divisions illustrate that neonatal mortality had less likelihood to be in neonatal mortality with compared to the Barisal division. Again Khulna and Sylhet divisions had more likely to be in neonatal mortality with compared to the Barisal division. The odds ratio of administrative divisions of Chittagong, Dhaka, Khulna, Rajshahi and Sylhet were 0.636, 0.568, 1.115, 0.840 and 1.782 respectively. It was indicated that the divisions of Khulna and Sylhet had 1.115 and 1.782 times higher risk being in neonatal mortality than those with Barisal division. On the contrary, Chittagong, Dhaka and Rajshahi divisions had $(1 - 0.636) \times 100 = 36.4\%$, $(1 - 0.568) \times 100 = 43.2\%$ and $(1 - 0.840) \times 100 = 16.0\%$ lower risk to be in neonatal mortality than Barisal division. This finding was substantiated by the fact that neonatal mortality occurred in highly densely populated areas. This may be due to the fact that peoples tendency to live and try to get better facilities from the capital city of Dhaka and the port city of Chittagong.

Place of residence had insignificant effect on neonatal mortality. The regression coefficient of place of residence of rural area was 0.134. So it was illustrated that residence in rural areas were the most likely to be in neonatal mortality than residence in urban areas. The odds ratio of place of residence of rural area was 1.143. It was indicated that place of residence in rural area had 1.143 times higher risks to be in neonatal mortality than that of in rural areas.

Mother's education status had insignificant effect on neonatal mortality in our given data. The regression coefficient for mother's education of primary, secondary and higher was -0.726, -0.567 and -0.357 respectively. It was indicated that mother's primary, secondary and higher education were comparatively less likely to be in neonatal mortality than mother's no education. The odds ratio of mother's primary, secondary and higher education were 0.484, 0.567 and 0.700 respectively. So it was illustrated that mother's primary, secondary and higher education have 0.484, 0.567 and 0.700 times lower risk to be in neonatal mortality than mother's had no education.

Father's education had significant effect on neonatal mortality. The regression coefficient for father's education of primary, secondary and higher was 0.890, 0.693 and 1.056 respectively. It was indicated that father's primary, secondary and higher education were more likely to be in neonatal mortality than father's had no education. The odds ratio of father's primary, secondary and higher education were 2.435, 2.000 and 2.875 respectively. It was indicated that father's primary, secondary and

higher education had 2.435, 2.000 and 2.875 times higher risk being in neonatal mortality than illiterate father.

Occupation of father had statistically insignificant effect on neonatal mortality. Here the regression coefficient of father's occupation for worker/labourer, professional worker, business and others were -0.478, -0.397, 0.600 and -0.367 respectively. It was clear except business all other occupations (Worker/Labourer, Professional worker and others) have negative coefficient which had comparatively less experience in neonatal mortality than agriculture. Only businessmen have the more experiences in neonatal mortality than farmers. The odds ratio of father's occupation for Day laborer, Professional worker, Business and Others were 0.620, 0.673, 1.822 and 0.693 respectively. So it was illustrated that father's occupation such as Day laborer had 0.620 times, Professional worker had 0.673 times, and others had 0.693 times lower risk being in neonatal mortality than agriculture. On the other hand, Businessmen had 1.822 times higher risk being in neonatal mortality than agriculture.

Mother's occupation had statistically insignificant effect on neonatal mortality. Here the regression coefficient of mother's occupation for worker/labourer, professional worker and others were 0.283, 0.448 and -0.014 respectively. It was clear occupations for Worker/Labourer and Professional worker had positive coefficient which have comparatively more experience in neonatal mortality than housewife. Only other occupations had less experience in neonatal mortality than housewife. The odds ratio of mother's occupation for Day laborer, Professional worker and others were 1.326, 1.565 and 0.986 respectively. So it was illustrated that father's occupation such as Day laborer had 1.326 times, Professional worker had 1.565 times higher risk to be in neonatal mortality than housewife mother. Again mother's for others occupation had $(1 - 0.986) \times 100 = 1.4\%$ lower risk being in neonatal mortality than housewife.

The regression coefficient for electricity in household was -0.899, which suggested that households with electricity have less likely to be in neonatal mortality than those which have no electricity. The regression coefficient for electricity was insignificant. The odds ratio for electricity was 0.407 which indicated that households were less likely to be in neonatal mortality where there was electricity. It was also indicated that keeping the other variables fixed for a unit change in electricity the odds in favour of a household being neonatal mortality decrease by $(1 - 0.407) \times 100 = 59.3\%$.

The estimated regression coefficient for television, radio and refrigerator in household were 0.304, -0.068 and 0.747 respectively. It was suggested that household with television and refrigerator have more likely to be in neonatal mortality than which have no television and refrigerator. But household with radio had less likely to be in neonatal mortality than which have no radio. The odds ratio for the

household with television, radio and refrigerator were 1.155, 0.934 and 2.111 respectively. It was illustrated that household with television and refrigerator were 1.155 and 2.111 times higher risks to be in neonatal mortality than where those goods were absent. Again household with radio had $(1 - 0.934) \times 100 = 6.6\%$ lower risk to be in neonatal mortality than which household has no radio.

Religion had no significant effect on neonatal mortality. The estimated regression coefficient for other religions was 0.400. It was illustrated that non Muslims were more likely to be in neonatal mortality than Muslims. The odds ratio for non Muslims was 1.492. It was indicated that non Muslims had 1.492 times higher risk being in neonatal mortality than Muslims. It was also indicated that keeping the other variables fixed for a unit change in religion the odds in favour of non Muslims being neonatal mortality increase by $(1.492 - 1) \times 100 = 49.2\%$.

Main wall material had significant effect on neonatal mortality. The estimated regression coefficient for main wall materials of bamboo with mud, tin and cement and others were 0.320, 0.249 and -0.222 respectively. It was indicated that main wall material such as Cement and Others had less likely to be in neonatal mortality than main wall materials of thatch/palm leaf. Again main wall materials like bamboo with mud and tin had more likely to be in neonatal mortality than main wall materials of thatch/palm leaf. The odds ratio of main wall materials of bamboo with mud, tin and cement and other were 1.377, 1.283 and 0.801 respectively. It was suggested that bamboo with mud based main wall materials were 1.377 times and Tin based main wall materials were 1.283 times higher risk to be in neonatal mortality than leaf based main wall materials. But cement and others based main wall materials were $(1 - 0.801) \times 100 = 19.9\%$ lower risk to be in neonatal mortality than leaf based main wall materials.

The regression coefficient of main floor material of cement and others were 0.060. Positive regression coefficient indicated that main floor material of cement and others were more likely to be in neonatal mortality than earth and sand based main floor materials. The odds ratio of main floor material of cement and others were 1.492. This was indicated that cement and others based main floor materials had 1.492 times higher risk to be in neonatal mortality than earth and sand based main floor materials.

The estimated regression coefficient of main roof material of tin, cement and others were -0.248 and 0.093 respectively. It was indicated that tin based main roof materials were less likely to be in neonatal mortality than those with thatch/palm leaf based main roof material. But cement and others based main roof materials were more likely to be in neonatal mortality than those with thatch/palm leaf based main roof material. The odds ratio of main roof material of tin, cement and others were 0.780 and 1.097 respectively. It was suggested that tin based main roof materials were 0.780 times lower risk and cement and others based main roof materials were

1.097 times higher risk to be in neonatal mortality than thatch/palm based main roof materials.

Households were classified into five types according to their wealth index. These five types were Poorest, Poorer, Middle, Richer and Richest. The estimated regression coefficient of wealth index of poorer, middle, richer and richest were -1.116, -0.876, -0.851 and -0.548 respectively. The negative regression coefficients of wealth index for poorer, middle, richer and richest were less experience to lead neonatal mortality than the poorest wealth index group. The odds ratio of wealth index of Poorer, Middle, Richer and Richest wealth status group were 0.328, 0.416, 0.427 and 0.578 respectively which indicated that except poorest wealth status group, all other types of wealth status groups were less likely to be in neonatal mortality.

Type of toilet facility had insignificant effect on neonatal mortality. The regression coefficient for type of toilet facility of pit latrine, hanging toilet/latrine and others were -0.071 and -0.074 respectively. It was indicated that type of toilet facility like pit latrine, hanging toilet/latrine and others have less likely to lead neonatal mortality than toilet with flush. The odds ratio of type of toilet facility of pit latrine, hanging toilet/latrine and other were 0.932 and 0.929 respectively. It was explained that pit latrine had $(1 - 0.932) \times 100 = 6.8\%$; hanging toilet/latrine and others have $(1 - 0.929) \times 100 = 7.1\%$ lower risk to be in neonatal mortality than toilet with flush.

The regression coefficient for source of drinking water from Tube well or borehole, Well and Protected spring and River/ponds/others were -0.322, -0.034 and 0.129 respectively. The estimated regression coefficient of source of drinking water explained that tube well or borehole and well & protected spring based source of drinking water have less likely to be in neonatal mortality, whereas rivers/ponds/others based source of drinking water had more likely to be in neonatal mortality. The odds ratio of source of drinking water from Tube well or borehole, Well and Protected spring and River/ponds/others were 0.724, 0.966 and 1.137 respectively. It was explained that source of drinking water from Tube well or borehole had 0.724 times and well and protected spring had 0.966 times lower risk to be in neonatal mortality than pipe based source of drinking water. But open place water or river/ponds/others sources based drinking water had 1.137 times higher risk to be in neonatal mortality than pipe based source of drinking water.

Types of cooking fuel were classified into four groups such as natural gas and kerosene, wood, agricultural crop and animal dung and others. The estimated regression coefficient of types of cooking fuel of natural gas and kerosene, wood, agricultural crop and animal dung and others were 0.260, 0.203 and 0.206 respectively. Types of cooking fuel of wood, agricultural crop and animal dung and others were more experience to lead neonatal mortality than natural gas and kerosene based type of cooking. The odds ratio of types of cooking fuel of natural

gas and kerosene, wood, agricultural crop and animal dung and others were 1.297, 1.225 and 1.229 respectively which indicated that except natural gas and kerosene all other types of cooking fuels were more likely to be in neonatal mortality.

Table 5.3.2: Logistic regression estimates for the demographic characteristics with neonatal mortality as the dependent variables in Bangladesh, BDHS-2007

Variable & Characteristics	Estimated Coefficients (B)	S.E. of estimates (B)	Wald Chi-square (Statistic)	Significant (P-value)	Odds ratio
Sex of child					
Male	-	-	-	-	1.000
Female	0.844	0.252	11.214	0.001 *	2.325
Birth order number					
1	-	-	-	-	1.000
2	-0.305	0.273	1.244	0.265	0.153
3	0.142	0.314	0.205	0.051 ***	1.009
4	0.008	0.306	0.001	0.978	1.277
5 and 5+	0.245	0.295	0.691	0.406	1.571
Previous birth interval					
< 24 months	-	-	-	-	1.000
24—60 months	-0.366	0.358	1.043	0.307	0.694
60+ months	-0.125	0.289	0.189	0.664	0.882
Age of mother at first birth					
<15 years	-	-	-	-	1.000
15—19 years	-0.907	1.098	0.682	0.409	0.404
19—24 years	-0.643	1.087	0.350	0.554	0.525
24+ years	-1.168	1.052	1.235	0.067 ***	0.311
Age at first marriage					
<15 years	-	-	-	-	1.000
15—19 years	0.132	1.130	0.014	0.907	1.142
19—24 years	-0.046	1.150	0.002	0.968	0.955
24+ years	-0.121	0.932	0.017	0.897	0.886
Duration of breastfeeding					
<1 month	-	-	-	-	1.000
1—12 months	21.298	27181.332	0.000	0.999	1776870
13—24 months	0.035	0.562	0.004	0.050 **	944.566
24+ months	0.204	0.389	0.275	0.600	1.036
No. of household members					
<4 members	-	-	-	-	1.000
4—6 members	0.227	0.289	0.617	0.432	1.255
6+ members	-0.197	0.404	0.237	0.626	0.821

* was significant at 1%; ** was significant at 5% and *** was significant at 10% level of significance

Sex of child had significant effect on neonatal mortality. The estimated regression coefficient for female child was 0.844. It was indicated that female child was more likely to be in neonatal mortality than male child. The odds ratio of sex of child of female was 0.146. It was indicated that female child had 2.325 times higher being in neonatal mortality than male child.

The regression coefficient of birth order number of 2, 3, 4 and 5+ were -0.305, 0.142, 0.008 and 0.245 respectively. It was indicated that second order number have negative coefficient which was less likely to be in neonatal mortality than first birth order and third, fourth and fifth plus birth order number had positive coefficient which was more likely to be in neonatal mortality than first birth order number. The odds ratio of 2, 3, 4 and 5+ birth order number were 0.153, 1.009, 1.277 and 1.571 respectively. It was illustrated that second birth order number had 0.153 times lower risk, but third birth order number had 1.009 times, fourth birth order number had 1.277 times and fifth and above birth order number had 1.571 higher risk to be in neonatal mortality than first birth order.

Previous birth interval had insignificant effect on neonatal mortality at 5% level of significant. The estimated regression coefficient of previous birth interval period of 24–60 months and 60+ months were -0.366 and -0.125 respectively. It was explained that both 24–60 months and above 60 months period of previous birth interval had less experience to lead neonatal mortality with compared to below 24 months period of previous birth interval. The odds ratio of previous birth interval of 2 to 5 years and above 5 years was 0.694 and 0.882 respectively. It was indicated that 2 to 5 years previous birth interval was 0.694 times and above 5 years previous birth interval was 0.882 times lower risk being in neonatal mortality than below 2 years previous birth interval.

Age of mother at first birth had significant effect on neonatal mortality at 5% level. The estimated regression coefficient of mother's age at first birth in 15–19 years, 19–24 years and 24+ years were -0.907, -0.643 and -1.168 respectively. It was indicated that all 15–19 years, 19–24 years and 24+ years age group mothers had less experience to lead neonatal mortality at their first birth with compared to below 15 years mother. The odds ratio of mother's age at first birth in 15–19 years, 19–24 years and 24+ years were 0.404, 0.525 and 0.311 respectively. It was suggested that 15–19 years age group mothers had 0.404 times and 19–24 years age group mothers had 0.525 times higher risk being in neonatal mortality than

below 15 years mother. But 24+ year's age groups mothers had 0.311 times lower risk to be in neonatal mortality than below 15 years mother.

Age at first marriage had insignificant effect on neonatal mortality at 5% level. The estimated regression coefficient of women age at first marriage in 15–19 years, 19–24 years and 24+ years were 0.132, -0.046 and -0.121 respectively. It was indicated that 15–19 years age group women had more experience to lead neonatal mortality but 19–24 years and 24+ years age group mothers had less experience to lead neonatal mortality at their first marriage with compared to below 15 years women. The odds ratio of women at first marriage in 15–19 years, 19–24 years and 24+ years were 1.142, 0.955 and 0.886 respectively. It was suggested that 15–19 years age group women had 1.142 times higher risk being in neonatal mortality than below 15 years women. But 19–24 years and 24+ year's age group women had 0.955 and 0.886 times lower risk being in neonatal mortality than below 15 years women.

Standard error was very high in calculation of duration of breastfeeding status. Multicollinearity problem affects in calculation of duration of breastfeeding portion. From the calculation, we see that duration of breastfeeding had statistically significant effect on neonatal mortality. The estimated regression coefficient of duration of breastfeeding for 1–12 months, 13–24 months and 24+ months were 21.298, 0.035 and 0.204 respectively. It was explained that all duration for breastfeeding was more likely to lead neonatal mortality except below 1 month breastfeeding. The odds ratio of duration of breastfeeding for 1–12 months, 13–24 months and 24+ months were 1776870944.566, 1.036 and 1.226 respectively. It was indicated that 1–12 months breastfeeding had 1776870944.566 times, 13–24 months breastfeeding had 1.036 times and 24+ months breastfeeding had 1.226 times higher risk to be in neonatal mortality than below 1 month breastfeeding.

The regression coefficient for family size or 4–6 and 6+ numbers of household members were 0.227 and -0.197 respectively. It was suggested that household with 4–6 have more likely to be in neonatal mortality than below 4 members of household, again more than 6 members households had less experience to lead neonatal mortality than below 4 members of household. The odds ratio of 4–6 and 6+ numbers of household members were 1.255 and 0.821 respectively. It was explained that 4–6 members household had 1.255 times higher risk to be in neonatal mortality and more

than 6 members household had $(1 - 0.821) \times 100 = 17.9\%$ lower risk to be in neonatal mortality than below 4 members household.

Table 5.3.3: Logistic regression estimates for the maternal health care service utilization characteristics with neonatal mortality as the dependent variables in Bangladesh, BDHS-2007

Variable & Characteristics	Estimated Coefficients (B)	S.E. of estimates (B)	Wald Chi-square (Statistic)	Significant (P-value)	Odds ratio
Place of delivery					
Home	-	-	-	-	1.000
Any medical facility	-1.841	1.115	2.726	0.099 ***	0.159
Timing of first antenatal check					
< 3 times	-	-	-	-	1.000
3—5 times	0.863	1.020	0.715	0.098 ***	2.370
5+ times	0.217	0.992	0.048	0.827	1.242
Tetanus injections before pregnancy					
1—3 doses	-	-	-	-	1.000
3—5 doses	0.687	0.987	0.485	0.486	1.988
5+ doses	1.865	1.121	2.766	0.096 ***	6.458
Read newspaper or magazine					
No	-	-	-	-	1.000
Yes	0.289	0.952	0.092	0.761	1.336
Listen radio					
No	-	-	-	-	1.000
Yes	-0.110	0.779	0.020	0.887	0.895
Watch television					
No	-	-	-	-	1.000
Yes	-0.201	0.882	0.052	0.820	0.818

* was significant at 1%; ** was significant at 5% and *** was significant at 10% level of significance

The estimated regression coefficients for place of delivery with any medical facility from any medical institute such as Government hospital, Maternal and child welfare centre, PVT Hospital/clinic was -1.841. It was suggested that all the mentioned places i.e. government hospital, maternal and child welfare centre, private hospital/clinic and other places were less likely to lead neonatal mortality than home which was treated as a place of delivery. The odds ratio of place of delivery in any medical facility (Government hospital, Maternal and child welfare centre, PVT Hospital/clinic) was 0.159. It was explained that place of delivery in any medical facility (Government hospital, Maternal and child welfare centre, PVT Hospital/clinic)

had 0.159 times lower risk to be in neonatal mortality than home which was treated as a place of delivery.

The estimated regression coefficients for timing of first antenatal check for 3—5 times and 5+ times were 0.863 and 0.217 respectively. It was explained that both 3—5 times and more than 5 times antenatal checks have more experience to lead neonatal mortality than below 3 times first antenatal check. The odds ratio for timing of first antenatal check for 3—5 times and more than 5 (5+) times were 2.370 and 1.242 respectively. It was indicated that 3—5 times antenatal check had 2.370 times and more than 5 (5+) times antenatal check had 1.242 times higher risk to be in neonatal mortality than below 3 times first antenatal check.

The estimated regression coefficient for tetanus injections before pregnancy of 3—5 doses and more than 5 (5+) doses were 0.687 and 1.865 respectively. It was explained that both 3—5 doses and more than 5 doses of tetanus injections before pregnancy had more experience to lead neonatal mortality than 1—3 doses of tetanus injection before pregnancy. The odds ratio for tetanus injections before pregnancy of 3—5 doses and more than 5 (5+) doses were 1.988 and 6.458 respectively. It was indicated that during pregnancy 3—5 doses of tetanus injections had 1.988 times and more than 5 (5+) doses of tetanus injections had 6.458 times higher risk to be in neonatal mortality than 1—3 doses of tetanus injection before pregnancy.

The regression coefficient for mother's read newspaper or magazine was 0.289, which indicates that the household where mother read newspaper or magazine was more likely to be in neonatal mortality than the household where mother does not read newspaper or magazine. The odds ratio for mother read newspaper or magazine was 1.336 which indicated that where mother read newspaper or magazine, it was 1.336 times higher risk to be in neonatal mortality than mother does not read newspaper or magazine.

The regression coefficient for mother's listening radio was -0.110 which indicates that the household where mother listen radio was less likely to be in neonatal mortality than the household where mother does not listen radio. The odds ratio for mothers mass media exposures in listen radio was 0.895 which indicated that where mother listen radio, it was 0.895 times lower risk being in neonatal mortality than mother does not listen radio.

The regression coefficient for mother's watching television was -0.201 which indicates that the household where mother watch television was less likely to be in neonatal mortality than the household where mother does not watch television. The odds ratio for mother watching television was 0.818 which indicated that where mother watch television; it was 0.818 times lower risk to be in neonatal mortality than mother does not watch television.

Salient features of neonatal mortality

Table 5.3.1 to 5.3.3 presented the neonatal mortality group built from the abovementioned variables. In the neonatal mortality group, out of all the variables that were included in the logistic regression, division, father's education, main roof materials, main wall materials, main floor materials, wealth status, sex of child, birth order number, age of mother at first birth, duration of breastfeeding, place of delivery, timing of first antenatal check and tetanus injection before pregnancy appeared to be the most significant factors in determining the likelihood of dying before reaching the first month of life. According to the neonatal mortality group,

- Chittagong, Dhaka and Rajshahi divisions were less likely but Khulna and Sylhet divisions were more likely to lead in neonatal mortality with compared to the Barisal division. The divisions of Chittagong, Dhaka, Khulna and Rajshahi have 36%, 43% and 16% lower risk but Khulna division had 1.115 times and Sylhet division had 1.782 times higher risk to be in neonatal mortality with compared to Barisal division.

- Place of residence has significant effect on neonatal mortality. Residence in rural area was the more likely to be in neonatal mortality than urban areas. Place of residence in rural area had 1.143 times higher risk to be in neonatal mortality than urban areas.

- Mother with primary, secondary and higher education were comparatively less likely to be in neonatal mortality than illiterate mother. Highly educated mother had lowest risk to lead neonatal mortality.

- Mother's occupation for Worker/Labourer, Professional worker had more experience in neonatal mortality than housewife. Other occupations had less experience in neonatal mortality than housewife.

- Literate father's had higher risk being in neonatal mortality than illiterate father. Fathers with primary, secondary and higher education had 2.435, 2.000 and 2.875 times higher risk being in neonatal mortality than fathers with no education.

➤ Except business all other occupations (Worker/Labourer, Professional worker and others) had less experience in neonatal mortality than agriculture. Businessmen had 1.822 times higher risk being in neonatal mortality than agriculture.

➤ The households with electricity had less likely to be in neonatal mortality than those which had no electricity. Households with electricity had 60% lower risk being in neonatal mortality than those households where electricity was absent.

➤ Household with television and refrigerator were more likely to be in neonatal mortality than where those goods were absent. But household with radio had less experience to lead neonatal mortality than where these goods were absent.

➤ Non Muslims were more likely to be in neonatal mortality than Muslims. Non Muslims had 1.492 times higher risk being in neonatal mortality than Muslims.

➤ Main wall materials such as bamboo with mud and tin were more likely to be in neonatal mortality than main wall materials of thatch/palm leaf. But main wall material of cement and others were less likely to be in neonatal mortality than main wall materials of thatch/palm leaf.

➤ Main floor material of cement and others were more likely to be in neonatal mortality than earth and sand based main floor materials.

➤ Tin based main roof materials were less likely to be in neonatal mortality than those with thatch/palm leaf based main roof material. Cement and others based main roof materials were 1.097 times higher risk to be in neonatal mortality than thatch/palm based main roof materials.

➤ Poorer, middle, richer and richest were less experience to lead neonatal mortality than the poorest wealth index group. Wealth status conditions were inversely related with neonatal mortality. Except poorest wealth status group, all other types of wealth status groups were less likely to be in neonatal mortality.

➤ Type of toilet facilities like pit latrine, hanging toilet/latrine and others were less likely to lead neonatal mortality than toilet with flush.

➤ Tube well or borehole and well & protected spring based source of drinking water were less likely to be in neonatal mortality, whereas open places like rivers/ponds/ others based source of drinking water were more likely to be in neonatal mortality than pipe based sources of drinking water.

➤ Types of cooking fuel of wood, agricultural crop and animal dung and others were more experience to lead infant mortality than natural gas and kerosene based type of cooking. Except natural gas and kerosene all other types of cooking fuels were more likely to be in neonatal mortality.

➤ Female child was more likely to be in neonatal mortality than male child. Female child had 2.325 higher risks being in neonatal mortality than male child.

➤ In birth order number, second order number had less likely but third, fourth, fifth and fifth plus birth order number had more likely to die before reaching first month of life than first birth order number.

➤ 24–60 months and above 60 months period of previous birth interval had less experience to lead neonatal mortality with compared to below 24 months period of previous birth interval.

➤ 15–19 years, 19–24 years and 24+ year's age group mothers had less experience to lead neonatal mortality at their first birth with compared to below 15 years mother. 15–19 years mothers had 59.6%, 19–24 mothers had 47.5%, 24+ years mothers had 68.9% lower risk to be in neonatal mortality than below 15 years mother.

➤ 15–19 years age group women had more experience to lead neonatal mortality but 19–24 years and 24+ years age group mothers had less experience to lead neonatal mortality at their first marriage with compared to below 15 years women.

➤ Any duration for breastfeeding was more likely to lead neonatal mortality except below 1 month breastfeeding.

➤ Household with 4–6 were more likely to be in neonatal mortality but more than 6 member's households were less experience to lead neonatal mortality than below 4 members of household. 4–6 members household had 1.255 times higher risk and more than 6 members household had $(1 - 0.821) \times 100 = 17.9\%$ lower risk to be in neonatal mortality than below 4 members household.

➤ Place of delivery with any medical facility from any medical institute such as Government hospital, Maternal and child welfare centre, PVT Hospital/clinic were less likely to lead neonatal mortality than home which was treated as a place of delivery.

➤ Both 3–5 times and more than 5 times of antenatal checks have more experience to lead neonatal mortality than below 3 times first antenatal check. 3–5 times antenatal check had 2.370 times and more than 5 (5+) times antenatal check had 1.242 times higher risk to be in neonatal mortality than below 3 times first antenatal check.

➤ Both 3–5 doses and more than 5 doses of tetanus injections before pregnancy had more experience to lead neonatal mortality than 1–3 doses of

tetanus injection before pregnancy. Before pregnancy 3—5 doses of tetanus injections had 1.988 times and more than 5 (5+) doses of tetanus injections had 6.458 times higher risk to be in neonatal mortality than 1—3 doses of tetanus injection before pregnancy.

➤ Household where mother read newspaper or magazine was more likely to be in neonatal mortality than the household where mother does not read newspaper or magazine. On the other hand, household where mother listen radio and watch television were less likely to be in neonatal mortality than the household where mother did not listen radio and watch television.

This group suggests that in order to lower neonatal mortality, it was essential to provide greater attention to increase education of lower educated women. Alternatively, the reproductive health program should pay special attention to the need of lower educated women. Similarly, it was very important for the Bangladesh government to take action to provide with electricity those households that do not use electricity in order to decrease neonatal mortality. Thus, according to the findings of this study, high risk of neonatal mortality in Bangladesh could be exists in those families where it was situated in rural areas, where parent's education was low, father's were businessmen, mother's were either worker or service holder, absence of radio in the house, sources of drinking water was open places, toilet with flush based sanitation system, new born babies were female, children were born within short birth intervals, women age at first marriage was 15—19 years, mother age at first birth was below 15 years, duration of breastfeeding was above 1 month, household with 4—6 members and which did not use electricity.

5.4 Group 2: Socio-economic, demographic and maternal health care service utilization characteristics for post-neonatal mortality

In logistic regression of group 2, it was includes that post-neonatal mortality was dependent variable and the selected socio-economic, demographic and maternal health care service utilization characteristics were the same as independent variable. According to the fitted group as shown in Table 5.4.1 to 5.4.3, 10 independent variables out of 31 independent variables were statistically significant at 1%, 5% and 10% level of significant. These significant variables of post-neonatal mortality were division, mother's education, mother's occupation, electricity, main wall materials, wealth status, type of cooking fuel, sex of child, previous birth interval and tetanus injection before pregnancy. The rest of the independent variables were statistically insignificant on post-neonatal mortality.

Table 5.4.1: Logistic regression estimates for the socio-economic characteristics with post-neonatal mortality as the dependent variables in Bangladesh, BDHS-2007

Variable & Characteristics	Estimated Coefficients (B)	S.E. of estimate s (B)	Wald Chi-square (Statistic)	Significant (P-value)	Odds ratio
Region/Division					
Barisal	-	-	-	-	1.000
Chittagong	-0.396	0.333	1.410	0.235	0.673
Dhaka	-0.096	0.293	0.108	0.743	0.908
Khulna	-0.299	0.305	0.960	0.327	0.742
Rajshahi	-0.413	0.336	1.510	0.219	0.662
Sylhet	-0.893	0.335	7.126	0.008 *	0.409
Residence					
Urban	-	-	-	-	1.000
Rural	0.228	0.231	0.974	0.324	1.256
Mother's Education					
No education	-	-	-	-	1.000
Primary	-0.888	0.856	1.078	0.299	0.411
Secondary	-0.810	0.858	0.890	0.346	0.445
Higher	-0.908	0.835	1.183	0.077 ***	0.403
Father's Education					
No education	-	-	-	-	1.000
Primary	-0.358	0.581	0.380	0.538	0.699
Secondary	0.020	0.568	0.001	0.972	1.020
Higher	-0.246	0.559	0.193	0.660	0.782
Father's Occupation					
Agriculture	-	-	-	-	1.000
Worker/Labourer	0.581	0.948	0.376	0.540	1.788
Professional worker	0.501	0.941	0.283	0.595	1.650
Business	-0.147	1.029	0.021	0.886	0.863
Others	0.463	0.946	0.239	0.625	1.588
Mother's Occupation					
Housewife	-	-	-	-	1.000
Worker/Labourer	-0.623	0.384	2.636	0.104	0.536
Professional worker	-0.873	0.472	3.419	0.064 ***	0.418
Others	0.621	1.612	0.148	0.700	1.860
Has electricity					
No	-	-	-	-	1.000
Yes	-0.623	0.573	1.185	0.027 **	0.536
Household goods					
Has television					
No	-	-	-	-	1.000
Yes	-0.165	0.299	0.304	0.582	0.846
Has radio					
No	-	-	-	-	1.000
Yes	0.077	0.231	0.110	0.740	1.080
Has refrigerator					
No	-	-	-	-	1.000
Yes	-0.044	0.547	0.006	0.331	0.577

Variable & Characteristics	Estimated Coefficients (B)	S.E. of estimates (B)	Wald Chi-square (Statistic)	Significant (P-value)	Odds ratio
Religion					
Islam	-	-	-	-	1.000
Others	-0.508	0.284	3.183	0.936	0.957
Main roof material					
Thatch/palm leaf	-	-	-	-	1.000
Tin	0.128	0.635	0.041	0.840	1.137
Cement and others	0.037	0.508	0.005	0.943	1.037
Main wall material					
Thatch/palm leaf	-	-	-	-	1.000
Bamboo with mud	-0.361	0.357	1.026	0.311	0.697
Tin	-0.490	0.362	1.830	0.076 ***	0.613
Cement and others	-0.081	0.324	0.063	0.802	0.922
Main floor material					
Earth, sand	-	-	-	-	1.000
Cement and others	-0.598	0.492	1.477	0.224	0.550
Wealth index					
Poorest	-	-	-	-	1.000
Poorer	1.307	0.710	3.391	0.066 ***	3.696
Middle	1.041	0.658	2.504	0.114	2.831
Richer	1.451	0.593	5.999	0.014 **	4.269
Richest	0.903	0.507	3.170	0.075 ***	2.467
Type of toilet facility					
Toilet with Flush	-	-	-	-	1.000
Pit latrine	0.015	0.354	0.002	0.967	1.015
Hanging toilet and other	-0.072	0.243	0.088	0.767	0.930
Source of drinking water					
Pipe	-	-	-	-	1.000
Tube well or borehole	-0.154	0.751	0.042	0.838	0.857
Well and Protected spring	-0.371	0.514	0.522	0.470	0.690
Rivers/ponds/Others	-0.648	1.023	0.401	0.526	0.523
Type of cooking					
Natural gas and kerosene	-	-	-	-	1.000
Wood	-1.071	0.724	2.185	0.139	0.343
Agricultural crop	-0.241	0.380	0.404	0.525	0.786
Animal dung and others	-0.235	0.383	0.378	0.039 **	0.790

* was significant at 1%; ** was significant at 5% and *** was significant at 10% level of significance

Table 5.4.2: Logistic regression estimates for the demographic characteristics with post-neonatal mortality as the dependent variables in Bangladesh, BDHS-2007

Variable & Characteristics	Estimated Coefficients (B)	S.E. of estimates (B)	Wald Chi-square (Statistic)	Significant (P-value)	Odds ratio
Sex of child					
Male	-	-	-	-	1.000
Female	-0.784	0.292	7.209	0.007 *	0.457
Birth order number					
1	-	-	-	-	1.000
2	0.485	0.313	2.399	0.121	1.624
3	0.183	0.340	0.279	0.598	1.201
4	0.035	0.331	0.011	0.917	1.035
5 and 5+	0.355	0.334	1.129	0.288	1.426
Previous birth interval					
< 24 months	-	-	-	-	1.000
24—60 months	0.314	0.395	0.629	0.428	1.368
60+ months	-0.110	0.330	0.110	0.040 **	0.896
Duration of Breastfeeding					
0 month	-	-	-	-	1.000
1—12 months	-20.139	28008.133	0.000	0.999	0.000
12—24 months	-1.234	0.802	2.366	0.124	0.291
24+ months	-0.172	0.437	0.155	0.693	0.842
Age at first marriage					
<15 years	-	-	-	-	1.000
15—19 years	-1.293	1.381	0.876	0.349	0.274
19—24 years	-0.830	1.407	0.348	0.555	0.436
24+ years	-1.749	1.189	2.164	0.141	0.174
Age of mother at first birth					
<15 years	-	-	-	-	1.000
15—19 years	0.329	1.343	0.060	0.806	1.390
19—24 years	0.130	1.334	0.010	0.922	1.139
24+ years	0.720	1.308	0.303	0.582	2.055
No. of household members					
<4 members	-	-	-	-	1.000
4—6 members	0.153	0.331	0.215	0.643	1.165
6+ members	0.308	0.457	0.454	0.500	1.361

* was significant at 1%; ** was significant at 5% and *** was significant at 10% level of significance

Table 5.4.3: Logistic regression estimates for the maternal health care service utilization characteristics with post-neonatal mortality as the dependent variables in Bangladesh, BDHS-2007

Variable & Characteristics	Estimated Coefficients (B)	S.E. of estimates (B)	Wald Chi-square (Statistic)	Significant (P-value)	Odds ratio
Place of delivery					
Home	-	-	-	-	1.000
Any medical facility	1.366	1.421	0.924	0.336	3.921
Timing of first antenatal check					
< 3 times	-	-	-	-	1.000
3—5 times	0.260	1.147	0.051	0.821	1.296
5+ times	-20.592	13215.014	0.000	0.999	0.000
Tetanus injections before pregnancy					
1—3 doses	-	-	-	-	1.000
3—5 doses	-0.108	1.216	0.008	0.929	0.898
5+ doses	-0.854	1.398	0.373	0.041 **	0.426
Read newspaper or magazine					
No	-	-	-	-	1.000
Yes	-0.744	1.251	0.354	0.552	0.475
Listen radio					
No	-	-	-	-	1.000
Yes	-1.504	1.041	2.088	0.148	0.222
Watch television					
No	-	-	-	-	1.000
Yes	0.397	1.141	0.121	0.728	1.488

* was significant at 1%; ** was significant at 5% and *** was significant at 10% level of significance

Salient features of post-neonatal mortality

Table 5.4.1 to 5.4.3 presents the post-neonatal mortality group built from the abovementioned variables. In the post-neonatal mortality group, out of all the variables that were included in the logistic regression, division, mother's education, mother's occupation, electricity, main wall materials, wealth status, type of cooking fuel, sex of child, previous birth interval and tetanus injection before pregnancy appeared to be the most significant factors in determining the likelihood of dying before reaching one year of life. According to the post-neonatal mortality group,

➤ Chittagong, Dhaka, Khulna, Rajshahi and Sylhet divisions were less likely to lead in neonatal mortality with compared to the Barisal division. Chittagong, Dhaka, Khulna, Rajshahi and Sylhet had 32.7%, 9.2%, 25.8%, 33.8% and 59.1% lower risk to be in post-neonatal mortality than those with Barisal division respectively.

➤ Residence in rural area was the more likely to be in post-neonatal mortality than urban areas. Place of residence in rural area had 1.256 times higher risk to be in post-neonatal mortality than urban areas.

➤ Mother with primary, secondary and higher education were comparatively less likely to be in neonatal mortality than illiterate mother. Mother with secondary level of education has lowest risk to lead post-neonatal mortality.

➤ Father with secondary level of education has higher risk being in post-neonatal mortality than illiterate father. Fathers with primary and higher education had 30.1% and 21.8% lower risk being in post-neonatal mortality than fathers with no education.

➤ Except business all other occupations (Worker/Labourer, Professional worker and others) have more experience in post-neonatal mortality than agriculture. Businessmen had 13.4% lower risk being in neonatal mortality than agriculture.

➤ Mother's occupation for Worker/Labourer, Professional worker have less experience in post-neonatal mortality than housewife. Other occupations of mother had 1.860 times higher risk in post-neonatal mortality than housewife.

➤ The households with electricity have less likely to be in post-neonatal mortality than those which had no electricity. Households with electricity had 46.4% lower risk being in post-neonatal mortality than those households where electricity was absent.

➤ Household with television and refrigerator were less likely to be in post-neonatal mortality than where those goods were absent. But household with radio had more experience to lead post-neonatal mortality than where these goods were absent.

➤ Non Muslims were less likely to be in post-neonatal mortality than Muslims. Non Muslims had 4.3% lower risk being in post-neonatal mortality than Muslims.

➤ Main wall materials such as bamboo with mud, tin and cement and others were less likely to be in post-neonatal mortality than main wall materials of thatch/palm leaf.

➤ Main floor material of cement and others have lower risk to lead post-neonatal mortality than earth and sand based main floor materials.

➤ Both tin and cement and others based main roof materials were more likely to be in post-neonatal mortality than those with thatch/palm leaf based main roof material.

➤ Poorer, middle, richer and richest wealth status groups were higher experience to lead post-neonatal mortality than the poorest wealth index group.

Wealth status conditions were related with post-neonatal mortality. Except poorest wealth status group, all other types of wealth status groups were more likely to be in post-neonatal mortality.

- Type of toilet facilities like pit latrine have more experience to lead post-neonatal mortality, but hanging toilet/latrine and others had less likely to lead post-neonatal mortality than toilet with flush.

- Tube well or borehole, well & protected spring and open place based source of drinking water were less likely to be in post-neonatal mortality than pipe based sources of drinking water.

- Types of cooking fuel of wood, agricultural crop and animal dung and others were less experience to lead post-neonatal mortality than natural gas and kerosene based type of cooking.

- Female child was less likely to be in post-neonatal mortality than male child. Female child had 54.3% lower risk being in neonatal mortality than male child.

- In birth order number, second, third, fourth, fifth and fifth plus birth order number had more experience to die before reaching first eleven month of life than first birth order number.

- 24–60 months previous birth interval have higher experience but above 60 months period of previous birth interval had lower experience to lead post-neonatal mortality with compared to below 24 months period of previous birth interval.

- 15–19 years, 19–24 years and 24+ year's age group mothers had more experience to lead post-neonatal mortality at their first birth with compared to below 15 years mother.

- 15–19 years, 19–24 years and 24+ year's age group mothers had less experience to lead post-neonatal mortality at their first marriage with compared to below 15 years women.

- Any duration for breastfeeding was lower experience to lead post-neonatal mortality except below 1 month duration of breastfeeding.

- Household with 4–6 and more than 6 member's households were more experience to lead post-neonatal mortality than below 4 members of household.

- Place of delivery with any medical facility from any medical institute such as Government hospital, Maternal and child welfare centre, PVT Hospital/clinic had higher risk to lead post-neonatal mortality than home which was treated as a place of delivery.

➤ 3—5 times antenatal check have more experience to lead post-neonatal mortality but more than 5 times antenatal checks had less experience to lead post-neonatal mortality than below 3 times first antenatal check.

➤ Both 3—5 doses and more than 5 doses of tetanus injections before pregnancy have less experience to lead neonatal mortality than 1—3 doses of tetanus injection before pregnancy. Before pregnancy 3—5 doses of tetanus injections had 10.2% and more than 5 (5+) doses of tetanus injections had 57.4% lower risk to be in post-neonatal mortality than 1—3 doses of tetanus injection before pregnancy.

➤ Household where mother read newspaper or magazine was less likely to be in post-neonatal mortality than the household where mother did not read newspaper or magazine. On the other hand, household where mother listen radio and watch television were more likely to be in post-neonatal mortality than the household where mother does not listen radio and watch television.

According to the findings of this study, high risk of post-neonatal mortality in Bangladesh could be exists in those families where it was situated in rural areas, where parent's education was low, father's were businessmen, mother's were either worker or service holder, absence of radio in the house, sources of drinking water was open places, toilet with flush based sanitation system, new born babies were female, children were born within short birth intervals, women age at first marriage was 15—19 years, mother age at first birth was below 15 years, duration of breastfeeding was above 1 month, household with 4—6 members and which did not use electricity.

5.5 Group 3: Socio-economic, demographic and maternal health care service utilization characteristics for infant mortality

In logistic regression of group 3, it was includes that infant mortality was dependent variable and the selected socio-economic, demographic and maternal health care service utilization characteristics were the same as independent variable. According to the fitted group as shown in Table 5.5.1 to 5.5.3, 10 independent variables out of 30 independent variables were statistically significant at 1%, 5% and 10% level of significant. These significant variables of infant mortality were division, father's education, father's occupation, refrigerator as household goods, main roof materials, sanitation system, sex of child, birth order number, age of mother at first birth, number of household members. The rest of the independent variables were statistically insignificant on infant mortality.

Table 5.5.1: Logistic regression estimates for the socioeconomic characteristics with infant mortality as the dependent variables in Bangladesh, BDHS-2007

Variable & Characteristics	Estimated Coefficients (B)	S.E. of estimates (B)	Wald Chi-square (Statistic)	Significant (P-value)	Odds ratio
Region/Division					
Barisal	-	-	-	-	1.000
Chittagong	-0.848	0.321	6.991	0.008 *	0.428
Dhaka	-0.696	0.286	5.908	0.015 **	0.499
Khulna	-0.152	0.301	0.256	0.613	0.859
Rajshahi	-0.594	0.330	3.242	0.072 ***	0.552
Sylhet	-0.022	0.320	0.005	0.944	0.978
Residence					
Urban	-	-	-	-	1.000
Rural	0.370	0.228	2.647	0.104	1.448
Mother's Education					
No education	-	-	-	-	1.000
Primary	-1.282	0.944	1.844	0.174	0.277
Secondary	-1.022	0.951	1.155	0.283	0.360
Higher	-0.836	0.927	0.814	0.367	0.433
Father's Education					
No education	-	-	-	-	1.000
Primary	0.898	0.527	2.903	0.088 ***	2.454
Secondary	1.034	0.519	3.966	0.046 **	2.814
Higher	1.215	0.512	5.626	0.018 **	3.370
Father's Occupation					
Agriculture	-	-	-	-	1.000
Worker/laborer	1.357	0.924	2.156	0.142	3.884
Professional worker	1.379	0.918	2.256	0.133	3.971
Business	2.428	1.106	4.817	0.028 **	11.333
Others	1.412	0.921	2.352	0.125	4.104
Mother's Occupation					
Housewife	-	-	-	-	1.000
Worker/laborer	-0.167	0.404	0.171	0.679	0.846
Professional worker	-0.181	0.469	0.149	0.699	0.834
Others	20.220	25347.776	0.000	0.999	604314 797.386
Has electricity					
No	-	-	-	-	1.000
Yes	0.011	1.018	0.000	0.992	1.011
Household goods					
Has television					
No	-	-	-	-	1.000
Yes	0.249	0.295	0.714	0.398	1.283
Has radio					
No	-	-	-	-	1.000
Yes	-0.009	0.220	0.002	0.967	0.991
Has refrigerator					
No	-	-	-	-	1.000
Yes	0.896	0.496	3.268	0.071 **	2.450

Variable & Characteristics	Estimated Coefficients (B)	S.E. of estimates (B)	Wald Chi-square (Statistic)	Significant (P-value)	Odds ratio
Religion					
Islam	-	-	-	-	1.000
Other	0.025	0.284	0.008	0.930	1.025
Main roof material					
Thatch/palm leaf	-	-	-	-	1.000
Tin	-0.057	0.573	0.010	0.921	0.945
Cement and others	0.278	0.458	0.370	0.543	1.321
Main wall material					
Thatch/palm leaf	-	-	-	-	1.000
Bamboo with mud	-0.033	0.355	0.009	0.925	0.967
Tin	-0.227	0.356	0.406	0.524	0.797
Cement and others	-0.441	0.329	1.797	0.180	0.644
Main floor material					
Earth, sand	-	-	-	-	1.000
Cement and others	-0.679	0.530	1.640	0.200	0.507
Wealth index					
Poorest	-	-	-	-	1.000
Poorer	-0.076	0.655	0.014	0.907	0.927
Middle	-0.021	0.605	0.001	0.973	0.980
Richer	0.389	0.555	0.491	0.484	1.476
Richest	0.267	0.497	0.288	0.592	1.306
Source of drinking water					
Pipe	-	-	-	-	1.000
Tube well or borehole	-0.647	0.754	0.737	0.391	0.524
Well and Protected spring	-0.360	0.553	0.423	0.516	0.698
Rivers/ponds/others	-0.464	1.030	0.203	0.652	0.629
Type of toilet facility					
Toilet with Flush	-	-	-	-	1.000
Pit latrine	-0.022	0.345	0.004	0.049 **	0.978
Hanging toilet and others	-0.135	0.222	0.369	0.543	0.874
Type of cooking					
Natural gas and kerosene	-	-	-	-	1.000
Wood	-0.570	0.646	0.777	0.378	0.566
Agricultural crop	0.034	0.374	0.008	0.928	1.035
Animal dung and others	0.045	0.372	0.014	0.904	1.046

* was significant at 1%; ** was significant at 5% and *** was significant at 10% level of significance

Table 5.5.2: Logistic regression estimates for the demographic characteristics with infant mortality as the dependent variables in Bangladesh, BDHS-2007

Variable & Characteristics	Estimated Coefficients (B)	S.E. of estimates (B)	Wald Chi-square (Statistic)	Significant (P-value)	Odds ratio
Sex of child					
Male	-	-	-	-	1.000
Female	0.484	0.292	2.745	0.098 ***	1.623
Birth order number					
1	-	-	-	-	1.000
2	0.073	0.314	0.055	0.815	1.076
3	-0.351	0.342	1.053	0.305	0.704
4	0.072	0.355	0.042	0.038 ***	1.075
5 and 5+	-0.482	0.317	2.308	0.129	0.618
Previous birth interval					
< 24 months	-	-	-	-	1.000
24—60 months	0.024	0.423	0.003	0.955	1.024
60+ months	-0.126	0.338	0.140	0.709	0.881
Month of Breastfeeding					
<1 month	-	-	-	-	1.000
1—12 months	19.903	27667.755	0.000	0.999	440413955.1
13—24 months	-0.889	0.582	2.337	0.126	0.411
24+ months	0.218	0.457	0.227	0.634	1.243
Age of mother at first birth					
<15 years	-	-	-	-	1.000
15—19 years	0.035	0.435	0.006	0.936	1.035
19—24 years	0.254	0.409	0.386	0.034 **	1.290
24+ years	0.214	0.495	0.187	0.665	1.239
No. of household members					
<4 members	-	-	-	-	1.000
4—6 members	0.540	0.323	2.794	0.095 ***	1.716
6+ members	0.113	0.425	0.070	0.791	1.119

* was significant at 1%; ** was significant at 5% and *** was significant at 10% level of significance

Table 5.5.3: Logistic regression estimates for the maternal health care service utilization characteristics with infant mortality as the dependent variables in Bangladesh, BDHS-2007

Variable & Characteristics	Estimated Coefficients (B)	S.E. of estimates (B)	Wald Chi-square (Statistic)	Significant (P-value)	Odds ratio
Place of delivery					
Home	-	-	-	-	1.000
Any medical facility	0.558	0.469	1.413	0.235	1.747
Read newspaper or magazine					
No	-	-	-	-	1.000
Yes	0.207	0.481	0.185	0.667	1.230
Listen radio					
No	-	-	-	-	1.000
Yes	0.733	0.457	2.572	0.109	2.080
Watch television					
No	-	-	-	-	1.000
Yes	-0.046	0.472	0.009	0.923	0.955

* was significant at 1%; ** was significant at 5% and *** was significant at 10% level of significance

Salient features of infant mortality

Table 5.5.1 to 5.5.3 presented the infant mortality group built from the abovementioned variables. In the infant mortality group, out of all the variables that were included in the logistic regression, division, father's education, father's occupation, refrigerator as household goods, main roof materials, sanitation system, sex of child, birth order number, age of mother at first birth, number of household members appeared to be the most significant factors in determining the likelihood of dying before reaching the first month of life. According to the infant mortality group,

- Chittagong, Dhaka, Khulna, Rajshahi and Sylhet divisions were less likely to lead in infant mortality with compared to the Barisal division. Chittagong, Dhaka, Khulna, Rajshahi and Sylhet had 57.2%, 50.1%, 14.1%, 44.8% and 2.2% lower risk to be in infant mortality than those with Barisal division respectively.

- Residence in rural area was the more likely to be in infant mortality than urban areas. Place of residence in rural area had 1.448 times higher risk to be in infant mortality than urban areas.

- Mother with primary, secondary and higher education were comparatively less likely to be in infant mortality than illiterate mother. Mother with primary level of education had lowest risk to lead infant mortality.

- Father with primary, secondary and higher level of education has higher risk being in infant mortality than illiterate father. Fathers with higher education had highest risk in infant mortality.

- Father's occupations such as worker/labourer, professional worker, business and others had more experience in child mortality than agriculture.

- Mother's occupations of worker/labourer and professional worker have less experience in child mortality than housewife. Other occupations of mother had higher risk in child mortality than housewife.

- The households with electricity had more likely to be in infant mortality than those which had no electricity. Households with electricity had 1.011 times higher risk being in infant mortality than those households where electricity was absent.

- Household with television and refrigerator were more likely to be in infant mortality than where those goods were absent. But household with radio had less experience to lead infant mortality than where these goods were absent.

- Non Muslims were more likely to be in infant mortality than Muslims. Non Muslims had 1.025 times higher risk being in post-neonatal mortality than Muslims.

- Main wall materials such as bamboo with mud, tin and cement and others were less likely to be in infant mortality than main wall materials of thatch/palm leaf.
- Main floor material of cement and others have lower risk to lead infant mortality than earth and sand based main floor materials.
- Tin based main roof materials were more likely but cement and others based main roof materials were less likely to be in infant mortality than those with thatch/palm leaf based main roof material.
- Type of toilet facility like pit latrine, hanging toilet/latrine and other had less likely to lead infant mortality than toilet with flush.
- Wealth index for poorer and middle have less experience but wealth index for richer and richest had more experience to lead infant mortality than the poorest wealth index group.
- Tube well or borehole, well & protected spring and open place based source of drinking water were less likely to be in infant mortality than pipe based sources of drinking water.
- Types of cooking fuel of wood had less experience but agricultural crop and animal dung and others had more experience to lead infant mortality than natural gas and kerosene based type of cooking.
- Female child was more likely to be in infant mortality than male child. Female child had 1.623 times higher risk be to in infant mortality than male.
- In birth order number, second and fourth birth order number have more likely but third and fifth and more birth order number had less likely to be in infant mortality than first birth order number.
- 24–60 months previous birth interval have higher experience but above 60 months period of previous birth interval had lower experience to lead infant mortality with compared to below 24 months period of previous birth interval.
- 15–19 years, 19–24 years and 24+ year's age group mothers had more experience to lead infant mortality at their first birth with compared to below 15 years mother.
- First year and more than 2 years breastfeeding have more likely but second year breastfeeding had lower experience to lead infant mortality than below 1 month breastfeeding.
- Household with 4–6 and more than 6 member's households were more experience to lead child mortality than below 4 members of household.

➤ Place of delivery with any medical facility have higher risk to lead infant mortality than home which was treated as a place of delivery.

➤ Household where mother watch television was less likely to be in infant mortality than the household where mother did not watch television. On the other hand, household where mother read newspaper or magazine and listen radio were more likely to be in child mortality than the household where mother does not read newspaper or magazine listen radio.

According to the findings, high risk of infant mortality in Bangladesh could be exists in those families where it was situated in rural areas, where mother's education was low, father's were agriculture, mother's were either worker or service holder, absence of radio in the house, thatch/palm leaf based house, sources of drinking water was open places, flush based sanitation system, agricultural crop and animal dung and others based cooking fuel, new born babies were female, children were born within very short or very long birth intervals, mother age at first birth was below 15 years, duration of breastfeeding was below one year or above two years, household with more than 4 members, place of delivery with medical facilities, where mother have no media exposure and which families use electricity.

5.6 Group 4: Socio-economic, demographic and maternal health care service utilization characteristics for child mortality

In logistic regression of group 4, it was includes that child mortality was dependent variable and the selected socio-economic, demographic and maternal health care service utilization characteristics were the same as independent variable. According to the fitted group as shown in Table 5.6.1 to 5.6.3, 13 independent variables out of 30 independent variables were statistically significant at 1%, 5%, 10% level of significant. These significant variables of child mortality were place of residence, mother's education, father's occupation, religion, wealth status, sources of drinking water, birth order number, previous birth interval, age of women at first birth, age at first marriage and mother's media exposure. The rest of the independent variables were statistically insignificant on child mortality.

Table 5.6.1: Logistic regression estimates for the socioeconomic characteristics with child mortality as the dependent variables in Bangladesh, BDHS-2007

Variable & Characteristics	Estimated Coefficients (B)	S.E. of estimates (B)	Wald Chi-square (Statistic)	Significant (P-value)	Odds ratio
Region/Division					
Barisal	-	-	-	-	1.000
Chittagong	0.543	0.345	2.472	0.116	1.721
Dhaka	0.242	0.312	0.603	0.438	1.274
Khulna	-0.150	0.330	0.205	0.651	0.861
Rajshahi	0.428	0.357	1.441	0.230	1.534
Sylhet	-0.159	0.352	0.204	0.651	0.853
Residence					
Urban	-0.310	0.249	1.548	0.013 **	0.733
Rural	-	-	-	-	1.000
Father's Education					
No education	-	-	-	-	1.000
Primary	-0.206	0.576	0.128	0.721	0.814
Secondary	-0.291	0.566	0.264	0.608	0.748
Higher	-0.590	0.561	1.106	0.293	0.554
Mother's Education					
No education	-	-	-	-	1.000
Primary	-0.267	0.975	0.075	0.785	0.766
Secondary	-0.432	0.984	0.193	0.661	0.649
Higher	-0.492	0.961	0.262	0.008 *	0.611
Father's Occupation					
Agriculture	-	-	-	-	1.000
Worker/laborer	-1.338	0.944	2.010	0.156	0.262
Professional worker	-1.160	0.935	1.540	0.215	0.313
Business	-3.208	1.353	5.619	0.018 **	0.040
Others	-1.363	0.941	2.098	0.147	0.256
Mother's Occupation					
Housewife	-	-	-	-	1.000
Worker/laborer	0.625	0.513	1.484	0.223	1.867
Professional worker	0.547	0.579	0.892	0.345	1.728
Others	-19.544	26217.146	0.000	0.999	0.000
Has electricity					
No	-	-	-	-	1.000
Yes	-0.520	1.224	0.181	0.671	0.594
Household goods					
Has television					
No	-	-	-	-	1.000
Yes	0.139	0.331	0.175	0.676	1.149
Has radio					
No	-	-	-	-	1.000
Yes	-0.100	0.244	0.169	0.681	0.905
Has refrigerator					
No	-	-	-	-	1.000
Yes	-0.706	0.536	1.733	0.188	0.494

Variable & Characteristics	Estimated Coefficients (B)	S.E. of estimates (B)	Wald Chi-square (Statistic)	Significant (P-value)	Odds ratio
Religion					
Islam	-	-	-	-	1.000
Others	0.208	0.326	0.408	0.023 **	1.231
Main roof material					
Thatch/palm leaf	-	-	-	-	1.000
Tin	-0.220	0.603	0.133	0.716	0.803
Cement and others	-0.728	0.476	2.335	0.127	0.483
Main floor material					
Earth, sand	-	-	-	-	1.000
Cement and others	0.888	0.570	2.427	0.119	2.430
Main wall material					
Thatch/palm leaf	-	-	-	-	1.000
Bamboo with mud	-0.190	0.394	0.233	0.630	0.827
Tin	0.264	0.387	0.466	0.495	1.302
Cement and others	0.389	0.364	1.142	0.285	1.475
Wealth index					
Poorest	-	-	-	-	1.000
Poorer	-0.590	0.721	0.669	0.413	0.555
Middle	-0.916	0.671	1.866	0.172	0.400
Richer	-1.283	0.616	4.345	0.037 **	0.277
Richest	-0.792	0.541	2.144	0.143	0.453
Type of toilet facility					
Toilet with Flush	-	-	-	-	1.000
Pit latrine	0.017	0.385	0.002	0.965	1.017
Hanging toilet and others	0.249	0.247	1.024	0.312	1.283
Source of drinking water					
Pipe	-	-	-	-	1.000
Tube well or borehole	1.256	0.970	1.677	0.195	3.511
Well and Protected spring	1.284	0.781	2.704	0.100 ***	3.612
Rivers/ponds/others	1.760	1.177	2.238	0.135	5.815
Type of cooking					
Natural gas and kerosene	-	-	-	-	1.000
Wood	0.010	0.721	0.000	0.988	1.011
Agricultural crop	0.074	0.421	0.031	0.861	1.077
Animal dung and others	-0.006	0.419	0.000	0.989	0.994

* was significant at 1%; ** was significant at 5% and *** was significant at 10% level of significance

Table 5.6.2: Logistic regression estimates for the demographic characteristics with child mortality as the dependent variables in Bangladesh, BDHS-2007

Variable & Characteristics	Estimated Coefficients (B)	S.E. of estimates (B)	Wald Chi-square (Statistic)	Significant (P-value)	Odds ratio
Sex of child					
Male	-	-	-	-	1.000
Female	-0.439	0.324	1.842	0.175	0.644
Birth order number					
1	-	-	-	-	1.000
2	-0.035	0.315	0.012	0.912	0.966
3	0.389	0.343	1.292	0.056 ***	1.476
4	-0.034	0.356	0.009	0.925	0.967
5 and 5+	0.458	0.320	2.044	0.153	1.581
Previous birth interval					
< 24 months	-	-	-	-	1.000
24—60 months	0.436	0.476	0.840	0.359	1.547
60+ months	0.674	0.396	2.899	0.089 ***	1.963
Duration of Breastfeeding					
<1 month	-	-	-	-	1.000
1—12 months	-19.906	27597.618	0.000	0.999	0.000
13—24 months	0.550	0.637	0.745	0.388	1.733
24+ months	-0.111	0.489	0.051	0.821	0.895
Age at first marriage					
< 15 years	-	-	-	-	1.000
15—19 years	-1.444	1.447	0.995	0.318	0.236
19—24 years	-1.851	1.461	1.604	0.205	0.157
24+ years	-0.344	1.202	0.082	0.075 ***	0.709
Mother's age at first birth					
< 15 years	-	-	-	-	1.000
15—19 years	0.737	1.426	0.267	0.605	2.089
19—24 years	0.768	1.405	0.299	0.085 ***	2.155
24+ years	0.953	1.345	0.502	0.479	2.594
No. of household members					
<4 members	-	-	-	-	1.000
4—6 members	-0.545	0.358	2.325	0.127	0.580
6+ members	-0.153	0.461	0.111	0.739	0.858

* was significant at 1%; ** was significant at 5% and *** was significant at 10% level of significance

Table 5.6.3: Logistic regression estimates for the maternal health care service utilization characteristics with child mortality as the dependent variables in Bangladesh, BDHS-2007

Variable & Characteristics	Estimated Coefficients (B)	S.E. of estimates (B)	Wald Chi-square (Statistic)	Significant (P-value)	Odds ratio
Place of delivery					
Home	-	-	-	-	1.000
Any medical facility	0.163	0.585	0.078	0.780	1.177
Timing of first antenatal check					
< 3 times	-	-	-	-	1.000
3—5 times	-0.999	0.775	1.661	0.197	0.368
5+ times	-0.232	0.669	0.120	0.728	0.793
Read newspaper or magazine					
No	-	-	-	-	1.000
Yes	-0.472	0.605	0.607	0.036 **	0.624
Listen radio					
No	-	-	-	-	1.000
Yes	-0.643	0.583	1.214	0.070 ***	0.526
Watch television					
No	-	-	-	-	1.000
Yes	-0.308	0.674	0.209	0.048 **	0.735

* was significant at 1%; ** was significant at 5% and *** was significant at 10% level of significance

Salient features of child mortality

Table 5.6.1 to 5.6.3 presented the child mortality group built from the abovementioned variables. In the child mortality group, out of all the variables that were included in the logistic regression, place of residence, mother's education, father's occupation, religion, wealth status, sources of drinking water, birth order number, previous birth interval, age of women at first birth, age at first marriage and mother's media exposure appeared to be the most significant factors in determining the likelihood of dying before reaching the first month of life. According to the child mortality group,

➤ Chittagong, Dhaka and Rajshahi divisions were more likely but Khulna and Sylhet divisions were less likely to lead in child mortality with compared to the Barisal division. The divisions of Chittagong, Dhaka and Rajshahi divisions had 1.721, 1.274 and 1.534 times higher risk but Khulna and Sylhet divisions had 13.9% and 14.7% lower risk to be in child mortality with compared to Barisal division.

- Place of residence has significant effect on child mortality. Residence in rural area was less likely to be in child mortality than urban areas. Place of residence in rural area had 26.7% lower risk to be in child mortality than urban areas.
- Mother with primary, secondary and higher level education had less experience to lead child mortality than no educated mother.
- Literate father's have lower risk being in child mortality than illiterate father. Fathers with primary, secondary and higher education had 18.6%, 25.2% and 44.6% lower risk being in child mortality than fathers with no education.
- Father's all occupations have less experience to lead child mortality than agriculture. Occupation such as worker/day laborer, professional worker, business and others had 73.8%, 68.7%, 96.0% and 74.4% lower risk being in child mortality than agriculture respectively.
- Mother's occupation for Worker/Labourer, professional worker had more experience in child mortality than housewife. Other occupations have less experience in child mortality than housewife.
- The households with electricity had less likely to be in child mortality than those which had no electricity. Households with electricity had 41.6% lower risk being in child mortality than those households where electricity was absent.
- Household with radio and refrigerator were less likely to be in child mortality than where those goods were absent. But household with television had more experience to lead child mortality than where these goods were absent.
- Non Muslims were more likely to be in child mortality than Muslims. Non Muslims had 1.231 times higher risk being in neonatal mortality than Muslims.
- Main wall material of tin, cement and others have more likely but bamboo with mud based main wall material had less likely to be in child mortality than leaf based main wall material.
- Main floor material of cement and others were more likely to be in child mortality than earth and sand based main floor materials.
- Tin, cement and other based main roof materials were less likely to be in child mortality than those with thatch/palm leaf based main roof material.
- All wealth status groups such as poorer, middle, richer and richest were less experience to lead child mortality than the poorest wealth index group.
- Type of toilet facilities like pit latrine, hanging toilet/latrine and others were more likely to lead child mortality than toilet with flush.

➤ Except pipe based source of drinking water all other sources of drinking water had more experience to lead child mortality.

➤ Wood based cooking fuel had 1.011 times, agricultural crop based cooking fuel had 1.077 times higher risk, but animal dung and others based cooking fuel had 0.994 times lower risk to be in child mortality than natural gas and kerosene based cooking fuel.

➤ Female child was less likely to be in child mortality than male child. Female child had 35.6% lower risk being in neonatal mortality than male child.

➤ In birth order number, second and fourth birth order number had less likely but third and fifth plus birth order number had more likely to be in child mortality than first birth order.

➤ 24–60 months and above 60 months period of previous birth interval had more experience to lead child mortality with compared to below 24 months period of previous birth interval.

➤ 15–19 years, 19–24 years and 24+ year's age group mothers had more experience to lead neonatal mortality at their first birth with compared to below 15 years mother.

➤ 15–19 years, 19–24 years and 24+ year's age group mothers had less experience to lead child mortality at their first marriage with compared to below 15 years women.

➤ 1–12 month or first year and more than 2 years breastfeeding had less likely but second year breastfeeding have more experience to lead child mortality than below 1 month breastfeeding.

➤ Household with 4–6 and more than 6 member's households were less experience to lead child mortality than below 4 members of household.

➤ Place of delivery with any medical facility from any medical institute had more experience to lead child mortality than home which was treated as a place of delivery.

➤ Both 3—5 times and more than 5 times of antenatal checks had less experience to lead neonatal mortality than below 3 times first antenatal check.

➤ Household where mother read newspaper or magazine, listen radio and watch television were less likely to be in child mortality than the household where mother did not read newspaper or magazine, listen radio and watch television.

According to the findings of this study, high risk of child mortality in Bangladesh could be exists in those families where it was situated in rural areas, where parent's education was low, father's were farmer, mother's were either worker or service holder, absence of radio and refrigerator in the house, thatch/palm leaf based house, without pipe based sources of drinking water, without flush based sanitation system, new born babies were male, children's were born with very short and very long birth intervals, women age at first marriage was below 15 years, mother age at first birth was also below 15 years, duration of breastfeeding was below 1 month, household with 4—6 members and which families did not use electricity.

5.7 Conclusion

From the above discussion we got brief picture of factors affecting infant and child mortality in terms of socioeconomic, demographic and behavioral variables of the target population. We can easily estimate determinant and differentiates of infant and child mortality with respect to socioeconomic, demographic and behavioral characteristics based on this logistic regression analysis.

Chapter: Six

Levels, Trends and Differentials of Reproductive Pattern



Chapter: Six

Levels, Trends and Differentials of Reproductive Pattern

6.1 Introduction

Bangladesh is one of the developing countries which have been experiencing accelerating population growth in recent decades. The ever growing population is putting severe constraints on nation efforts to improve the overall living conditions of the people. The high rate of growth is presumably due to sustained high level of fertility and declining mortality as in other developing countries. Population growth is the resultant of three components— fertility, mortality and migration as such any change in the growth rate can be brought about by manipulating any or all or a combination of these components. The possibility to bring down population growth by migration seems to be bleak, because of imposed restrictions on migration, as also the possibility by raising the mortality (on moral grounds). Thus, it appears that fertility is the only to reduce population growth (UN, 1973: 631–660).

Human reproduction is influenced by social, economic, psychological, physiological, genetic and cultural factors interacting with each other in a complex manner. Since Simmon and Saunders (1977:85) pointed out, “genetic and physiological factors set conditions that make reproduction both certain and limited. Societal and psychological forces determine to a large extent when and where it will occur”. Thus with equal level of development, other determining factors may cause variation in the fertility level among nations and even among regions within the same nation. Moreover, socio-cultural considerations may pre-dominate the economic considerations in some countries or regions in determining the level of fertility in contrast to others. Thus, the study of fertility is of prime importance not only for its own sake, but also in understanding the mechanism through which it works and its subsequent relationship with other components of population growth and related matters.

Levels and patterns of fertility vary in various sub-groups in the same population. A study of differential fertility is useful in identifying the factors which determine

fertility levels among various sub groups. It is also helpful in projecting more accurately population size of entire country. Not only can this but such a study which family planning programs are concentrated. There are several factors which are responsible for differential fertility. Moreover, assessment of the extent of differences among various groups in a population is often the first step in identifying the important determinants of fertility behavior. Information on fertility differentials provides a basis for projecting changes in the overall level of fertility. Differential fertility includes ecological factors, regional differences, urban-rural setting, educational attainment, economic status, occupation, employment of women, religion, caste, race, age and sex structure, etc. Therefore, for differential fertility study several factors combined together are always taken into consideration.

6.2 Trends in Fertility

It may be ascertained that fertility levels in Bangladesh have been relatively high and fluctuating within a relatively narrow range except in catastrophic situations such as war and famine. The prospects for a dramatic decline in the birth rate do not appear to be bright given the age structure of population, the early age at marriage, universality of marriage and the high traditional value given to childbearing and large families in the Islamic as well as the Hindu cultures. The slow pace of mortality decline, particularly the persistence of high infant and child mortality, does not provide a strong incentive for family limitation either. Table 6.2 represented the trends of crude birth rates total fertility rates, gross reproduction rates and net reproduction rates from 1961 to 2008. The rates have been estimated from various sources and thus may be of varying reliability. On the whole, however, they indicate that probably until 1970s, Bangladesh spanned the second phase of the demographic transition and high fertility was needed to offset the high but declining mortality operating in the country. As evidenced in Table 6.2, the crude birth rates were exist around 45 to 50 per 1000 population throughout the period until 1975. After 1975, fertility has been declining moderately. The fluctuations in the birth rates at the high levels indicate forces operating that serve to compensate for high mortality resulting from the recurrent epidemics, famines and the consequent worsening nutritional situation.

Table 6.2: Crude Birth Rates (CBR), Total Fertility Rate (TFR), Gross Reproduction Rate (GRR) and Net Reproduction Rate (NRR) of Bangladesh, obtained from different sources indicated year.

Year	Source	CBR	TFR	GRR	NRR
1961	DSEP	47.0	-	-	-
1963	PGE	44.0	-	-	-
1964	PGE	42.0	-	-	-
1965	PGE	37.0	-	-	-
1967–68	MOS	42.0	-	-	-
1974	BRSFM	48.3	-	-	-
1975	BFS	47.0	6.33	-	-
1978	Pilot Survey	37.0	5.77	-	-
1979	ICDDR,B (Mat) and BCPS	47.0	5.38	-	-
1980	BLDS.BBS	33.4	4.99	-	-
1981	Planning Com. GOB	43.0	5.04	-	-
1982	ICDDR (Mat)	44.6	5.21	-	-
1983	ICDDR (Mat)	42.4	5.07	-	-
1984	ICDDR (Siraj)	46.6	4.83	-	-
1985	Planning Com. GOB	39.0	4.71	-	-
1986	ICDDR (Mat)	40.0	4.70	-	-
1987	ICDDR (Siraj)	40.6	4.42	-	-
1988	VRS, BBS	33.3	4.45	-	-
1989	BFS	31.0	4.35	-	-
1990	VRS, BBS	32.8	4.33	-	-
1991	SVRS, BBS	31.6	4.24	2.06	1.70
1992	SVRS, BBS	30.8	4.18	2.03	1.68
1993	SVRS, BBS	28.8	3.84	2.01	1.57
1993–94	BDHS and SVRS, BBS	29.4	3.40	1.81	1.51
1995	SVRS, BBS	26.5	3.45	1.68	1.48
1996	BDSR, BBS	25.6	3.41	1.68	1.46
1997	BDSR, BBS	21.0	3.10	1.66	1.37
1998	VRS, BBS	19.9	2.98	1.52	1.31
1999	VRS, BBS	19.2	2.64	1.45	1.25
2000	VRS, BBS	19.0	2.59	1.29	1.24
2001	VRS, BBS	18.9	2.56	1.27	1.23
2002	SVRS, BBS	20.1	2.55	1.26	1.22
2003	SVRS, BBS	20.9	2.57	1.26	1.20
2004	BDHS and SVRS, BBS	28.7	3.00	1.24	1.18
2005	SVRS, BBS	20.7	2.46	1.21	1.17
2006	SVRS, BBS	20.6	2.41	1.19	1.15
2007	BDHS and SVRS, BBS	26.1	2.70	1.17	1.14
2008	SVRS, BBS	20.54	2.30	1.17	1.09

The crude birth rate, total fertility rate, gross reproduction rate and net reproduction rate were the measures of fertility was limited by its inability to reflect the reproductive pattern of the population by age and marital status. Shifts in the age structure, particularly in the proportion of women of childbearing ages, and changes

in the marriage pattern affecting proportions of married women at each age group may lead to a change in the number of births and the crude birth rate even if the underlying reproductive behavior of the population remained unchanged. Cohort and period fertility represented a better measure of the reproductive behavior.

6.3.1 Cohort Fertility

Cohort fertility computed for each age group reflects the actual cumulative fertility rate of the age cohorts which for women 15–49, may be assumed to be the completed family size. The completed family size in the case of cohort fertility will give the level of fertility of a particular cohort. Usually, cumulative fertility is expected to increase with age. However, accurate reporting of the number of children ever-born is questionable, especially among older women. As such the completed family size may give an under-estimate of the level of fertility of the cohort, which will mainly depend on the extent of underreporting.

If fertility did not change much overtime and the reporting of the number of children ever-born is reasonably good, the completed fertility might be expected to give a closer approximation to the current level of fertility. The information on reported mean number of children ever-born was presented in Table 6.3.1 by age of ever-married women of age 15 years and over in different time periods. The mean numbers of live births per ever-married woman were calculated for each group of women by dividing the total number of live births in each age group by the total number of ever-married women in the corresponding age group. The table indicated that the average number of children ever-born per ever-married woman had been declining overtime. This was slightly lower in recent years in each age group.

Table 6.3.1: Mean number of children ever-born per ever-married woman: Bangladesh 1975 to 2007

Age group	1975 BFS	1981 CPS	1983 CPS	1985 CPS	1989 CPS	1989 BFS	1991 CPS	1993–1994 BDHS	1996–1997 BDHS	1999–2000 BDHS	2004 BDHS	2007 BDHS
15–19	0.6	0.5	0.6	0.4	0.4	0.4	0.4	0.3	0.4	0.4	0.4	0.3
20–24	2.3	2.0	2.2	2.0	1.8	1.7	1.7	1.6	1.5	1.4	1.4	1.3
25–29	4.2	3.7	3.8	3.6	3.3	3.1	3.2	2.9	2.8	2.6	2.6	2.3
30–34	5.7	5.4	5.5	5.1	4.7	4.7	4.5	4.1	3.9	3.6	3.4	3.2
35–39	6.7	6.4	6.5	6.5	5.9	5.9	5.7	5.2	4.8	4.3	4.1	3.8
40–44	7.1	7.3	7.4	7.4	7.0	6.6	6.7	6.4	5.6	5.1	4.7	4.3
45–49	6.7	7.6	7.5	7.2	7.5	7.3	7.4	6.9	6.4	6.1	5.6	4.9
Total	u	u	u	u	u	u	3.5	3.0	2.8	2.6	2.5	2.3

6.3.2 Period Fertility

Period fertility is measured by the total fertility rate (TFR) based on the age specific fertility rates of women of different age groups in the reproductive period (15–49 years of age) during a year. Period fertility gives the current picture of the actual fertility performance in recent times (generally the year preceding the census or survey) by women of different age groups in the reproductive period within a population. The age specific fertility rates and the total fertility rates for the period of 1975 to 2007 were presented in table 6.3.2. The table 6.3.2 revealed that the level of fertility was still very high in Bangladesh although the age specific fertility rate had been decreasing over time in each age group. The peak age had shifted from 25–29 in 1975 to 20–24 in 2007.

Table 6.3.2: Age specific fertility rates (per 1000 women) among women age 15–49, selected sources, Bangladesh, 1975 to 2007

Sources →	1975 BFS	1989 BFS	1991 CPS	1993– 1994 BDHS	1996– 1997 BDHS	1999– 2000 BDHS	2004 BDHS	2007 BDHS
Age groups ↓	1971– 1975	1984– 1988	1989– 1991	1991– 1993	1994– 1996	1997– 1999	2001– 2003	2004– 2006
15–19	109	182	179	140	147	144	135	126
20–24	289	260	230	196	192	188	192	173
25–29	291	225	188	158	150	165	135	127
30–34	250	169	129	105	96	99	83	70
35–39	185	114	78	56	44	44	41	34
40–44	107	56	36	19	18	18	16	10
45–49	35	18	13	14	6	3	3	1
TFR	6.3	5.1	4.3	3.4	3.3	3.3	3.0	2.7

Thus, it may conclude that the level of fertility was still high and seemed to change little overtime. It was observed that fertility increases up to age group 20–24 and then declines sharply. This implied that women who postpone their marriage to later ages try to recover the reproductive period already lost by producing on the average more children. But beyond age group 20–24, the fertility performance slows down, which might be due to the fact that women who postpone their fertility by using some methods of modern contraception, and/or might had become less fecund as the level of fecundity decreases with increasing age or might had even become sterile.

6.4 Trends in age at marriage

The mean age at first marriage is a useful tool for summary measure to study the pattern of distributions of first marriages. Mean age at marriage is a straightforward matter to compute directly the mean age or median age at first marriage, if data on age at first marriage are available. In absence of detail and adequate data on first marriage, it is possible to adopt indirect method. Hajnal (1953) suggested such a method for computing mean age at marriage (SMAM). Since the most frequently considered age groups were five years in span, the process of computing the SMAM was described for data classified by such age group. It was assumed that no first marriage occurs after age 50 or before age 15. The summary of the results on SMAM at different time was presented in Table 6.4.

Table 6.4: Singulate mean age at marriage for the women of Bangladesh, indicated year obtained from different sources.

Year	Source	MAM (Women)	MAM (Men)
1974	Population Census and BRSFM	24.0	15.9
1975	BFS	16.0	16.6
1980	BLDS	16.4	24.5
1981	Population Census (PC)	16.8	24.9
1982	VRS, BBS	17.7	25.6
1983	VRS, BBS	18.6	25.9
1984	VRS, BBS	17.8	25.2
1985	VRS, BBS	18.0	23.9
1986	VRS, BBS	17.5	25.3
1987	VRS, BBS	17.9	24.5
1988	VRS, BBS	18.0	25.0
1989	VRS, BBS	18.2	24.8
1990	VRS, BBS	18.0	25.0
1991	Population Census (PC)	17.9	25.1
1992	VRS, BBS	18.2	25.2
1993	VRS, BBS	19.6	25.2
1994	VRS, BBS	19.8	26.6
1995	VRS, BBS	19.5	27.7
1996	VRS, BBS	20.0	27.6
1997	VRS, BBS	20.0	27.6
1998	VRS, BBS	20.2	27.6
1999	VRS, BBS	20.3	27.7
2000	VRS, BBS	20.4	27.7
2001	VRS, BBS	20.4	25.8
2002	VRS, BBS	20.6	25.6
2003	VRS, BBS	20.4	25.2
2004	VRS, BBS	19.0	25.3
2005	VRS, BBS	17.9	23.3
2006	VRS, BBS	18.1	23.4
2007	VRS, BBS	18.4	23.6
2008	VRS, BBS	19.1	23.8

6.5 Total Fertility Rate and Mean Age at Marriage

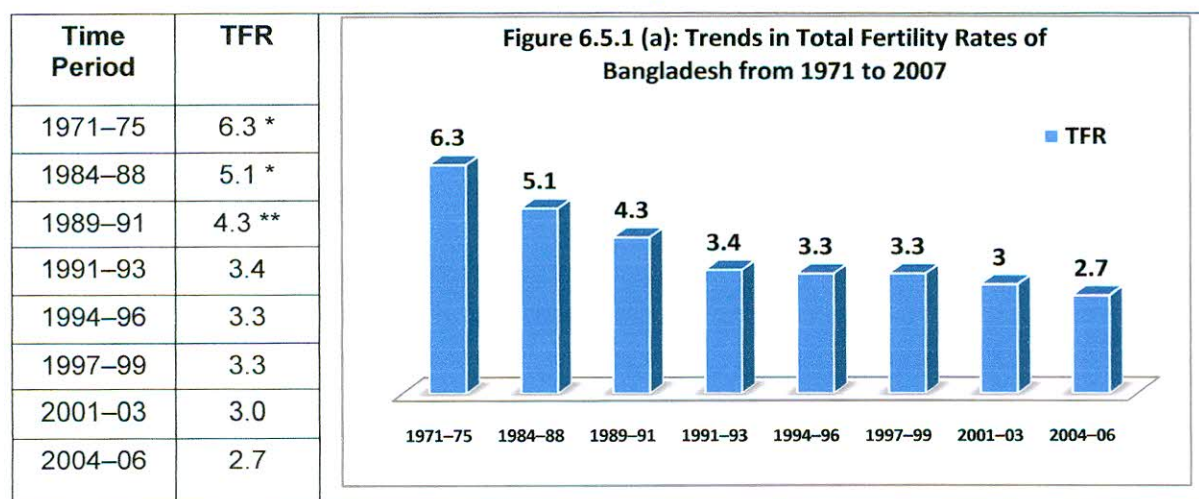
It is a common belief that age at marriage is inversely related to fertility, particularly in countries with no popular effective use of contraceptives. This means that delayed marriage increases the interval between generations and hence puts an independent barrier to long range population growth by reducing the proportion of married female in the reproductive ages relative to the total population. As a society develops, desired family size declines, because of the influences of different socio-demographic and socio-economic determinants. The evidence for this view of the reproductive behavior includes the high degree of negative association ($r = -0.91629$) between the total fertility rate and the mean age at marriage.

A simple regression of the total fertility rate (TFR) on mean age at marriage (MAM) of Bangladesh yielded the regression line given by

$$\text{TFR} = 15.536339 - 0.61167 \times \text{MAM}$$

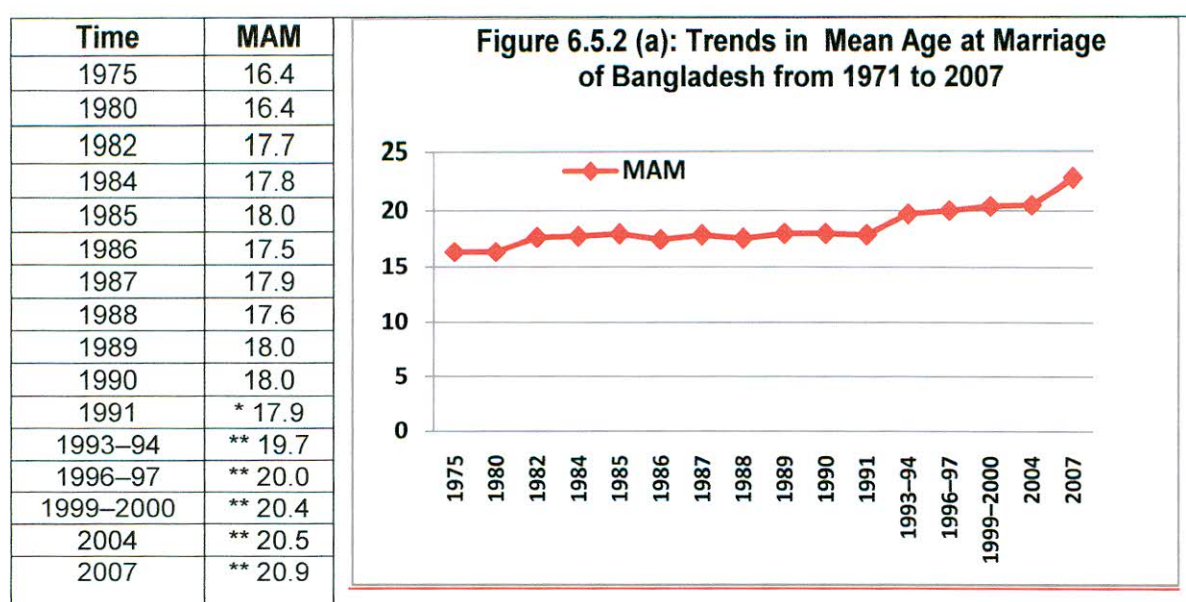
According to this regression, the total fertility rate is equal on average 15.5 births per women in the non-increasing of age at marriage and fertility declined at a rate of 6.1 births per women for each 10 percent in mean age at marriage. It also indicated that mean age at marriage explains about 84 percent ($R^2 = 0.8396$) of the variation in the total fertility rate. Deviations from the regression line were partly due to measurement errors and partly to variations in other determinants. This was a statistical relationship, but in Bangladesh, the increase in contraceptive use also might be a factor for declining fertility.

Table 6.5.1: Total Fertility Rates (TFR) of Bangladesh from 1971 to 2007



Sources: * for BFS; ** for CFS and BDHS

Table 6.5.2: Mean Age at Marriage of Bangladesh from 1975 to 2007



Sources: VRS, BBS; SVRS, BBS; * for BBS; ** for BDHS

6.6 Current marital status

In Bangladesh, it is common for a woman to wait several months or even years after formal marriage before going to live with her husband. Marriage is a key factor in women's exposure to the risk of childbearing in societies where sexual activity usually takes place within marriage. In Bangladesh, a greater proportion of men than women had never married: 16 percent of women were 15–49 had never married with compared with 27 percent of men age 15–54. The proportion of never-married fallen sharply with age for both women and men. Among women it fallen from 53 percent in the age group 15–19 to less than 1 percent in the age group 30–34 (BDHS, 2007).

Table 6.6: Percentage of women who have never married by age group, Bangladesh from 1975 to 2007

Age group	1975 BFS	1983 CPS	1985 CPS	1989 CPS	1989 BFS	1991 CPS	1993–1994 BDHS	1996–1997 BDHS	1999–2000 BDHS	2004 BDHS	2007 BDHS
10–14	91.2	98.0	98.7	96.2	96.4	98.5	95.2	95.2	92.7	88.6	u
15–19	29.8	34.2	47.5	49.0	45.8	46.7	50.5	49.8	51.9	52.1	52.8
20–24	4.6	4.0	7.1	12.0	9.3	12.3	12.4	17.2	18.5	15.2	14.3
25–29	1.0	0.7	1.0	2.3	1.6	2.8	2.2	3.4	4.2	4.2	4.3
30–34	0.2	0.4	0.1	0.3	0.5	0.5	0.3	0.5	0.1	1.2	0.6
35–39	0.4	-	-	0.1	0.5	0.1	0.3	0.0	0.2	0.4	0.6
40–44	0.1	0.1	-	0.2	0.2	0.3	0.7	0.0	0.0	0.3	0.2
45–49	0.0	0.1	-	0.1	0.1	-	0.2	0.0	0.0	0.0	0.8

The proportion of the female population that remains single and never marries impacts fertility level in a society like Bangladesh, where childbearing outside marriage was uncommon. Table 6.6 represented the trends in the proportion of

women never married by age group from previous surveys in Bangladesh. Between 1975 and 2007, the proportion of never-married women in the age group 15–19 increased. The proportion of never-married women age 20–24 increased from 1975 to 2000, after which it declined.

6.7 Age at first marriage

Marriage in Bangladesh marks the point in a woman's life when childbearing becomes socially acceptable. Age at first marriage has a major effect on childbearing because women who marry early have, on average, a longer period of exposure to the risk of becoming pregnant and a greater number of lifetime births. There had been a slow but steady increase over the past 25 years in the age at which Bangladeshi women first marry, from a median age of 14.1 years for women in their late forties to 16.4 years for those in their early twenties. A dramatic decline in the proportion of women marrying in their early teens had been observed. The proportion of women marrying by age 15 had declined by two-thirds over time, from 65 percent among women in the oldest cohort to 21 percent among women in the youngest cohort. Similarly, the proportion of women marrying by ages 18 and 20 decreased substantially from the oldest cohort to the youngest cohort. The legal age of marriage in Bangladesh was 18 years for women, but a large proportion of marriage still take place before the legal age. 66 percent of women age 20–24 were married before age 18 (BDHS, 2007). Over the past two decades, the proportion of women marrying before the legal age gradually decreased until 2000, then increased slightly in 2004 and declined in 2007 (BDHS survey).

Table 6.7: Percentage of women age 15–49 who were first married by exact ages and median age at first marriage, according to current age, Bangladesh 2007

Age group	Percentage first married by exact age					Percentage never married	Number of women	Median age at first marriage
	15	18	20	22	25			
15–19	21.1	na	na	na	na	52.8	3,019	a
20–24	32.3	66.2	79.2	na	na	14.3	2,537	16.4
25–29	41.3	75.4	86.4	91.4	94.7	4.3	2,018	15.6
30–34	48.5	81.1	90.2	94.2	97.3	0.6	1,670	15.1
35–39	47.2	81.8	91.0	94.5	97.3	0.6	1,573	15.2
40–44	54.4	87.1	94.0	97.2	99.3	0.2	1,216	14.7
45–49	64.7	90.1	95.3	97.0	98.3	0.8	1,038	14.1
20–49	45.2	78.0	87.8	na	na	4.8	10,052	15.3
25–49	49.5	81.9	90.7	94.4	97.1	1.6	7,515	15.0

na = Not applicable.

a = Omitted because less than 50% of women had a birth before reaching the beginning of the age group.

Table 6.7 showed the percentage of women who were married by specific ages and the median age at first marriage, according to current age. Marriage occurs early for women in Bangladesh: among women age 20–49, 78 percent were married by age 18 years and 88 percent were married by age 20 years.

6.8 Trends in Pregnancy Rate

Table 6.8 showed the percentage of currently married women who reported that they were pregnant at the time of survey, according to age groups. Reports about current pregnancy are almost surely under estimates, since many women may be pregnant but not yet aware of their status. However, the data are useful, because, while fertility rates depend on some extent to accurate reporting of dates of events, the proportion pregnant is a current status indicator. Change over time in the pregnant was an independent indicator of fertility change. In Bangladesh, the present pregnant had generally declined over time, it was 12.5 percent in 1975 and 6.5 percent in 2007. During the period 1975 to 2007, the present pregnant declined in the late 1980s and early 1990s, and stalled around 8 percent for most of the 1990s.

Table 6.8: Percentage distributions of currently married women who were pregnant at the time of interview, Bangladesh 1975 to 2007

Sources →	1975 BFS	1989 BFS	1991 CPS	1993– 1994 BDHS	1996– 1997 BDHS	1999– 2000 BDHS	2004 BDHS	2007 BDHS
Age groups ↓	1971– 1975	1984– 1988	1989– 1991	1991– 1993	1994– 1996	1997– 1999	2001– 2003	2004– 2006
15–19	15.2	14.7	19.6	17.1	14.7	15.9	14.3	17.1
20–24	15.5	13.1	16.2	13.0	10.3	11.8	9.9	11.5
25–29	14.9	10.4	11.2	9.0	8.9	8.5	7.8	7.3
30–34	11.2	8.3	7.1	7.0	5.1	4.8	4.8	4.2
35–39	10.7	4.8	4.2	2.7	3.4	2.4	2.3	1.2
40–44	u	u	1.5	1.5	0.8	1.3	1.0	0.4
45–49	u	u	0.2	0.0	0.0	0.4	0.2	0.2
Total	12.5	9.3	10.7	8.7	7.7	7.8	6.6	6.5

u = Unknown

6.9 Age at First Birth

Age at first birth has a direct effect on fertility. Early initiation of childbearing lengthens the reproductive period and subsequently fertility. In many countries, postponement of first births—reflecting an increase in the age at marriage—has contributed greatly to overall fertility decline. Moreover, bearing children at a young age involve substantial risks to the health of both the mother and child. Early

childbearing also tends to restrict educational and economic opportunities for women. Table 6.9 represented the percentage of all women by exact age at first birth for different age cohorts. The median age at first birth was not shown for young women age 15–19, because a large majority had not become mothers before age 15. The median age at first birth was about 18 years across all age cohorts, except for women age 20–24 years, whose median age at first birth was also reflected in the smaller proportion of younger women having a child by age 15: 16 percent of women in their late forties reported having had their first birth by age 15, compared with only 5 percent of women age 15–19. A comparison of data from the 2004 and 2007 BDHS survey showed a slight increase in the median age at first birth for women in all age groups.

Table 6.9: Percentage of women age 15–49 who gave birth by exact ages, percentage who have never given birth, and median age at first birth, according to current age, Bangladesh 2007

Age group	Percentage who give birth by exact age					Percentage who have never given birth	Number of women	Median age at first birth
	15	18	20	22	25			
15–19	5.0	na	na	na	na	73.4	3,019	a
20–24	8.4	40.0	61.1	na	na	25.1	2,537	19.0
25–29	10.8	49.1	67.8	79.9	88.9	8.6	2,018	18.1
30–34	12.4	52.3	72.0	84.2	91.9	3.5	1,670	17.8
35–39	10.6	47.6	71.2	82.8	91.6	2.6	1,573	18.2
40–44	10.0	53.2	73.5	86.1	93.7	2.2	1,216	17.8
45–49	16.4	55.2	72.9	83.6	90.3	3.4	1,038	17.6
20–49	10.9	48.2	68.6	na	na	9.7	10,052	18.2
25–49	11.8	51.0	71.1	83.0	91.1	4.4	7,515	17.9

na = Not applicable.

a = Omitted because less than 50% of women had a birth before reaching the beginning of the age group.

6.10 Ever use of contraception

Respondents who said that they had heard of a method of family planning were asked whether they had ever used that method. Ever use of family planning methods in the 2007 BDHS thus refers to use of a method at any time, with no distinction between past and current use. Collection and analysis of ever-use data have special significance for family planning programs. These data indicate the proportion of the population who has been exposed to contraceptive use at least once. Therefore, data on ever use reflect the success of programs in promoting use of family planning

methods among eligible couples. In addition, data on ever use, together with data on current use, are valuable for studying contraceptive discontinuation.

Table 6.10.1: Ever use of contraception by age (ever-married women)

Age group	Any method	Any modern method	Any traditional method
15–19	67.4	64.3	15.0
20–24	80.8	78.1	20.2
25–29	87.3	84.5	24.5
30–34	88.0	85.0	28.1
35–39	84.7	80.9	30.8
40–44	77.8	72.6	29.0
45–49	69.1	61.4	27.2
Total	80.4	76.7	24.6

Figure 6.10.1 (a): Ever use of contraception by age 15 to 49

Legend:
— Any traditional method
— Any modern method
— Any method

X-axis labels: 15–19, 20–24, 25–29, 30–34, 35–39, 40–44, 45–49

Table 6.10.1 represented that among ever-married women, four-fifths had used a contraceptive method at some time, three-fourths had used a modern method, and one-fourth had used a traditional method. In age groups 15–19 and 45–49 contraceptive use rate was lower than any other age groups. In beginning and ending period of reproductive age women were less interested in contraceptive using. As teenage marriage was a great problem, so contraceptive use in early reproductive ages were prerequisite condition for fertility reduction.

Table 6.10.2: Trends in ever use of family planning methods

Method	1975 BFS	1983 CPS	1985 CPS	1989 CPS	1989 BFS	1991 CPS	1993– 1994 BDHS	1996– 1997 BDHS	1999– 2000 BDHS	2004 BDHS	2007 BDHS
Any method	13.6	33.4	32.5	44.2	45.0	59.0	63.1	69.2	74.6	80.2	80.4
Any modern method	u	23.8	25.9	37.5	u	49.2	56.4	63.0	67.9	74.5	76.7
Any traditional method	u	17.3	11.9	15.3	u	29.6	24.0	23.0	28.8	29.3	24.6

U = Unknown

Table 6.10.2 represented that use of family planning had increased steadily in Bangladesh. In 2007, 80 percent of ever-married women of reproductive age reported having used a family planning method at some time, compared with only 14 percent in 1975; this was more than a fivefold increase over the past three decades.

6.11 Current use of contraception

Current use of contraception is defined as the proportion of currently married women who report that they are currently using a family planning method. Current use of

contraception varies by age. Initially use of any method increases with age rising from 42 percent among currently married women age 15–19 to a peak of 67 percent at age 35–39. Then it decreased to 41 percent at age 45–49. This inverted U-shaped pattern of contraceptive use by age was typical fecundity—whether perceived or real—while lower levels of use among young women were usually attributed to their desire to have (more) children. Contraceptive use among women in age group 15–19 was 25 percent increased in 1993–94 and 42 percent increased in 2007.

Table 6.11.1: Current use of contraception by age (ever-married women)

Age group	Any method	Any modern method	Any traditional method
15–19	41.8	37.6	4.3
20–24	52.4	47.5	4.9
25–29	60.9	55.4	5.6
30–34	65.1	56.4	8.7
35–39	66.5	52.3	14.2
40–44	55.3	40.2	15.0
45–49	40.9	30.2	10.7
Total	55.8	47.5	8.3

Figure 6.11.1(a): Current use of contraception by age 15 to 49

Legend:
— Any traditional method
— Any modern method
— Any method

Age groups: 15–19, 20–24, 25–29, 30–34, 35–39, 40–44, 45–49

Table 6.11.1 represented that 56 percent of currently married women in Bangladesh were currently using a contraceptive method. Almost half (48 percent) of the total contraceptive users used modern methods and only 8 percent used traditional methods.

Table 6.11.2: Trends in Current use of family planning methods

Method	1975 BFS	1983 CPS	1985 CPS	1989 BFS	1991 CPS	1993– 1994 BDHS	1996– 1997 BDHS	1999– 2000 BDHS	2004 BDHS	2007 BDHS
Any method	7.7	19.1	25.3	30.8	39.9	44.6	49.2	53.8	58.1	55.8
Any modern method	5.0	13.8	18.4	23.2	31.2	36.2	41.5	43.4	47.3	47.5
Any traditional method	2.7	5.4	6.9	7.6	8.7	8.4	7.7	10.3	10.8	8.3

Table 6.11.2 represented that the contraceptive prevalence rate for married women in Bangladesh had increased from 8 percent in 1975 to 56 percent in 2007, a sevenfold increase over more than three decades. Current contraceptive use had declined by two percentage points in the past three years, from 58 percent in 2004 to 56 percent in 2007 but use of modern methods had remained unchanged. Between

2004 and 2007, use of traditional methods also declined from 11 percent to 8 percent.

6.12 Fertility Preference

Reproductive preference is the fundamental importance for population policy and for refining and modifying existing family planning programs. Whether couples want to cease childbearing or delay the next pregnancy determines the demand for family planning. Fertility preferences can be controversial because generally respondent's preferences are hypothetical. They do not take into consideration the influence of social pressures or attitudes of other family members and therefore are subject to change and rationalization.

Table 6.12: Percentage distribution of currently married women by desire for children according to age group

Age group	Have another soon	Have another later	Have another, undecided when	undecided	Want no more
15–19	23.9	62.2	1.2	1.3	11.2
20–24	17.0	41.3	1.6	1.6	37.5
25–29	12.7	17.4	1.2	1.8	62.2
30–34	10.1	4.8	0.3	0.7	77.2
35–39	6.5	1.4	0.5	0.4	80.6
40–44	2.1	0.6	0.1	0.4	76.3
45–49	2.5	0.0	0.0	0.0	64.2
Total	11.9	21.0	0.8	1.0	56.7

Table 6.12 showed the percent distribution of currently married women by desire for children according to age. As expected, the proportion of women who want no more children increases with age. 11 percent of women in age group 15–19 want no more children, whereas it was 64.2 percent in age group 45 or are-49 years. It was also observed that within 35 years, all currently married women want another child later on. They were not interested for getting child early. But with increasing of age, their desire for children increases proportionately. So the proportion that wants to delay the next birth for two or more year's declined with age, but the proportion of women who want the next birth within two years increased with age.

6.13 Fertility differentials

Every animal increases family. Human beings are not exception of it. To give birth of a child is a general characteristic of a woman. But the capacity of giving birth is not the same for all women. At a time the variation which is seen in different region and within the same region is called the differential fertility. Human fertility is known to be influenced by a host of socio-economic, socio-cultural, biological and demographic factors. Socio-economic and socio-cultural variables cannot directly influence fertility but must act on fertility through their effect on one or more of the proximate determinants. Socio-economic conditions of a population and differences among the sub-groups or sub-regions. Socio-economic variables in the form of normative social structure and social stratification and economic constraints influence fertility through their impact on social psychological processes (Bagozzi and Vanloo, 1978). In this section differentials in fertility were examined by some selected background variables: division, place of residence, education, occupation, religion, wealth status, birth status of women, birth order number, previous birth interval, women age at marriage, women age at first birth etc. using BDHS 2007 data. Here the age specific fertility rate was used as a fertility measurement.

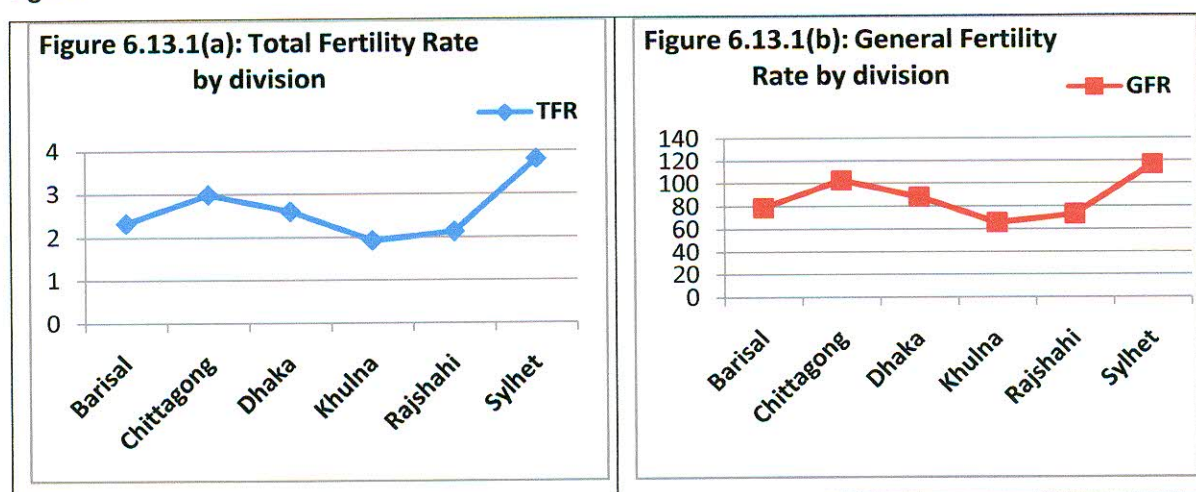
6.13.1 Division

The study of the regional differentials in fertility is of great importance because it will throw light on the regional variation, if any, in the child bearing patterns. The identification of the factors underlying the differentials will help in formulating strategies and programs for reducing fertility. It has been shown that the regional variation in the rate of growth of population in Bangladesh is mainly due to the variations in fertility (Sivamurthy and Ahmed, 1979b). Table 6.13.1 showed the age specific fertility rate by age group among the regions. It can be seen that the variation was prominent in the age group 20–24 and diminishes with increasing age. The higher variation in the age groups might be attributed to variations in the proportion married in these age groups among the regions. On the other hand, the variation in the higher age groups might be due to the extent of variation in widowhood, divorce and childlessness, in addition to differential behavior towards fertility regulations or family planning practices among the regions which were dependent on socio-cultural differences.

Table 6.13.1: Age specific fertility rate (per 1000 women), the total fertility rate (per woman) and the general fertility rate (per 1000 women) by division, BDHS, 2007

Age group of women	Division						
	Barisal	Chittagong	Dhaka	Khulna	Rajshahi	Sylhet	Total
15–19	85.989	107.077	112.394	87.273	96.43	139.169	103.852
20–24	143.478	197.842	155.46	140.735	143.571	202.682	163.937
25–29	124.993	148.207	130.958	75.654	113.151	181.972	128.512
30–34	63.183	84.07	87.599	73.818	67.902	133.846	83.246
35–39	36.378	36.27	33.19	3.84	5.916	69.126	29.779
40–44	5.903	23.778	-	4.367	-	29.688	9.839
45–49	6.381	-	-	-	-	4.621	1.511
TFR	2.331	2.986	2.598	1.928	2.134	3.805	2.603
GFR	78.676	102.769	88.000	65.663	73.115	116.719	86.968

Table 6.13.1 showed that age specific fertility was higher in Sylhet and Chittagong, with the total fertility rates were 3.805 and 2.986 respectively. Total fertility rate was lowest in Khulna (1.928) and Rajshahi (2.134). Barisal and Dhaka have intermediate levels of total fertility with 2.331 and 2.598 respectively. Total fertility rate of Barisal division was 2.331 means woman of Barisal division would had on average 2.331 children in her lifetime if the current age specific fertility rate of Barisal division remained unchanged. General fertility rates of Barisal, Chittagong, Dhaka, Khulna, Rajshahi and Sylhet divisions were respectively 78.6, 102.7, 88.0, 65.6, 73.1 and 116.7 births per 1000 women of reproductive age. Among the six divisions, Sylhet division's general fertility rate (GFR) was highest (116.7). GFR of Barisal division was 78.676 means Barisal division had 78.676 births per 1000 women of reproductive ages.



6.13.2 Place of Residence

Urban-rural differential in fertility is one of the most widely studied areas in differential fertility. While higher fertility in rural areas than in the urban has almost consistently

observed in the present developed countries, results from the developing countries do not show consistent differentials by urban-rural place of residence (UN, 1965: 124–133). Thus urban fertility was found to be lower in Taiwan (Freedman, et al., 1972: 294) and Thailand (Goldstein, 1973: 225) than the rural one, while higher in urban than rural fertility has observed in Indonesia (University of Indonesia, 1974: 6) and Egypt (Omran, 1973: 100).

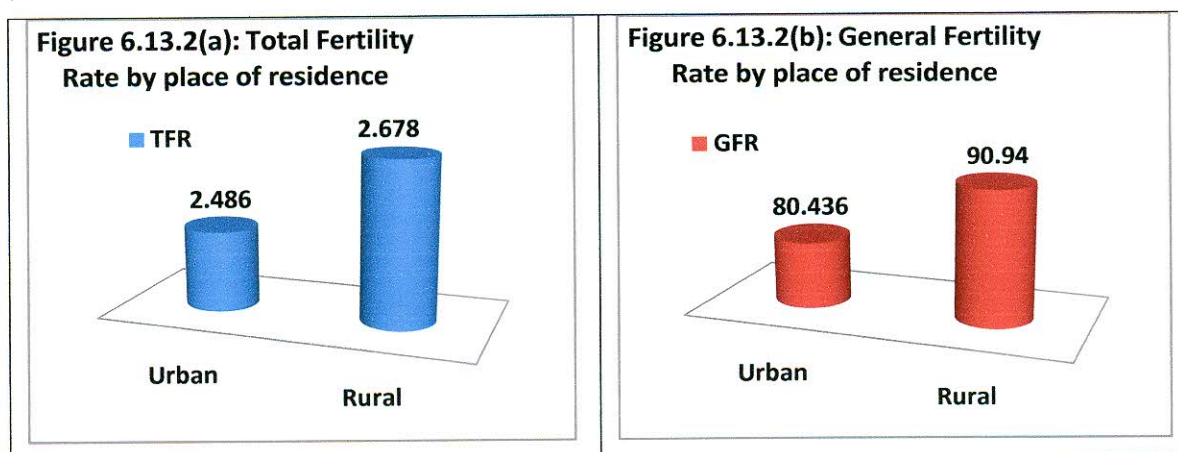
Data on urban-rural fertility for Bangladesh were presented in Table 6.13.2. Considering the age specific fertility rate in the age group (15–49), it was observed that urban total fertility rate was lower (2.486) than the rural one. The lower fertility for urban women was also seen for all age groups except the younger (<20). The reason for higher fertility in the age group (<20) in the urban areas might be due to the fact that the number of married females in this age group was much less in the urban than in the rural areas due to higher age at marriage in the urban areas. Moreover, women in this age group in the rural areas might be comparatively suffering more from adolescent sterility resulting from early age at marriage as well as various diseases in the rural areas or may be due to the higher age at menarche (Chowdhury, et al., 1977). Recent migration of young couples from the rural to urban environment might be responsible to some extent for this observed lack of differential.

Table 6.13.2: Age specific fertility rate (per 1000 women), the total fertility rate (per woman) and the general fertility rate (per 1000 women) by place of residence, BDHS, 2007

Age group of women	Place of residence		
	Urban	Rural	Total
15–19	105.659	103.062	103.852
20–24	161.195	165.611	163.937
25–29	111.897	139.004	128.512
30–34	82.228	83.872	83.246
35–39	28.994	30.336	29.779
40–44	7.285	11.444	9.839
45–49	-	2.436	1.511
TFR	2.486	2.678	2.603
GFR	80.436	90.940	86.968

When we observed general fertility rate towards place of residence, higher fertility in the rural area was still apparent (Table 6.13.2). This observed differential might be attributed to higher age at marriage, higher level of real income per person, better health facilities, educational facilities, employment of women in the modern sector

and other social amenities in the urban areas which had the effect of reducing fertility. Furthermore, children might be considered as economic assets rather than burden in the rural areas which cause higher fertility in the rural areas (Caldwell, 1978) where children were considered both as earners during childhood and as social security in old age. The relative economic cost of bearing children and the lower economic value of children in the urban area, opportunity cost for mother's time might had played an important role in lowering the fertility of urban women through practice of the effective methods of birth control.



6.13.3 Mother's Education Level

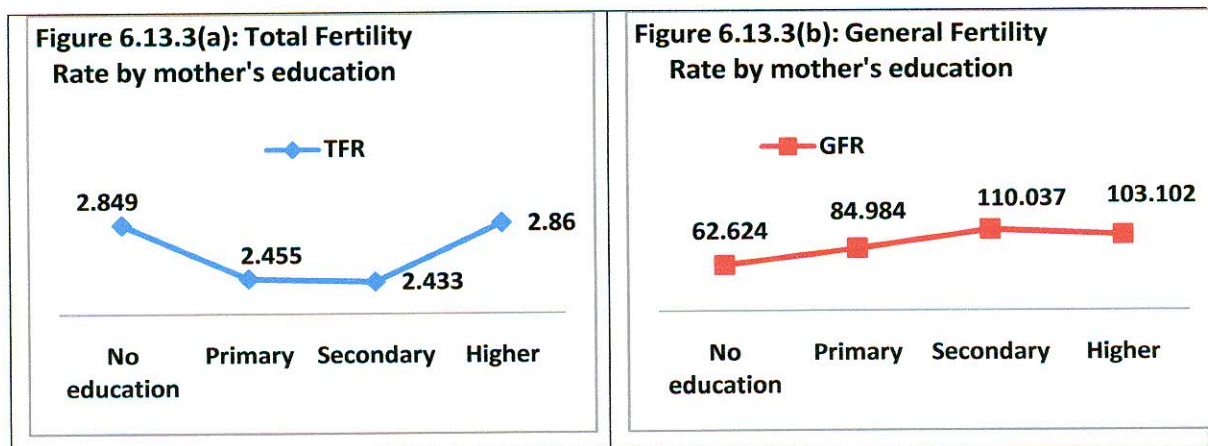
One of the consistent findings in the study of fertility differentials was the inverse relationship between mother's education and fertility. Mother's education may affect fertility through raising age at marriage, giving alternative source of new normative orientations and expansion of vision, increasing a woman's knowledge and use of birth control as well as providing better opportunity for labour force participation (Ryder, 1967; Janowity, 1976).

Table 6.13.3: Age specific fertility rate (per 1000 women), the total fertility rate (per woman) and the general fertility rate (per 1000 women) by mother's education, BDHS, 2007

Age group of women	Mother's education level				
	No education	Primary	Secondary	Higher	Total
15-19	139.333	103.582	97.756	97.714	103.852
20-24	147.761	166.427	167.592	161.508	163.633
25-29	149.685	112.393	115.125	155.443	128.578
30-34	79.669	85.547	68.647	121.524	83.246
35-39	37.866	16.285	28.652	35.984	29.798
40-44	12.926	6.885	8.917	-	9.839
45-49	2.689	-	-	-	1.511
TFR	2.849	2.455	2.433	2.860	2.602
GFR	62.624	84.984	110.037	103.102	86.968

Table 6.13.3 represented age specific fertility rate in age groups (15–49) by mother's education which revealed that mother who had no education show the highest total fertility rate 2.849. The total fertility rate for mother with education level primary, secondary and higher was respectively 2.455, 2.433 and 2.860. It can also be seen from table 6.13.3 that mother with no education tended to had more fertility rate in all the groups than those with primary, secondary and higher level. General fertility rate of illiterate mother was 62.6 births per 1000 women of reproductive age. Among the four mother's education level, general fertility rate of mother's secondary education level was highest, which was 110 births per 1000 women of reproductive age. The higher level of fertility for women with no education than educated women may be due to the following reasons:

- ❖ Illiterate women were not conscious of having a limited family size.
- ❖ At an age when there were more chances of having fertility, the girls are in the colleges and university and thus do not get children which during this period uneducated girls get.
- ❖ In many cases educated women get employed and with employment they cannot afford to have more children.
- ❖ Uneducated mother fell very hesitant to use contraceptives to control family size and go on accepting even unnecessary motherhood responsibilities imposed on them
- ❖ Span of child producing time in the case of uneducated women was quick, as compared with educated women.



6.13.4 Father's Education Level

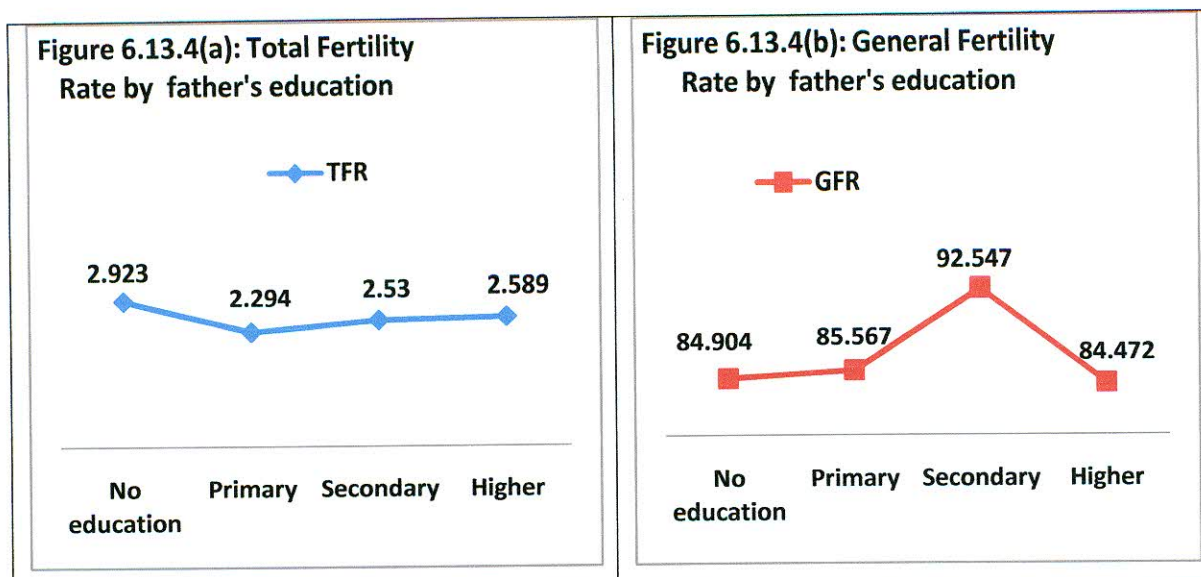
Father's education was one of the important factors which influence fertility. Because of in our society almost everything depends on the opinion of a husband in a family.

Now-a-days higher educated persons are giving importance to the educated female for marriage. As a result a balance was prevailing upon the families which play a negative role in fertility. Table 6.13.4 represented the age specific fertility rates of the age groups (15–49) by father's education which reveals that those women whose husband's had completed primary education, the total fertility rate was lower than those of whose husband's are with no education although the difference was very little. Table 6.13.4 also revealed that women with husband's educational level higher tended to had more children in all age groups than those with secondary education. The total fertility rate whose husband's with primary education was (2.923), which was greater than higher level that was (2.589). When general fertility rate was calculated the same picture was visible. That was, higher the education level, lower the number of children ever-born. The lower level of fertility for women whose husband's education level was higher than those with secondary may be due to the following reasons:

- ❖ Educated men were generally involved in different occupation and so they had to go different places and they want to maintain the high living standard with other families. But too many children create hindrance to maintain it.
- ❖ Usually educated men marry at late stage and so fewer children were produced but uneducated men marry at early ages, as a result they produce more children.
- ❖ Uneducated men were usually orthodox about religion and they consider family planning as anti-religious and don't use any method. But the educated men always think practically and they maintain different customs in a systematic way.

Table 6.13.4: Age specific fertility rate (per 1000 women), the total fertility rate (per woman) and the general fertility rate (per 1000 women) by father's education level, BDHS, 2007

Age group of women	Father's education level				
	No education	Primary	Secondary	Higher	Total
15–19	128.250	92.181	99.916	97.466	103.744
20–24	159.341	154.051	174.885	170.156	164.013
25–29	147.418	113.655	113.771	138.15	128.778
30–34	91.712	69.825	82.437	86.661	83.296
35–39	37.339	25.648	25.912	25.49	29.817
40–44	18.908	0	9.271	0	9.863
45–49	1.831	3.526	0	0	1.513
TFR	2.923	2.294	2.530	2.589	2.605
GFR	84.904	85.567	92.547	84.472	86.968



6.13.5 Father's Occupation

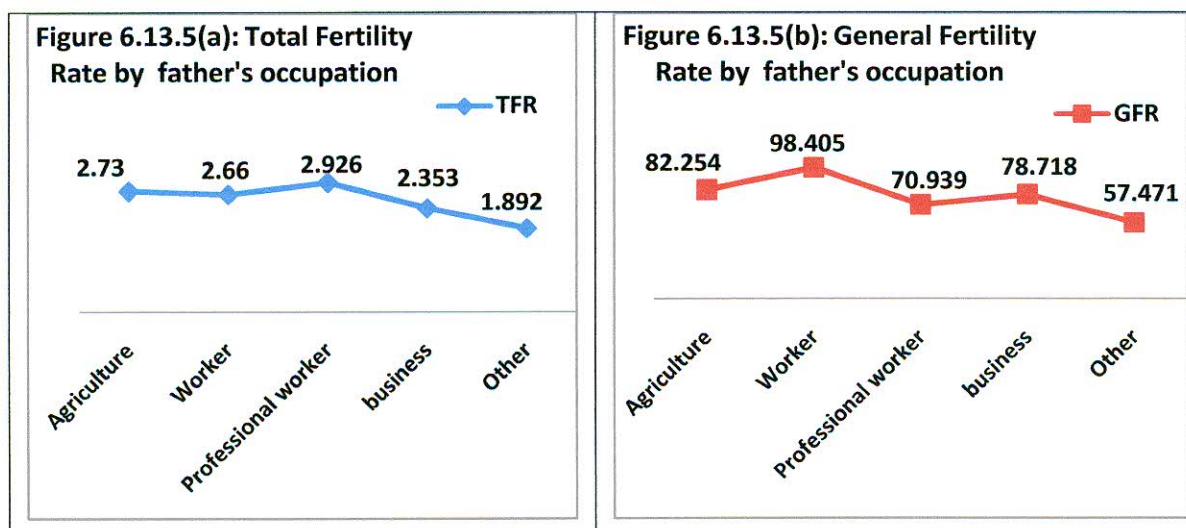
According to Prof. Donald J Bogue's view fertility was influenced by the occupation of the head of the family. The people with good occupation are likely to check fertility where as those with menial occupations are likely to have more children. He has related this to income also. According to him where income was low, fertility goes up, but income was not very high, then the fertility was the lowest, but when income considerably increases with that fertility goes up. He was of the opinion that it was wrong to think that when the family was reached the number of children will be less (Bogue, 1969).

It was usually seen that those who are engaged in mental work have less number of children, as compared with those who are occupied with of physical labour. Such as those whose business was such that takes them to clubs and other places of interest and recreation have less number of children. There was a common believed that very child who was born; will after some time start earning something even at a very young age by doing menial jobs. They fell that where as cost of their bringing up was very less that of their giving returns was very high. Thus, addition of a child in the family was considered a matter of joy rather than that of sorrow. When child birth was a matter of pleasure, obviously fertility rate will considerably increase. In developing countries like Bangladesh, the husband's occupation was closely related to fertility. The various occupational categories included in 2007 BDHS data. For the sake of our analysis the categories are classified into five groups. Major groups viz agriculture, worker or day laborer, professional worker or service holder, business and others.

Table 6.13.5: Age specific fertility rate (per 1000 women), the total fertility rate (per woman) and the general fertility rate (per 1000 women) by father's occupation, BDHS, 2007

Age group of women	Father's occupation					
	Agriculture	Worker/Laborer	Professional worker	business	Other	Total
15–19	100.265	106.286	95.000	105.231	82.909	103.791
20–24	174.051	168.158	192.123	144.708	124.315	163.397
25–29	146.289	128.918	145.825	13.14	73.68	128.768
30–34	81.225	84.113	122.711	74.24	66.286	83.599
35–39	32.863	34.432	29.724	20.878	0	29.372
40–44	9.254	10.264	0	12.406	20.381	9.896
45–49	2.185	0	0	0	11.014	1.521
TFR	2.730	2.660	2.926	2.353	1.892	2.601
GFR	82.254	98.405	70.939	78.718	57.471	86.968

Age specific fertility rate in age groups 15–49 by husband's occupation was presented in Table 6.13.5. According to the table, the total fertility rate for farmer was 2.73, for day labourer was 2.66, for professional worker was 2.926, for businessmen was 2.353 and for others occupation was 1.892. The above table indicated that the total fertility rate was higher in number for farmers and day laborer or worker than other all types of occupation in all age groups. When we observed general fertility rate of different occupations, we found that higher fertility for farmers and workers. It was primarily because husband and wife always live together and had no other source of entertainment except that of sexual exposure.



6.13.6 Mother's Occupation

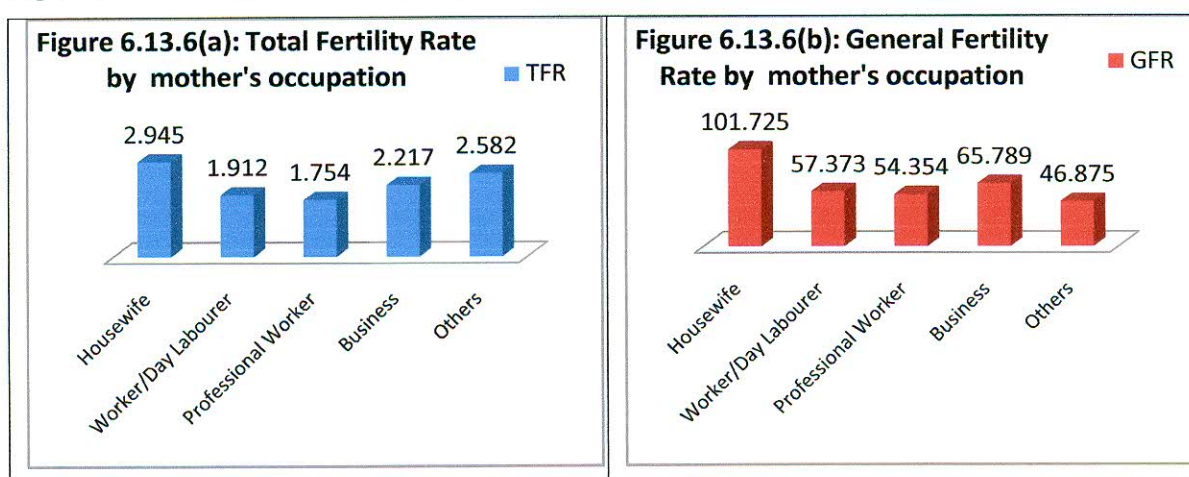
Studies concerning the impact of labor force participation of fertility suggest that working women have lower fertility than their non-working counterparts (Devanzo, 1972; UN, 1973). It argued that labor-force participation will have a decreasing effect

on fertility only if it was incompatible with child-bearing (UN, 1973). The direction of causality between labor force participation and fertility was not certain, because labor force participation might be a consequence and cause of lower fertility.

Table 6.13.6: Age specific fertility rate (per 1000 women), the total fertility rate (per woman) and the general fertility rate (per 1000 women) by mother's occupation, BDHS, 2007

Age group of women	Mother's Occupation					Total
	Housewife	Worker/Laborer	Professional worker	business	Other	
15-19	107.69	89.287	82.514	-	202.667	103.852
20-24	180.485	122.525	115.432	194.118	103.125	164.088
25-29	152.664	95.938	60.893	40.933	153.500	128.711
30-34	100.95	52.429	46.400	154.667	43.163	83.246
35-39	36.306	18.653	14.062	53.765	14.062	29.798
40-44	9.789	3.706	24.812	-	-	9.855
45-49	1.118	-	6.700	-	-	1.511
TFR	2.945	1.912	1.754	2.217	2.582	2.605
GFR	101.725	57.373	54.354	65.789	46.875	86.968

Age specific fertility rate of age groups (15-49) by mother's occupation was presented in Table 6.13.6. It was indicated that housewife mother had shown highest total fertility rate 2.945. Total fertility rate for day labourer, professional worker, business and others working mothers were 1.912, 1.754, 2.217 and 2.582 respectively. So the following table indicates that the children ever-born on the average was higher for non working women than working women for each age group. Among the mother's occupations, housewife mother's general fertility rate was highest, which was 101.7 births per 1000 women of reproductive age.



6.13.7 Religion

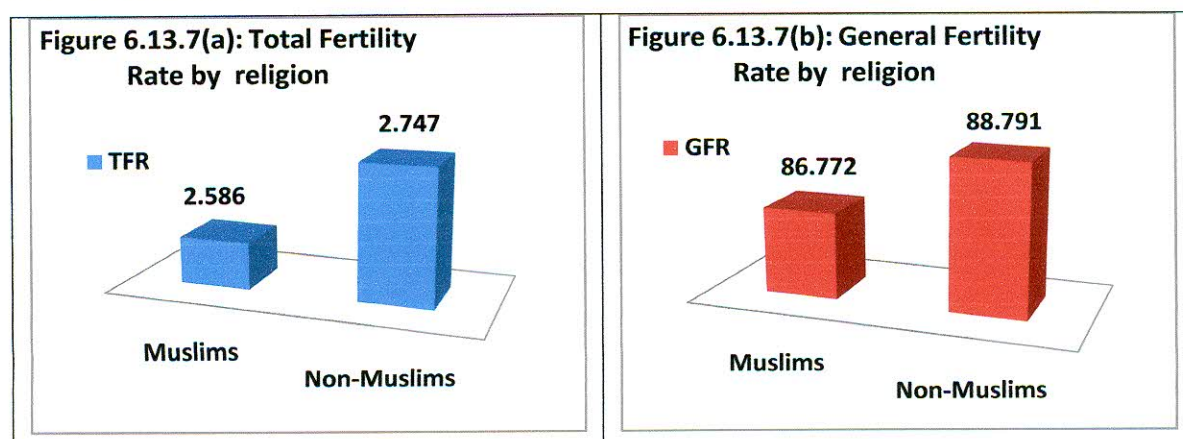
Fertility was affected and influenced by the religions. Those religions which do not put any bar on the number of marriage and children are likely to have more fertility

than the others. Because of more the number of wife's normally there are, more the number of children. Islam was the predominant religion in Bangladesh. Muslims constitute almost 90 percent of the population of Bangladesh; Hindus are about 9 percent, and others less than one percent (BDHS, 2007). Religious value systems which influence individual values are different between the Muslims and others.

Table 6.13.7: Age specific fertility rate (per 1000 women), the total fertility rate (per woman) and the general fertility rate (per 1000 women) by religion, BDHS, 2007

Age group of women	Religion		
	Muslims	Non-Muslims	Total
15–19	104.249	98.722	103.852
20–24	162.801	173.879	163.937
25–29	124.316	166.16	128.512
30–34	84.139	74.932	83.246
35–39	29.957	28.21	29.779
40–44	10.061	7.643	9.839
45–49	1.709	0	1.511
TFR	2.586	2.747	2.603
GFR	86.772	88.791	86.968

The age specific fertility rate of age groups 15–49 by religions were presented in Table 6.13.7. The table indicates that the Muslims had lower fertility than others in each age group except 15–19 and 25–29 age groups. Total fertility rate for Muslims was 2.586 which indicated that Muslims mothers would had on average 2.586 children in her life time if the current age specific fertility rate of Muslim mothers remained unchanged. Again total fertility rate for non-Muslims was 2.747 which were higher than Muslims. The table also depicts general fertility rate for age differences, Muslims had shown the lowest fertility 86.772 than non-Muslims 88.791. Obviously, we can see from the table 6.13.7 that fertility among Muslims was lower as compared with non-Muslims.



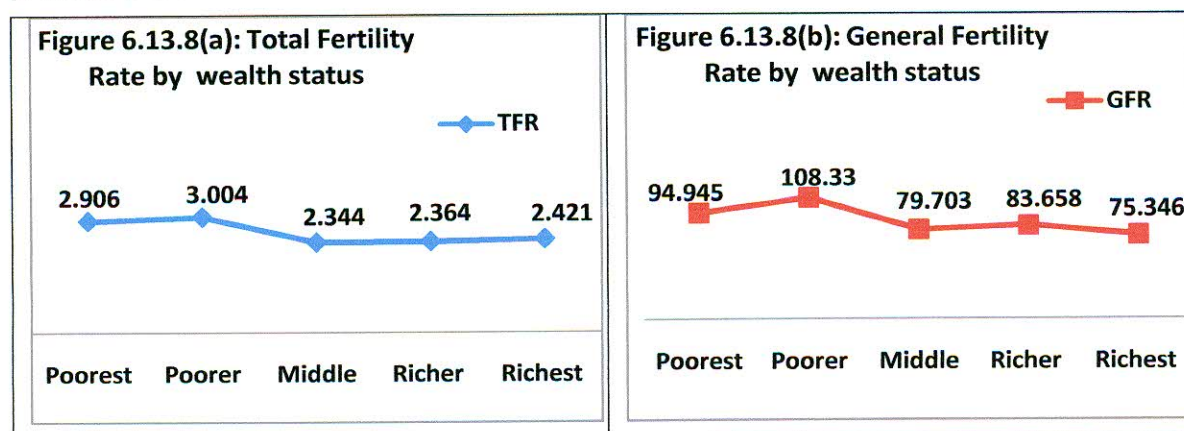
6.13.8 Wealth status

Table 6.13.8 showed differentials in fertility by wealth status. Fertility was negatively associated with wealth, the difference in fertility between women in the lowest and highest wealth quintiles amounts to one child per woman, on average. Age specific and total fertility rates for wealth status were shown in table 6.13.8 along with the general fertility rate. According to the table, the total fertility rate for women age 15–49 in poorest wealth group was 2.906. This means that a poorest wealth group woman would have on average 3 children in her lifetime if the current age specific fertility rate of poorest wealth status remained unchanged. General fertility rate of poorest wealth status group was 95 births per 1000 women of reproductive age. Among the wealth status groups' general fertility rate was lowest in richest wealth group which was 75 births per 1000 women of reproductive age. Again total fertility rate was lowest in middle class wealth group which was 2.344. Women in poorest wealth status exhibit a pattern of early childbearing. According to current fertility rates, women had 18 percent of their children before reaching age 20, on average. They had more than 70 percent children during their twenty five years age.

Table 6.13.8: Age specific fertility rate (per 1000 women), the total fertility rate (per woman) and the general fertility rate (per 1000 women) by wealth status, BDHS, 2007

Age group of women	Wealth status					
	Poorest	Poorer	Middle	Richer	Richest	Total
15–19	103.959	141.625	89.705	103.636	79.085	103.852
20–24	163.491	192.776	139.41	176.663	151.121	163.937
25–29	143.044	151.662	131.181	108.353	115.978	128.512
30–34	100.407	76.624	58.202	59.234	106.922	83.246
35–39	41.892	33.852	24.956	18.527	31.264	29.779
40–44	23.388	4.323	21.58	6.559	-	9.839
45–49	5.057	-	3.961	-	-	1.511
TFR	2.906	3.004	2.344	2.364	2.421	2.603
GFR	94.945	108.330	79.703	83.658	75.346	86.968

Total fertility rate and general fertility rate by wealth status was given below by a pictorial presentation



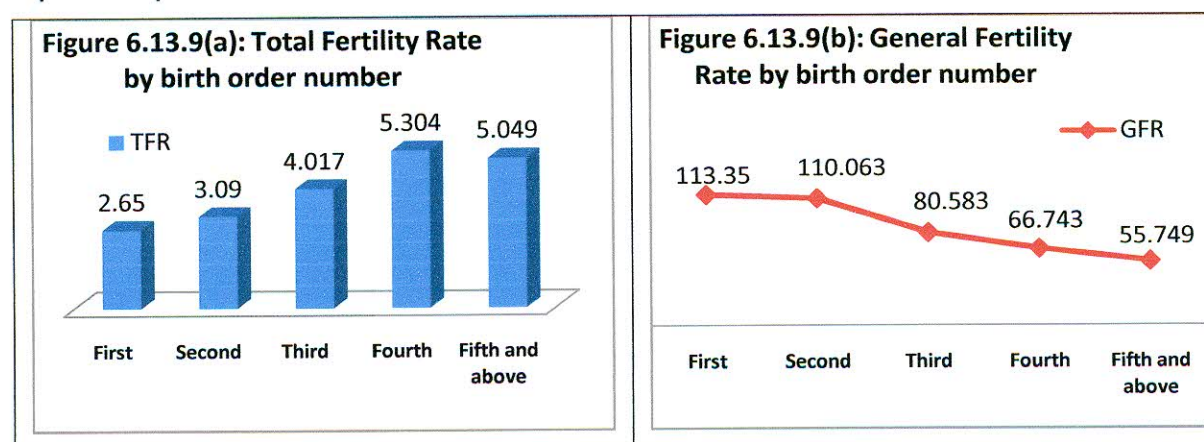
6.13.9 Birth order number

Table 6.13.9 showed differentials in fertility by birth order numbers. Age specific and total fertility rates for birth order number were shown in table 6.13.9 along with the general fertility rate. According to the table, the total fertility rate for woman's first birth was 2.650. This means that first birth woman would had on average 2.65 children in her lifetime if the current age specific fertility rate of poorest wealth status remained unchanged. General fertility rate of first birth women was 113 births per 1000 women of reproductive age. Among the birth order number general fertility rate was decreasing with the increasing number of birth order. Again total fertility rate was also increase with increasing number of birth order. Women in first birth order exhibit a pattern of early childbearing.

Table 6.13.9: Age specific fertility rate (per 1000 women), the total fertility rate (per woman) and the general fertility rate (per 1000 women) by birth order number, BDHS, 2007

Age group of women	Birth order number					
	First	Second	Third	Fourth	Fifth and more	Total
15-19	136.986	240.976	325.714	456.000	-	185.912
20-24	188.210	220.94	236.771	264.623	471.429	190.588
25-29	124.934	101.407	144.587	215.859	283.385	135.515
30-34	65.174	42.278	67.409	103.482	175.042	85.937
35-39	-	12.478	29.058	14.193	58.731	30.506
40-44	17.120	-	-	6.740	18.535	10.045
45-49	-	-	-	-	2.851	1.560
TFR	2.650	3.090	4.017	5.304	5.049	3.200
GFR	113.350	110.063	80.583	66.743	55.749	86.968

Total fertility rate and general fertility rate by birth order number was given below by a pictorial presentation



6.13.10 Previous birth interval

Birth interval was defined as the length of time between two successive live births. It was important in providing insight into births spacing pattern and maternal and child

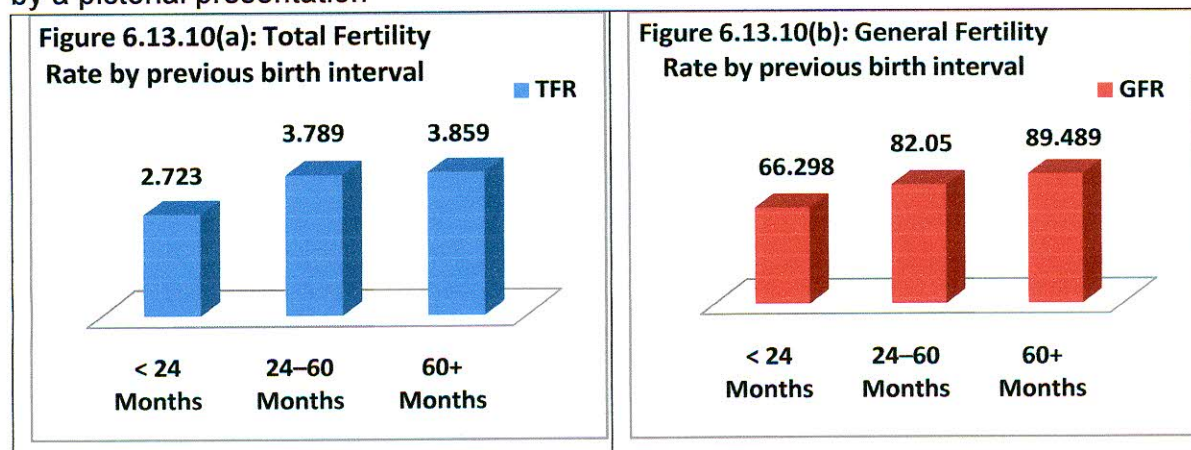
health. Short birth intervals are associated with an increased risk of death for mother and child. Short birth interval also threatens maternal health. The shorter interval following the death of a child was partly due to a shortened period of breastfeeding for the preceding child, who leads to an earlier return of ovulation and hence increase change pregnancy.

Age specific and total fertility rates for previous birth interval were shown in table 6.13.10 along with the general fertility rate. According to the table, the total fertility rate for women age 15–49 in below 24 months or 2 years previous birth interval was 2.723. This means that a poorest wealth group woman would had on average 2.7 children in her lifetime if the current age specific fertility rate of poorest wealth status remained unchanged. General fertility rate of below 2 years previous birth interval was 66 births per 1000 women of reproductive age. Among the previous birth interval general fertility rate was highest in above 5 years previous birth interval which was 89 births per 1000 women of reproductive age. Again total fertility rate was highest in more than 5 years previous birth interval which was 3.859.

Table 6.13.10: Age specific fertility rate (per 1000 women), the total fertility rate (per woman) and the general fertility rate (per 1000 women) by previous birth interval, BDHS, 2007

Age group of women	Previous birth interval			
	< 24 Months	24–60 Months	60+ Months	Total
15–19	231.304	270.957	-	251.13
20–24	149.055	233.239	368.182	229.448
25–29	79.921	138.042	211.26	147.708
30–34	53.857	73.901	137.336	91.341
35–39	21.339	33.097	37.847	32.598
40–44	9.155	7.157	14.346	9.736
45–49	-	1.514	2.989	1.616
TFR	2.723	3.789	3.859	3.817
GFR	66.298	82.050	89.489	81.169

Total fertility rate and general fertility rate by previous birth interval was given below by a pictorial presentation



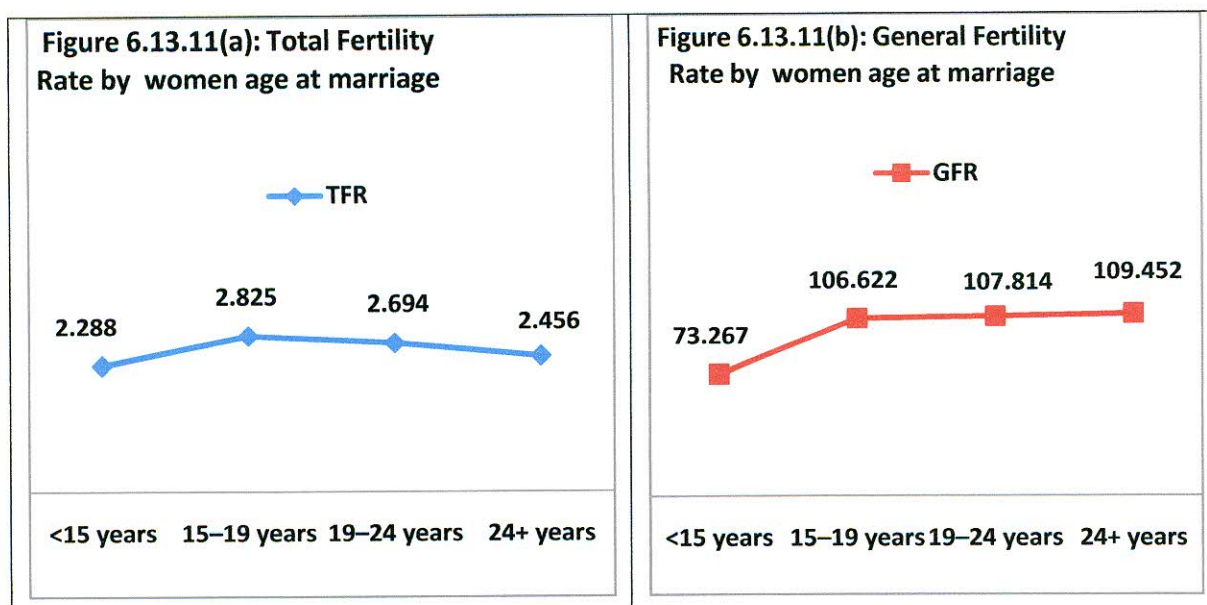
6.13.11 Women age at marriage

It was a common belief that age at marriage was inversely related to fertility. While early marriage of women has been conducive to high fertility (Osborn, 1958) late marriage was argued to have a fertility reducing effect (Coale, 1975). Delayed marriage (other things being equal) shortens the period between generations and hence puts an independent brake on long range population growth (Davis and Blake, 1956). Agarwala (1967) estimated that an increase in average age at marriage from the existing 15.6 years to 19 or 20 would lead to a decline of birth rate by 29% in India. The potential impact of age at first marriage was especially high in countries where there was little voluntary control of fertility (Yaukey and Thorsen, 1972). Age specific fertility rate of age groups (15–49) was calculated by women age at marriage which was presented in table 5.13.12. From this table, it was revealed that age specific fertility rate was high for the women whose age at marriage between 15–19 years, it was also high form below 15 years women though legal age of marriage in Bangladesh was 18 years. Here early marriage picture surely revealed. From the analysis it was observed that fertility increased with the increased in age.

Table 6.13.11: Age specific fertility rate (per 1000 women), the total fertility rate (per woman) and the general fertility rate (per 1000 women) by women age at marriage, BDHS, 2007

Age group of women	Women age at marriage				
	<15 years	15–19 years	19–24 years	24+ years	Total
15–19	105.639	100.712	-	-	103.852
20–24	135.482	192.748	191.667	-	163.937
25–29	107.51	142.536	167.867	259.031	128.512
30–34	74.202	85.265	103.789	175.094	83.246
35–39	26.479	27.53	54.22	57.125	29.779
40–44	6.310	16.357	21.4	-	9.839
45–49	1.998	-	-	-	1.511
TFR	2.288	2.825	2.694	2.456	2.603
GFR	73.267	106.622	107.814	109.452	86.968

The table 6.13.11 also presented that the women completing her child bearing period who was married at the age of (<19 years) has on an average produced 2.288, while one who was married at the age of (24+) has produced an average of 2.456 children which was 7 percent more than those married at (<19 years). It appeared that fertility goes down when marriage takes place at a late stage. It was a well known fact that fertility rate was higher in countries where marriages take place at comparatively early ages, as compared with the people who marry at late stage.



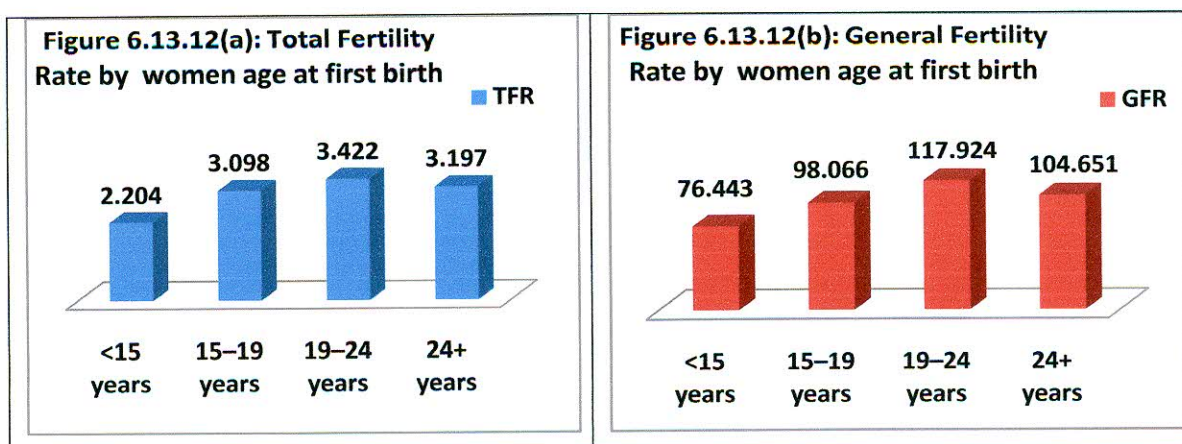
6.13.12 Women age at first birth

Fertility was affected by mother's age at first birth. Age at first birth gives a clear picture on early childbearing, contraceptive use status, pregnancy pattern of women, maternal and child health status which are influence fertility mostly in Bangladesh. In recent years age at first birth was slightly increasing. Since, early childbearing was common demographic measurement which influenced by age at first births, age at first birth was an important indicator of fertility pattern as well as reproductive health. Age specific and total fertility rates for women age at first birth are shown in table 6.13.12 along with the general fertility rate. According to the table, the total fertility rate for women age 15–49 in age at first birth below 15 years was 2.204. This means that below 15 years mothers when gave first birth, she would had on average 2.2 children in her lifetime if the current age specific fertility rate of poorest wealth status remained unchanged. General fertility rate for women who gave first birth within 15 years was 76 births per 1000 women of reproductive age. Among the age at first birth general fertility rate was highest in 19–24 years mother's which was 118 births per 1000 women of reproductive age. Again total fertility rate was highest in 19–24 years mother's which was 3.422. Teenagers exhibit a pattern of early childbearing. According to current fertility rates, women had 30 percent of their children before reaching age 15, on average. They had more than 70 percent children during their teenage.

Table 6.13.12: Age specific fertility rate (per 1000 women), the total fertility rate (per woman) and the general fertility rate (per 1000 women) by women age at first birth, BDHS, 2007

Age group of women	Women age at birth				Total
	<15 years	15–19 years	19–24 years	24+ years	
15–19	131.961	223.873	-	-	185.912
20–24	127.893	160.745	354.863	-	190.588
25–29	95.938	122.8	158.583	379.235	135.515
30–34	57.843	78.624	112.796	149.98	85.937
35–39	17.805	27.838	42.023	48.105	30.506
40–44	6.821	4.129	16.151	62.255	10.045
45–49	2.707	1.693	-	-	1.560
TFR	2.204	3.098	3.422	3.197	3.200
GFR	76.443	98.066	117.924	104.651	86.968

Total fertility rate and general fertility rate by women age at first birth was given below by a pictorial presentation



6.14 Conclusion

Fertility in Bangladesh was declining over the past 36 years by observing the trends in fertility. The trends in the crude birth rates from 1974 to 2010 indicates that the crude birth rates fluctuated around 34 per 1000 population throughout the period until 1989 then fertility had been declining moderately. Total fertility rate had declined about 60 percent from 6.3 births per women in the period 1975 to 2.7 births for the period 2007. It was truly an exceptionally steep decline. Period fertility approach reveals that the level of fertility was still very high in Bangladesh although the age specific fertility rate had been decreasing over time in each age group. The age had shifted from 25–29 in 1975 to 20–24 in 1999–2000 and 2007. Moreover, the

completed family size in case of cohort fertility gave the level of fertility of a particular cohort and it indicated that the mean number of children ever born per ever married women had been declining over time and it was slightly lower on recent years in each age group. In Bangladesh, the norm of early and universal marriage still prevails. Most of the first marriage occurs within a short of life. The age patterns of marriage occurred within a short span of life. The age patterns of marriage and the contraceptive use had changed in a positive direction, the negative impact of which had fallen on fertility. The change in marital fertility that had taken place in the country overtime was contributed less by the change in marital fertility in comparison to the change in marriage pattern. Also the effect of change of marriage pattern in reducing fertility level perhaps had increased over time.

Almost all studies had shown that selected background variables had positive or negative effect on reproductive behaviour. From the analysis, the regional differentials revealed the regional variation in fertility and those might be the result of education, occupation, religion, urbanization and economic condition of that area. The urban-rural differentials of fertility show that the rural fertility was higher than the urban. Level of education may effectively reduce reproductive performance of the women in Bangladesh. Besides these socio-economic variables that was women and men labour force participation influence fertility negatively. Again, it was usually seen that those who are engaged in mental work have less number of children, as compared with those who are in physical labour. Socio-cultural variables religion and birth status of women prove that in our rural and superstitious society such variables help to increase fertility. Age at marriage had a reducing effect on fertility furthermore the increase of the age at marriage and age at first birth may effectively reduce reproductive performance of the women in Bangladesh.

Chapter: Seven

Fertility Situation in Bangladesh: Application of Bongaart's Model



Chapter: Seven

Fertility Situation in Bangladesh: Application of Bongaarts Model

7.1 Introduction

The study of fertility cannot be overemphasized because of its great impact on both population growth rate and on other social, economical and cultural parameters. This is especially true in Bangladesh, which until very recently has been characterized by a population growth rate of 2.7% per year. While human fertility influence population growth, which has consequences towards pressure on resource, employment situations, health and other social facilities and savings and investment: such consequences, in turn, great bearing on the socio-demographic and socio-economic variables that affect fertility behavior. The level of fertility in a society is directly influenced by a set of variables is called intermediate variable or proximate determinants (Davis and Blake, 1956). Factors influencing fertility can be classified into two groups, namely intermediate fertility variables, or proximate determinants, and socioeconomic variables. The former, of interest because of its direct impact on fertility, consists of a set of biological and behavioral factors through which social, economic and cultural conditions can affect fertility. In other words, in the absence of these determinants, human fertility may reach a theoretical maximum of total fecundity (TF), accounting to an average of 15.3 births per woman¹. Thus, fertility differentials between regions and across time within the same region can always be traced to changes in one or more of the proximate determinants. Bongaart's (1978) revised the original classification and provide a simple analytical method accounting framework, which permits a quantitative assessment of the contribution of different proximate determinants to give fertility levels or change. Bongaart's (1978) demonstrated that most of the variation in fertility is due to four intermediate variables or proximate determinants. These are marriage, contraception, abortion and lactational infecundability. Since fertility is the resultant of multiplicity of factors, studies have attempted to identify these factors which have important bearing for policy interventions in altering the level of fertility (Heer, 1966; Cain and Weininger,

¹ TF varies from culture to culture. For high level of C_c Bongaart's (1978) considered TF as 15.4, Islam and Musleuddin (1987) as 15.3, Kabir and Rab (1990) as 15.3 and BFS (1989) as 15.3.

1973; Bahr, 1975; Defranzo, 1976; Kohli, 1977). In this chapter we attempt to identify the four intermediate variables namely proportion married among females, contraceptive use effectiveness, induced abortion and duration of lactational infecundability and analyze the role of each of the proximate determinants in the fertility decline of Bangladesh and compare the changes. Moreover, we try to investigate their impacts on change in the level of fertility for the period 1993–94 to 2007 in Bangladesh. During this period decomposing Bongaarts' model assesses the individual contribution made by each of the four intermediate variables to change the fertility level.

While Davis and Blake (1956) were the first to identify a set of 11 proximate determinants known as “Intermediate Fertility Variables”, their classification did not get wide acceptance because it was not easily incorporated in fertility analysis. In view of that, Bongaarts (1978) reclassified this list of determinants into seven variables, including marriage pattern, contraceptive use, induced abortion, lactation infecundability, spontaneous abortion, frequency of coitus and sterility. However, after various studies, Bongaarts realized that some of these factors are more relevant than others in determining the magnitude of fertility change. In fact, only four of them (proportion married, contraceptive use and effectiveness, induced abortion and postpartum infecundability) are the most important in explaining fertility variation, accounting for up to 96% of fertility change in some populations (Bongaarts, 1982; 1978).

$$TFR = C_m \times C_c \times C_a \times C_i \times TF \quad \text{--- (1)}$$

7.2.1 Index of Proportion Married (C_m)

$$C_m = \frac{\sum m(a)g(a)}{\sum g(a)} \quad \text{--- --- --- --- --- (2)}$$

$q(a)$: Age specific marital fertility rate

$$C_m = \frac{TFR}{TM} \quad \text{so that, } TFR = C_m \times TM \quad \dots \dots \dots (3)$$

7.2.2 Index of Non-Contraception (C_c)

- 200 -

$$TM = C_c \times TMN \quad (4)$$

Where, TNM is the total natural marital fertility rates which are equal to TM in the absence of contraception and induced abortion. Equation (4) simply states that TM is smaller than TNM by a proportion C_c with the value of C_c depending on the prevalence of contraception that is the extent of use effectiveness of contraception; that is, the extent of use effectiveness of contraception (induced abortion is assumed absent for the moment). When no contraception is practiced, $C_c = 1$, and when all non-sterile women in the reproductive years are protected by 100 percent effective contraception; $C_c = 0$, and then $TM = 0$. If all couples, who practice contraception, is assumed non-sterile, the index C_c can be written as:

$$C_c = 1 - s \times u \times e \quad \text{--- --- --- --- ---} \quad (5)$$

Where, u = Proportion currently using contraception among married women of reproductive age.

e = Average use effectiveness of contraception.

s = 1.08: Sterility correction factor.

To relate the index of contraception to the total fertility rate, equation (4) is substituted in equation (3) and becomes

$$\text{TFR} = C_m \times C_a \times \text{TNM} \quad \dots\dots\dots(6)$$

This equation gives the total fertility rate from the natural fertility rate by taking into account the fertility reducing impact of contraception and marriage measured by the index of C_m and C_c respectively.

7.2.3 Index of Induced Abortion (C_a)

Although a reliable measurement of the prevalence of reduced abortion is practiced in many societies, even in cases where good estimates are available, it has proven difficult to determine the reduction in fertility that is associated with the practice of induced abortion.

Estimates of number birth averted by induced abortion are largely based on numerical exercise using mathematical reproductive models. The most detailed studies of this topic have been made by Potter (1976), whose work has demonstrated as the following: In the absence of contraception, an induced abortion averts about 0.4 births, while about 0.8 births are averted when moderately effective

contraceptive is practiced. To generalize from these findings the births averted per induced abortion B, may be estimated with the following the equation.

$$B = 0.4(1+u) \quad (7)$$

A convenient overall measure of the incidence of induced abortion is provided by the Total Abortion rate (TA) equal to the average number of induced abortions per women at the end of the reproductive period, if induced abortion rates remain at prevailing levels through the reproductive period (excluding induced abortion to women who are not married). The reduction in fertility associated with a given level of total abortion rate is calculated as:

$$A = B \times TA = 0.4 (1+u) \times TA$$

Where, A equals the average number of birth averted per women by the reproductive years. The index of induced abortion is defined as the ratio of the observed Total Fertility Rate (TFR), to the estimated total fertility rate without induced abortion, TFR+A; that is

$$C_a = \frac{TFR}{TFR + A} \quad (8)$$

The index C_a equals the proportion by which fertility is reduced as the consequence of the practice of induced abortion (Note that C_a decline with increasingly incidence of induced abortion). Modifying equation (6) accordingly, the relationship between TFR and TNM becomes:

$$\text{TFR} = C_m \times C_c \times C_a \times \text{TNM} \quad (9)$$

7.2.4 Index of lactational Infecundability ((C_i))

In modern western population lactation is generally short and many women do not lactate at all. In traditional societies in Africa, Latin America and Asia, lactation is usually long and lasts until the next pregnancy occurs. Lactation has an inhibition effect on fertility and thus increases the birth interval and reduces natural fertility (potter, 1965). A typical average birth intervals with and without lactation can be estimated to be 18.5 months². The ratio of the average birth intervals without and with lactation is given by-

² Chen, Ahmed, Gesche and Mosely (1974) found for Matlab Population and average duration of lactional infecundable period as 18.7 months, Abedin (1983) as 18.0 months for a rural population in Bangladesh and BFS (1989) as 18.5 months.

$$C_i = \frac{20}{18.5 + i} \quad \text{--- (10)}$$

Where, i is the average duration (in months) of infecundability from birth to the first to the first post-partum ovulation (menses).

An indirect estimates of i as developed by Bongaarts' is given by-

$$i = 0.1753 \times \exp[0.1396 \times B - 0.001872 \times B^2]$$

Where, B is the average duration of breastfeeding in months. The relationship between lactation and the total natural marital fertility rate becomes:

$$TNM = C_i \times TF$$

Where, TF is the total fecundity rate equal to the natural marital fertility rate in the absence of lactation. Then the model is represented including lactation infecundability as:

$$TFR = C_m \times C_c \times C_a \times C_i \times TF$$

7.3 The estimated Proximate Variables and Implications for three different women groups

On the basis of the Bongaarts' model gives in equation (1), the estimated value of the measures and indices for different times points were presented in table 7.3 the complement of the represented the proportionate reduction in fertility attribute to the fertility determinant. The lower the estimated value of the indices, the greater the fertility reducing effect.

Table 7.3: Estimated of different reproductive measures and indices of fertility for three different women groups, BDHS, 1993–94, 2004 and 2007

Measures and indices	Women according to BDHS			Women who lost their baby according to BDHS			Women who did not lost their baby according to BDHS		
	1993-94	2004	2007	1993-94	2004	2007	1993-94	2004	2007
TFR	3.400	3.000	2.700	3.600	3.270	3.205	3.075	2.875	2.605
TM	5.538	3.369	3.554	5.412	3.509	4.485	5.771	3.468	3.864
TNM	9.532	7.405	7.405	8.430	7.222	7.258	10.251	8.283	8.258
TF	15.300	15.305	15.292	15.300	15.316	15.302	15.300	15.300	15.302
C _m	0.614	0.890	0.759	0.665	0.932	0.715	0.533	0.829	0.674
C _c	0.581	0.455	0.474	0.642	0.486	0.618	0.563	0.413	0.468
C _a	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
C _i	0.623	0.484	0.484	0.551	0.472	0.474	0.670	0.541	0.540

Source: BDHS 1993–94, 2004, 2007

For the women group according to BDHS, we had the value of C_m in 1993–94 was 0.614, indicating that the proportion of women married reduces fertility by 38.6% while the value of C_m in 2004 was 0.890, in 2007 was 0.759 indicating that the proportion of women married reduces fertility by 11.0% and 24.1% respectively. The value of C_c in 1993–94 was 0.581 indicating that the index of contraception reduces fertility by 41.9%, while the value of C_c in 2004 was 0.526 and in 2007 was 0.474, indicating that the index of contraception reduces fertility by 47.4% and 52.6% respectively. Again the index C_i in 1993–94 was 0.623, indicating that the average estimated effect was not very strong for the reduction in fertility 37.7%, compared with the value of the index C_i in 2004 was 0.484 and in 2007 was 0.484 which was remain unchanged between 2004 and 2007. The reducing impact of contraception on fertility varies from time to time, because of decreasing the use of effectiveness of methods. In recent years, the use of contraception decreased slowly and as a result the average fertility reducing impact of contraception decreased. It was clear fertility; the effect of proportion married was increasing but contraception was decreasing.

Again from the women group where women lost their baby according to BDHS, we had the value of C_m in 1993–94 was 0.665, indicating that the proportion of women married reduces fertility by 33.5% while the value of C_m in 2004 was 0.932, in 2007 was 0.715 indicating that the proportion of women married reduces fertility by 6.8% and 28.5% respectively. The value of C_c in 1993–94 was 0.642 indicating that the index of contraception reduces fertility by 35.8%, while the value of C_c in 2004 was 0.486 and in 2007 was 0.618 indicating that the index of contraception reduces fertility by 51.4% and 38.2% respectively. Again the index C_i in 1993–94 was 0.551, indicating that the average estimated effect was not very strong for the reduction in fertility 44.9%, compared with the value of the index C_i in 2004 was 0.472 and in 2007 was 0.474 indicating that the proportion of lactational infecundability reduced fertility by 52.8% and 52.6% respectively. In recent years, the use of contraception decreased slowly and as a result the average fertility reducing impact of contraception decreased. It was clear in reducing fertility that the effect of proportion married was increasing but proportion contraception and lactational infecundability are decreasing.

Now from the women group where women did not lost their baby according to BDHS, we had the value of C_m in 1993–94 was 0.533, indicating that the proportion of women married reduces fertility by 46.7% while the value of C_m in 2004 was 0.829,

in 2007 was 0.674 indicating that the proportion of women married reduces fertility by 17.1% and 32.6% respectively. The value of C_c in 1993–94 was 0.563 indicating that the index of contraception reduces fertility by 43.7%, while the value of C_c in 2004 was 0.413 and in 2007 was 0.468, indicating that the index of contraception reduces fertility by 58.7% and 53.2% respectively. Again the index C_i in 1993–94 was 0.670, indicating that the average estimated effect was very strong for the reduction in fertility 33.0%, compared with the value of the index C_i in 2004 was 0.541 and in 2007 was 0.540, indicating that the proportion of lactational infecundability reduces fertility by 45.9% and 46.0% respectively. It was clear the effect of proportion married was increasing but proportion contraception and lactational infecundability were decreasing for the reduction of fertility.

7.4 Magnitude of the Total Fertility Inhibiting Effect being accounted for each Proximate Determinant:

The difference between the total fecundity rate (TF, taken as 15.30) and the estimated TFR was attributed the result of the inhibitory effect of each variable. The total inhabiting effect was prorated by the proportion of the logarithm of each index to the sum of logarithm of all indices (Wang et al., 1987).

$$\text{Effect of marriage} = \frac{[TF - TFR(\text{estimated})] \times \log_e C_m}{\log_e C_m + \log_e C_c + \log_e C_i}$$

$$\text{Effect of contraception} = \frac{[TF - TFR(\text{estimated})] \times \log_e C_c}{\log_e C_m + \log_e C_c + \log_e C_i}$$

$$\text{Effect of Postpartum Infecundability} = \frac{[TF - TFR(\text{estimated})] \times \log_e C_i}{\log_e C_m + \log_e C_c + \log_e C_i}$$

Here, $TFR(\text{estimated}) = C_m \times C_c \times C_i \times 15.30$

Table 7.4 exhibited the trend in the magnitude of the inhabiting effect being accounted for each proximate variable for three different women groups. The results indicate that women group based on BDHS, a total of 11.899 births in 1993–94 being inhibited; 3.861 births were due to effect of marriage variable; 4.296 births were due to contraception and 3.742 births were due to postpartum infecundability. A total of 12.301 births in 2004 being inhibited; 0.883 births were due to effect of marriage variable; 5.939 births were due to contraception and 5.478 births were due to postpartum infecundability. Again a total of 12.636 births in 2007 being inhibited;

1.994 births were due to effect of marriage variable; 5.397 births were due to contraception and 5.245 births were due to postpartum infecundability. Again for the women group where women lost their baby, a total of 11.701 births in 1993–94 being inhibited; 3.299 births were due to effect of marriage variable; 3.582 births were due to contraception and 4.819 births were due to postpartum infecundability. A total of 12.029 births in 2004 being inhibited; 0.546 births were due to effect of marriage variable; 5.629 births were due to contraception and 5.854 births were due to postpartum infecundability. Again a total of 12.095 births in 2007 being inhibited; 2.594 births were due to effect of marriage variable; 3.724 births were due to contraception and 5.776 births were due to postpartum infecundability. Furthermore, for the women group where women did not lost their baby, a total of 12.223 births in 1993–94 being inhibited; 4.796 births were due to effect of marriage variable; 4.377 births were due to contraception and 3.050 births were due to postpartum infecundability. A total of 12.466 births in 2004 being inhibited; 1.383 births were due to effect of marriage variable; 6.539 births were due to contraception and 4.542 births were due to postpartum infecundability. Again a total of 12.694 births in 2007 being inhibited; 2.827 births were due to effect of marriage variable; 5.446 births were due to contraception and 4.420 births were due to postpartum infecundability.

Table 7.4: Trends in the Magnitude of the Total Fertility Inhibiting Effect being accounted for each proximate variable, Bangladesh 1975-2007

Proximate Variable	Fertility Inhibiting Effect								
	Birth per women								
	Women of BDHS			Women who lost their baby according to BDHS			Women who did not lost their baby according to BDHS		
	1993-94	2004	2007	1993-94	2004	2007	1993-94	2004	2007
Marriage	3.861	0.883	1.994	3.299	0.546	2.594	4.796	1.383	2.827
Contraception	4.296	5.939	5.397	3.582	5.629	3.724	4.377	6.539	5.446
Postpartum infecundability	3.742	5.478	5.245	4.819	5.854	5.776	3.050	4.542	4.420
TF-TFR(estl.)	11.899	12.301	12.636	11.701	12.029	12.095	12.223	12.466	12.694

Proximate Variable	Fertility Inhibiting Effect								
	Percentage								
	Women of BDHS			Women who lost their baby according to BDHS			Women who did not lost their baby according to BDHS		
	1993-94	2004	2007	1993-94	2004	2007	1993-94	2004	2007
Marriage	32.448	7.178	15.780	28.194	4.539	21.446	39.237	11.094	22.270
Contraception	36.104	48.281	42.711	30.613	46.795	30.789	35.809	52.455	42.902
Postpartum infecundability	31.448	44.533	41.508	41.184	48.665	47.755	24.953	36.435	34.819
TF-TFR(estl.)	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Table 7.4 also depicts that for the women group based on BDHS, the contribution of marriage in reducing fertility decreased from 3.861 births per-women in 1993–94 to 0.883 births in 2004 and 1.994 in births per-women in 2007. The effect of contraceptive use increased from 4.296 births per-women in 1993–94 to 5.939 births in 2004 and 5.397 births per-women in 2007. Again the effect of postpartum infecundability increased from 3.742 births per-women in 1993–94 to 5.478 births in 2004 and 5.245 births per-women in 2007. Now for the women group where women lost their baby, the contribution of marriage in reducing fertility decreased from 3.299 births per-women in 1993–94 to 0.546 births in 2004 and 2.594 in births per-women in 2007. The effect of contraceptive use increased from 3.582 births per-women in 1993–94 to 5.629 births in 2004 and 3.724 births per-women in 2007. Again the effect of postpartum infecundability increased from 4.819 births per-women in 1993–94 to 5.854 births in 2004 and 5.776 births per-women in 2007. Furthermore, for the women group where women did not lost their baby, the contribution of marriage in reducing fertility decreased from 4.796 births per-women in 1993–94 to 1.383 births in 2004 and 2.827 in births per-women in 2007. The effect of contraceptive use increased from 4.377 births per-women in 1993–94 to 6.539 births in 2004 and 5.446 births per-women in 2007. Again the effect of postpartum infecundability increased from 3.050 births per-women in 1993–94 to 4.542 births in 2004 and 4.420 births per-women in 2007.

7.5 Decomposition of the Change in Fertility and Contraception of Proximate Variables for three different groups of women

Bongaarts' model given by the equation (1), we can easily be turned to a decomposition equation that allows the quantification of the contribution made by each of the four intermediate fertility variables to an observed change in fertility between two time points 0 and t, the basic equation was as follows:

$$\frac{TFR(t)}{TFR(0)} = \frac{C_m(t)}{C_m(0)} \times \frac{C_c(t)}{C_c(0)} \times \frac{C_a(t)}{C_a(0)} \times \frac{C_i(t)}{C_i(0)} \times \frac{TF(t)}{TF(0)} \quad \text{--- (11)}$$

If the two points of times were 1993–94 and 2007, using equation (11) for two times 1993–94 and 2007, we can show that:

$$\frac{TFR(2007)}{TFR(1993/94)} = \frac{C_m(2007)}{C_m(1993/94)} \times \frac{C_c(2007)}{C_c(1993/94)} \times \frac{C_a(2007)}{C_a(1993/94)} \times \frac{C_i(2007)}{C_i(1993/94)} \times \frac{TF(2007)}{TF(1993/94)} \quad \dots \quad \dots \quad (12)$$

Define again,

$$P_f = \frac{TFR(2007)}{TFR(1993/94)} - 1$$

= Proportional change in TFR between in 2004 and 2007.

$$P_m = \frac{C_m(2007)}{C_m(1993/94)} - 1$$

= Proportional change in TFR due to a change in the index of marriage.

$$P_c = \frac{C_c(2007)}{C_c(1993/94)} - 1$$

=Proportional change in TFR due to a change in the index of contraception.

$$P_a = \frac{C_a(2007)}{C_a(1993/94)} - 1$$

= Proportional change in TFR due to a change in the index of abortion

$$P_i = \frac{C_i(2007)}{C_i(1993/94)} - 1$$

= Proportion change in TFR due to a change in the lactational infecundability.

$$P_r = \frac{TF(2007)}{TF1993/94)} - 1$$

= Proportion change in TFR due to a change in the remaining proximate determinants-natural fecundability, spontaneous intrauterine mortality and permanent sterility.

Now equation (12) can be rearranged as

$$P_f = P_m + P_c + P_a + P_i + P_r + I \dots \dots \dots (13)$$

Where, $\square$ represented an interaction factor. This equation simply states a given proportion change in the TFR between 1993–94 and 2007 equal to the sum of the proportional fertility changes due to the different intermediate fertility variables plus an interaction term. It was simply estimated by substituting the sum of P_m , P_c , P_a , P_i , and P_r , from P_f . Equation (13) can now easily be turned into a decomposition equation for the absolute decline in TFR (2007) viz. $\{TFR(2007) - TFR(1993-94)\}$ multiplying TFR (1993–94). The decomposition procedure for the TFR can easily be extended also to allow the decompositions of a change in the crude birth rate (CBR). The CBR was linked to its proximate determinants by the following equation:

about 0.03% increase and by interaction factor decrease 12.7% in TFR. Again the decomposition of this decline in TFR between 1993–94 to 2007 had been nearly 23.6% arise due to increase in the proportion of women married, about 18.4% decline due to an increase in contraception use and effectiveness and about 22.3% decline due to increase of the duration of lactational infecundability. The remaining proximate determinants together contribute about 0.05% decreases and about 3.4% decrease by interaction factors. The decomposition results were standardized to add to 100%. Further table 7.5.1 indicated that during 1993–94 to 2004, it had declined by 0.400 births per-women of which 1.528 births increased by proportion married, 0.737 births declined due to contraceptive use, 0.759 births decline due to lactational infecundability, 0.001 births increased by other proximate determinants and the interaction factor has decreased 0.434 births per-women. Again during 1993–94 to 2007, it had declined by 0.700 births per-women of which 0.803 births increased by proportion married, 0.626 births declined due to contraceptive use, 0.759 births decline due to lactational infecundability, 0.002 births decreased by other proximate determinants and the interaction factor has decreased 0.116 births per-women. It was clear from table 7.5.1 that decline in fertility by proportion married made significant contribution to the overall fertility reduction, and that the contraception use has made an impact on reducing fertility of total reduction which may be attributed to the decrease use of contraception from 44.6% in 1993–94 to 58.1% in 2004 and 55.8% in 2007.

Table 7.5.1(a): decomposition of changes in CBR by different measures and indices between 1993–94 and 2007 for the women of BDHS 2007

Changing Indices	Percentage of Change		Distribution of Percentage Change		Absolute Change of CBR	
	1993/94–2004	1993/94–2007	1993/94–2004	1993/94–2007	1993/94–2004	1993/94–2007
P _s	14.197	9.537	596.262	84.969	4.174	2.804
C _m	44.951	23.616	1887.904	210.406	13.215	6.943
C _c	–21.687	–18.416	–910.836	–164.077	–6.376	–5.415
C _a	0	0	0	0	0	0
C _i	–22.311	–22.311	–937.043	–198.779	–6.559	–6.559
TF	0.033	–0.052	1.386	–0.463	0.010	–0.015
I	–12.700	–25.700	–535.531	–30.515	–3.749	–1.007
P _b	–2.381	–11.224	100.000	100.000	–0.700	–3.300

It was clear from table 7.5.1(a) that the change in CBR by different intermediate fertility variables and age-sex composition has contributed that in decreasing of CBR. It has increased about 13.215 births by the proportion of women married during 1993–94 to 2004 and about 6.943 births during 1993–94 to 2007; but it had decrease 6.376 births by the use of contraception during 1993–94 to 2004 and about 5.415 births during 1993–94 to 2007; again it has decrease 6.559 births by the proportion of lactational infecundability during 1993–94 to 2004 and same births during 1993–94 to 2007.

Table 7.5.2: Decomposition of changes in TFR by different measures and indices for those women who lost their baby according to BDHS 2007

Changing Indices	Percentage of Change		Distribution of Percentage Change		Absolute Change of TFR	
	1993/94–2004	1993/94–2007	1993/94–2004	1993/94–2007	1993/94–2004	1993/94–2007
C _m	40.150	7.519	437.984	68.529	1.445	0.271
C _c	–24.299	–3.738	–265.070	–34.069	–0.875	–0.135
C _a	0	0	0	0	0	0
C _i	–14.338	–13.975	–156.409	–127.370	–0.516	–0.503
TF	0.105	0.013	1.145	0.118	0.004	0.001
I	–10.785	–0.791	–117.650	–7.209	–0.388	–0.028
TFR	–9.167	–10.972	100.000	100.000	–0.330	–0.395

Source: BDHS 1993-94, 2004 and 2007

Table 7.5.2 represented the decomposition of change of all indices in TFR between 1993–94 and 2004 and 1993–94 and 2007. It indicated that TFR has decline about 9.167% from 3.6 in 1993–94 to 3.27 in 2004. From 1993–94 to 2007 TFR declined 10.972% from 3.6 in 1993–94 to 3.205 in 2007. It also indicated that the decomposition of this decline in TFR between 1993–94 to 2007 though 40.150% increase in the proportion of women married, about 24.299% decline due to an increase in contraceptive use and effectiveness but about 14.338% decrease due to the duration of lactational infecundability. The remaining proximate determinants together contribute about 0.105% increase and by interaction factor decrease 10.785% in TFR. Again the decomposition of this decline in TFR between 1993–94 to 2007 has been nearly 7.5% arise due to increase in the proportion of women married, about 3.738% decline due to an increase in contraception use and effectiveness and about 13.975% decline due to increase of the duration of

lactational infecundability. The remaining proximate determinants together contribute about 0.013% decreased and about 0.791% decrease by interaction factors. The decomposition results were standardized to add to 100%. Further table 7.5.2 indicated that during 1993–94 to 2004, it had declined by 0.330 births per-women of which 1.445 births increased by proportion married, 0.875 births declined due to contraceptive use, 0.516 births decline due to lactational infecundability, 0.004 births increased by other proximate determinants and the interaction factor had decreased 0.388 births per-women. Again during 1993–94 to 2007, it had declined by 0.395 births per-women of which 0.271 births increased by proportion married, 0.135 births declined due to contraceptive use, 0.503 births decline due to lactational infecundability, 0.001 births decreased by other proximate determinants and the interaction factor had decreased 0.028 births per-women.

Table 7.5.2(a): decomposition of changes in CBR by different measures and indices between 2004 and 2007 for the women who lost their baby according to BDHS 2007

Changing Indices	Percentage of Change		Distribution of Percentage Change		Absolute Change of CBR	
	1993/94–2004	1993/94–2007	1993/94–2004	1993/94–2007	1993/94–2004	1993/94–2007
P _s	26.246	35.214	153.674	145.260	9.528	12.783
C _m	40.150	7.519	235.084	31.016	14.575	2.729
C _c	–24.299	–3.738	–142.274	–15.419	–8.821	–1.357
C _a	0	0	0	0	0	0
C _i	–14.338	–13.975	–83.951	–57.869	–5.205	–5.092
TF	0.105	0.013	0.615	0.054	0.038	0.048
I	–10.785	–0.791	–63.148	–3.263	–3.915	–0.287
P _b	–17.079	–24.242	100.000	100.000	–6.200	–8.800

It was clear from table 7.5.2(a) that the change in CBR by different intermediate fertility variables and age-sex composition has contributed that in decreasing of CBR. It had increased about 14.575 births by the proportion of women married during 1993–94 to 2004 and about 2.729 births during 1993–94 to 2007; but it had decrease 8.821 births by the use of contraception during 1993–94 to 2004 and about 1.357 births during 1993–94 to 2007; again it had decrease 5.205 births by the proportion of lactational infecundability during 1993–94 to 2004 and 5.092 births by the proportion of lactational infecundability during 1993–94 to 2007.

Table 7.5.3: Decomposition of changes in TFR by different measures and indices for those women who did not lost their baby according to BDHS

Changing Indices	Percentage of Change		Distribution of Percentage Change		Absolute Change of TFR	
	2004-2007	2004-2007	2004-2007	2004-2007	2004-2007	2004-2007
C _m	10.882	26.454	167.312	173.083	0.335	0.813
C _c	-26.642	-16.874	-409.625	-110.403	-0.819	-0.519
C _a	0	0	0	0	0	0
C _i	23.731	-19.403	364.868	-126.950	0.730	-0.597
TF	0.013	0	0.200	0	0.001	0
I	-14.488	-5.461	-222.755	-35.730	-0.446	-0.168
TFR	-6.504	-15.284	100.000	100.000	-0.200	-0.470

Source: BDHS 1993-94, 2004 and 2007

Table 7.5.3 represented the decomposition of change of all indices in TFR between 1993-94 and 2004 and 1993-94 and 2007. It indicated that TFR has decline about 6.504% from 3.075 in 1993-94 to 2.875 in 2004. From 1993-94 to 2007 TFR declines 15.284% from 3.075 in 1993-94 to 2.605 in 2007. It also indicated that the decomposition of this decline in TFR between 1993-94 to 2007 though 10.882% increase in the proportion of women married, about 26.642% decline due to an increase in contraceptive use and effectiveness but about 23.731% increase in the duration of lactational infecundability. The remaining proximate determinants together contribute about 0.013% increase and by interaction factor decrease 14.488% in TFR. Again the decomposition of this decline in TFR between 1993-94 to 2007 had been nearly 26.454% increase in the proportion of women married, about 16.874% decline due to an increase in contraception use and effectiveness and about 19.403% decline due to increase of the duration of lactational infecundability. The remaining proximate determinants together contribute nil and about 5.461% decrease by interaction factors. The decomposition results were standardized to add to 100%. Further table 6.5.3 indicate that during 1993-94 to 2004, it has declined by 0.200 births per-women of which 0.335 births increased by proportion married, 0.819 births declined due to contraceptive use, 0.730 births increase due to lactational infecundability, 0.001 births increased by other proximate determinants and the interaction factor had decreased 0.446 births per-women. Again during 1993-94 to 2007, it had declined by 0.700 births per-women of which 0.813 births increased by proportion married, 0.519 births declined due to contraceptive use, 0.597 births decline due to lactational infecundability, nil births by

other proximate determinants and the interaction factor has decreased 0.168 births per-women.

Table 7.5.3(a): decomposition of changes in CBR by different measures and indices between 2004 and 2007 for the women who did not lost their baby according to BDHS

Changing Indices	Percentage of Change		Distribution of Percentage Change		Absolute Change of CBR	
	1993/94–2004	1993/94–2007	1993/94–2004	1993/94–2007	1993/94–2004	1993/94–2007
P_s	18.683	34.194	153.403	180.825	5.829	10.668
C_m	10.882	26.454	89.351	139.894	3.395	8.254
C_c	-26.642	-16.874	-218.754	-89.233	-8.313	-5.265
C_a	0	0	0	0	0	0
C_i	23.731	-19.403	194.852	-102.607	7.404	-6.054
TF	0.013	0	0.107	0	0.004	0
I	-14.488	-5.461	-118.959	-28.879	-4.520	-1.704
P_b	-12.179	-18.910	100.000	100.000	-3.800	-5.900

It was clear from table 7.5.3(a) that the change in CBR by different intermediate fertility variables and age-sex composition has contributed that in decreasing of CBR. It had increased about 3.395 births by the proportion of women married during 1993–94 to 2004 and about 8.254 births during 1993–94 to 2007; but it had decrease 8.313 births by the use of contraception during 1993–94 to 2004 and about 5.265 births during 1993–94 to 2007; again it had increase 7.404 births by the proportion of lactational infecundability during 1993–94 to 2004 and decrease 6.054 births by the proportion of lactational infecundability during 1993–94 to 2007.

7.6 Some application of Bongaart's Model

Bongaart's model of proximate determinants was now used worldwide for fertility analysis. Moreover, it can be used for projecting future fertility and estimating required contraceptive prevalence rate (CPR) to reach a certain fertility level, which were illustrated below:

7.6.1 Projection of Future Fertility for three different women groups

Suppose that, TFR_x and TFR_y be the total fertility rates, in the year 'x', the present and year 'y', a year in the future; and let the corresponding levels of contraceptive prevalence rate and use-effectiveness was u_x , e_x and u_y , e_y respectively. The objective now was to estimate the level of total fertility rate; if contraceptive practice changes between year 'x' and year 'y'.

Here, we assume that the indices for all other proximate determinants except for contraception remain constant, that was

$$C_{m,x} = C_{m,y}; C_{a,x} = C_{a,y}; C_{i,x} = C_{i,y}; \text{ and } TF_x = TF_y$$

$$\text{Then obviously, } \frac{TFR_y}{TFR_x} = \frac{C_{c,y}}{C_{c,x}}$$

$$\begin{aligned} \text{or, } TFR_y &= \frac{C_{c,y}}{C_{c,x}} \times TFR_x \\ TFR_y &= \frac{(1 - 1.08 \times u_y \times e_y)}{(1 - 1.08 \times u_x \times e_x)} \text{ ----- (15)} \end{aligned}$$

With the help of equation (15), we project fertility in some future time. Suppose that the Government of Bangladesh wants to increase the contraceptive prevalence rate (CPR) to reduce the level of fertility. In Bangladesh current CPR was 56.0 percent (BDHS, 2007). Let the government has taken a program to CPR would 60 percent. If this achieved prevalence rate remain constant till the year 2020, then we can project the TFR for the year 2020. Then the projected total fertility rate for three different women groups were given below:

(a) Women group where women were based on BDHS

$$\begin{aligned} TFR_{2020} &= \frac{(1 - 1.08 \times u_{2020} \times e_{2020})}{(1 - 1.08 \times u_{2007} \times e_{2007})} \times TFR_{2007} \\ &= \frac{(1 - 1.08 \times 0.60 \times 0.87)}{(1 - 1.08 \times 0.56 \times 0.87)} \times 2.7 \\ &= 2.485 \end{aligned}$$

Here, e_{2020} and e_{2007} were contraceptive use-effectiveness for the year 2020 and 2007 respectively and it was assumed that contraceptive use-effectiveness remain constant. Hence the projected total fertility rate for the year 2020 was 2.485 per 1000 for the women of BDHS.

(b) Women group where women lost their baby based on BDHS

$$TFR_{2020} = \frac{(1 - 1.08 \times u_{2020} \times e_{2020})}{(1 - 1.08 \times u_{2007} \times e_{2007})} \times TFR_{2007}$$

$$\begin{aligned}
&= \frac{(1 - 1.08 \times 0.60 \times 0.87)}{(1 - 1.08 \times 0.407 \times 0.87)} \times 3.205 \\
&= 2.264
\end{aligned}$$

Here, e_{2020} and e_{2007} were contraceptive use-effectiveness for the year 2020 and 2007 respectively and it was assumed that contraceptive use-effectiveness remain constant. Hence the projected total fertility rate for the year 2020 was 2.264 per 1000 for the women who lost their baby based on BDHS.

(c) Women group where women did not lost their baby based on BDHS

$$\begin{aligned}
TFR_{2020} &= \frac{(1 - 1.08 \times u_{2020} \times e_{2020})}{(1 - 1.08 \times u_{2007} \times e_{2007})} \times TFR_{2007} \\
&= \frac{(1 - 1.08 \times 0.60 \times 0.87)}{(1 - 1.08 \times 0.566 \times 0.87)} \times 2.605 \\
&= 2.427
\end{aligned}$$

Here, e_{2020} and e_{2007} were contraceptive use-effectiveness for the year 2020 and 2007 respectively and it was assumed that contraceptive use-effectiveness remain constant. Hence the projected total fertility rate for the year 2020 was 2.427 per 1000 for the women who did not lost their baby based on BDHS.

7.6.2 Projection of Contraceptive Prevalence Rate (CPR), Required to Reach Replacement Level for three different women groups

Suppose the government of Bangladesh wants replacement level fertility by the year 2020. For this purpose, the government might want to increase current contraceptive prevalence rate to achieve that goal. In this case, the government might be benefited in allowing exact amount of money to enhance family planning program, if the required CPR known. Bongaarts' model could help the government to project the CPR required to reach the replacement level for three different women groups.

A little arrangement of the equation (15) leads to the following equation, which could be used to estimate the CPR, required achieving a projective fertility level:

$$u_y = \frac{1}{1.08 \times 0.87} \times \left[1 - \frac{TFR_y}{TFR_x} \times C_{c,x} \right] \quad \text{--- --- --- --- --- --- --- --- --- (16)}$$

Here, TFR_x in the year 2007 was 2.7 and expected TFR_y in the year 2020 was 2.1. Then using the relation (16), the required contraceptive prevalence rates to achieve replacement level fertility for three different women groups were given bellow:

(a) Women group where women were based on BDHS

$$u_{2020} = \frac{1}{1.08 \times 0.87} \times \left[1 - \frac{2.1}{2.7} \times 0.56 \right]$$
$$= 0.601$$

Here, 0.56 was the value of $C_{c,x}$ and 2.1 was the replacement fertility level. Hence projected contraceptive prevalence rate (CPR) was to be 60.1 percent in order to achieve replacement level of fertility for the women of BDHS.

(b) Women group where women lost their baby based on BDHS

$$u_{2020} = \frac{1}{1.08 \times 0.87} \times \left[1 - \frac{2.1}{3.205} \times 0.407 \right]$$
$$= 0.780$$

Here, 0.407 was the value of $C_{c,x}$ and 2.1 was the replacement fertility level. Hence projected contraceptive prevalence rate (CPR) was to be 78.0 percent in order to achieve replacement level of fertility for the women who lost their baby based on BDHS.

(c) Women group where women did not lost their baby based on BDHS

$$u_{2020} = \frac{1}{1.08 \times 0.87} \times \left[1 - \frac{2.1}{2.605} \times 0.566 \right]$$
$$= 0.579$$

Here, 0.566 was the value of $C_{c,x}$ and 2.1 was the replacement fertility level. Hence projected contraceptive prevalence rate (CPR) was to be 57.9 percent in order to achieve replacement level of fertility for the women who did not lost their baby based on BDHS.

7.7 The Inhabiting Effect of marriage on Fertility for three women groups

The approximate effect of marriage pattern on fertility can be measured by adopting Bongaarts' model (Bongaarts', 1982). The model assumes that women who were not currently married would experience the same fertility as their married counterparts, if they themselves were married as shown in table 7.7.1 to 7.7.3 which included the relevant data for 1993–94, 2004 and 2007. Column 1 gives the all-women age specific fertility rates, averaged for the live year's period prior to the survey. By multiplying these rates by the reciprocal of the proportions ever-married at the time of

the survey, an estimate was formed of hypothetical in the absence of any postponement of marriage beyond age 15 which was shown in column 3. Column 4 showed the proportion who were currently married among those who ever-married. The reciprocal of these proportions multiplied by the rates in column 3 gives an estimate of hypothetical fertility in the absence of any postponement of marriage beyond age 15 and in the absence of divorce and widowhood shown in column 5. In column 6, the reduction in fertility by marriage had shown.

Table 7.7.1: Estimation of the effect of marriage pattern on fertility for the women of BDHS

Age	ASFR (1)	Proportion ever married (2)	ASEMFR (3) = (1)/(2)	Proportion Currently married ever married (4)	ASMFR (5) = (3)/(4)	(6) = $1.0 - \{(1)/(5)\}$
1993-94						
15—19	0.1400	0.5230	0.2677	0.9522	0.2811	0.5020
20—24	0.1960	0.8920	0.2197	0.9540	0.2303	0.1489
25—29	0.1580	0.9693	0.1630	0.9677	0.1684	0.0618
30—34	0.1050	0.9940	0.1056	0.9456	0.1117	0.0599
35—39	0.0560	0.9990	0.0561	0.9359	0.0599	0.0651
40—44	0.0190	0.9970	0.0191	0.8546	0.0223	0.1480
45—49	0.0140	0.9990	0.0140	0.8318	0.0168	0.1667
	3.4400	---	4.2260 0.7860	---	4.4525 0.2265	0.2274
2004						
15—19	0.1350	0.4790	0.2818	0.9600	0.2935	0.5400
20—24	0.1920	0.8480	0.2264	0.9170	0.2469	0.2223
25—29	0.1350	0.9580	0.1409	0.9210	0.1530	0.1176
30—34	0.0830	0.9880	0.0840	0.9270	0.0906	0.0839
35—39	0.0410	0.9960	0.0412	0.8940	0.0461	0.1106
40—44	0.0160	0.9970	0.0160	0.8440	0.0189	0.1534
45—49	0.0030	1.0000	0.0030	0.8160	0.0037	0.1892
	3.0250	---	3.6485 0.6235	---	3.9165 0.2680	0.2276
2007						
15—19	0.1260	0.4720	0.2669	0.9661	0.2763	0.5440
20—24	0.1730	0.8570	0.2019	0.9300	0.2171	0.2031
25—29	0.1270	0.9570	0.1327	0.8950	0.1483	0.1436
30—34	0.0700	0.9940	0.0704	0.9336	0.0754	0.0716
35—39	0.0340	0.9940	0.0342	0.9195	0.0372	0.0860
40—44	0.0100	0.9980	0.0100	0.8577	0.0117	0.1453
45—49	0.0010	0.9920	0.0010	0.8104	0.0012	0.1667
	2.7050	---	3.5855 0.8805	---	3.8360 0.2505	0.2948

Table 7.7.1 represented the estimated effect of marriage pattern on fertility for the women of BDHS. Here we observed that in absolute terms, postponement of marriage in 1993–94, 2004 and 2007 was estimated to reduce fertility by 0.7860, 0.6235 and 0.8805 births respectively. Again widowhood, separation, not living together and divorced further reduces fertility by 0.2265, 0.2680 and 0.2505 births respectively. It also observed that the effect of postponement of marriage on fertility by age. At the ages 15–19 the reduction of fertility by postponement of marriage was being 0.5020 births in 1993–94, 0.5400 births in 2004 and 0.5440 births in 2007. After the ages 15–19 the rate had been decreasing up to the ages 40–44 in 1993–94, up to the ages 35–40 in 2004 and up to ages in 40–44 in 2007. After that the rates were found to be gradually increases up to the marriageable ages. The effect of postponement of marriage on fertility in 2007 was 0.2948, which was higher than any other point of time. It implied that age at marriage was higher and also the fertility was lower in 2007 than in the other study periods. It also indicated that the effect of marriage on fertility in higher in recent times. Again, divorce, separation, not living together and widowhood have a major contribution on fertility reduction. That means the contribution has been decreasing and so that the amount of divorce, separation, not living together and widowhood have decreased in recent times. The table further shows the effect of marriage pattern respectively in the years of 1993–94, 2004 and 2007 by 22.74%, 22.76% and 29.48% reduction in fertility. Thus, the fertility reducing effect of marriage patterns had increased over time for the years 1993–94, 2004 and 2007. The impact of changing marriage pattern between 1993–94 and 2007 might had caused fertility decrease.

Table 7.7.2: Estimation of the effect of marriage pattern on fertility for those women who lost their baby according to BDHS

Age	ASFR (1)	Proportion ever married (2)	ASEMFR (3) = (1)/(2)	Proportion Currently married ever married (4)	ASMFR (5) = (3)/(4)	(6) = $1.0 - \{(1)/(5)\}$
1993–94						
15–19	0.0900	0.5470	0.1645	0.9610	0.1712	0.4743
20–24	0.2120	0.9110	0.2327	0.9560	0.2434	0.1290
25–29	0.1810	0.9770	0.1853	0.9600	0.1930	0.0622
30–34	0.1310	0.9970	0.1313	0.9520	0.1379	0.0500
35–39	0.0630	0.9980	0.0631	0.9400	0.0671	0.0611
40–44	0.0300	1.0000	0.0300	0.8900	0.0337	0.1098
45–49	0.0120	1.0000	0.0120	0.8610	0.0139	0.1367
	3.5950	----	4.0945 0.4995	---	4.3010 0.2065	0.1641

Age	ASFR (1)	Proportion ever married (2)	ASEMFR (3) = (1)/(2)	Proportion Currently married ever married (4)	ASMFR (5) = (3)/(4)	(6) = $1.0 - \{(1)/(5)\}$
2004						
15—19	0.0610	0.4830	0.1263	0.9650	0.1309	0.5340
20—24	0.1980	0.8610	0.2300	0.9450	0.2434	0.1865
25—29	0.1950	0.9670	0.2017	0.9380	0.2150	0.0930
30—34	0.1050	0.9890	0.1062	0.9190	0.1156	0.0917
35—39	0.0690	0.9970	0.0692	0.9120	0.0759	0.0909
40—44	0.0240	1.0000	0.0240	0.8650	0.0277	0.1336
45—49	0.0020	1.0000	0.0020	0.8270	0.0024	0.1667
	3.2700	---	3.7970 0.5270	---	4.0545 0.2575	0.1935
2007						
15—19	0.0660	0.4890	0.1350	0.9690	0.1393	0.5262
20—24	0.1510	0.8670	0.1742	0.9600	0.1815	0.1680
25—29	0.2170	0.9490	0.2287	0.9510	0.2405	0.0977
30—34	0.1420	0.9810	0.1448	0.9440	0.1534	0.0743
35—39	0.0380	0.9920	0.1076	0.9280	0.1159	0.6721
40—44	0.0230	0.9990	0.0230	0.8710	0.0264	0.1288
45—49	0.0040	1.0000	0.0040	0.8590	0.0047	0.1489
	3.205	---	4.0865 0.8815	---	4.3085 0.2220	0.2561

Table 7.7.2 represented the estimated effect of marriage pattern on fertility for the women who lost their baby according to BDHS. Here we observed that in absolute terms, postponement of marriage in 1993–94, 2004 and 2007 was estimated to reduce fertility by 0.4995, 0.5270 and 0.8815 births respectively. Again widowhood, separation, not living together and divorced further reduces fertility by 0.2065, 0.2575 and 0.2220 births respectively. It also observed that the effect of postponement of marriage on fertility by age. At the ages 15–19 the reduction of fertility by postponement of marriage was being 0.4743 births in 1993–94, 0.5340 births in 2004 and 0.5262 births in 2007. After the ages 15–19 the rate had been decreasing up to the ages 40–44 in 1993–94, up to the ages 40–44 in 2004 and up to ages in 40–44 in 2007. After that the rates were found to be gradually increases up to the marriageable ages. The effect of postponement of marriage on fertility in 2007 was 0.2561, which was higher than any other point of time. It implies that age at marriage was higher and also the fertility was lower in 2007 than in the other study periods. It also indicates that the effect of marriage on fertility is higher in recent times. Again, divorce, separation, not living together and widowhood have a major contribution on fertility reduction. That means the contribution has been decreasing and so that the

amount of divorce, separation, not living together and widowhood have decreased in recent times. The table further showed the effect of marriage pattern respectively in the years of 1993–94, 2004 and 2007 by 16.41%, 19.35% and 25.61% reduction in fertility. Thus, the fertility reducing effect of marriage patterns had increased over time for the years 1993–94, 2004 and 2007. The impact of changing marriage pattern between 1993–94 and 2007 might have caused fertility decrease.

Table 7.7.3: Estimation of the effect of marriage pattern on fertility for those women who did not lost their baby according to BDHS

Age	ASFR (1)	Proportion ever married (2)	ASEMFR (3) = (1)/(2)	Proportion Currently married ever married (4)	ASMFR (5) = (3)/(4)	(6) = $1.0 - \{(1)/(5)\}$
1993–94						
15—19	0.1630	0.4840	0.3368	0.9410	0.3579	0.5446
20—24	0.1750	0.8850	0.1977	0.9500	0.2081	0.1591
25—29	0.1470	0.9640	0.1525	0.9540	0.1599	0.0807
30—34	0.0720	0.9900	0.0727	0.9390	0.0774	0.0698
35—39	0.0420	0.9930	0.0423	0.9190	0.0460	0.0870
40—44	0.0100	1.0000	0.0100	0.8593	0.0116	0.1379
45—49	0.0060	1.0000	0.0060	0.8220	0.0073	0.1781
	3.0750	---	4.0900 1.0150	---	4.3410 0.2510	0.2916
2004						
15—19	0.2140	0.4490	0.4766	0.9580	0.4975	0.5698
20—24	0.1890	0.8270	0.2285	0.9300	0.2457	0.2308
25—29	0.0950	0.9360	0.1015	0.9150	0.1109	0.1434
30—34	0.0560	0.9670	0.0579	0.9030	0.0641	0.1264
35—39	0.0170	0.9800	0.0173	0.8890	0.0195	0.1282
40—44	0.0030	0.9900	0.0030	0.8210	0.0037	0.1892
45—49	0.0010	0.9990	0.0010	0.8110	0.0012	0.1667
	2.8758	---	4.4290 1.5532	---	4.7130 0.2840	0.3898
2007						
15—19	0.1130	0.4610	0.2451	0.9490	0.2583	0.5625
20—24	0.1800	0.8430	0.2135	0.9520	0.2243	0.1975
25—29	0.1240	0.9390	0.1321	0.9400	0.1405	0.1174
30—34	0.0730	0.9750	0.0749	0.9100	0.0823	0.1130
35—39	0.0250	0.9890	0.0253	0.8990	0.0281	0.1103
40—44	0.0050	0.9920	0.0050	0.8380	0.0060	0.1667
45—49	0.0010	1.0000	0.0010	0.8080	0.0012	0.1667
	2.6050	---	3.4845 0.8795	---	3.7035 0.2190	0.2966

Table 7.7.3 represented the estimated effect of marriage pattern on fertility for the women who did not lost their baby according to BDHS. Here we observed that in absolute terms, postponement of marriage in 1993–94, 2004 and 2007 was estimated to reduce fertility by 1.0150, 1.5532 and 0.8795 births respectively. Again widowhood, separation, not living together and divorced further reduces fertility by 0.2510, 0.2840 and 0.2190 births respectively. It also observed that the effect of postponement of marriage on fertility by age. At the ages 15–19 the reduction of fertility by postponement of marriage was being 0.5446 births in 1993–94, 0.5698 births in 2004 and 0.5625 births in 2007. After the ages 15–19 the rate had been decreasing up to the ages 40–44 in 1993–94, up to the ages 40–44 in 2004 and up to ages in 40–44 in 2007. After that the rates were found to be gradually increases up to the marriageable ages. The effect of postponement of marriage on fertility in 2004 was 0.2840, which was higher than any other point of time. It implies that age at marriage was higher and also the fertility was lower in 2004 than in the other study periods. It also indicates that the effect of marriage on fertility is higher in 2004 but gradually decreasing in recent times. Again, divorce, separation, not living together and widowhood had a major contribution on fertility reduction. That means the contribution had been increasing and so that the amount of divorce, separation, not living together and widowhood had increased in recent times. The table further shows the effect of marriage pattern respectively in the years of 1993–94, 2004 and 2007 by 25.10%, 28.40% and 21.90% reduction in fertility. Thus, the fertility reducing effect of marriage patterns had decreased over time for the years 1993–94, 2004 and 2007. The impact of changing marriage pattern between 1993–94 and 2007 might have caused fertility decrease.

7.8 Child Mortality's Impact on Fertility based on Bongaart's Model

Bongaart's proximate determinants model was applied for three different women groups based on BDHS. From this compared with two women groups where women lost their baby in one group and did not lost baby in other group, we tried to estimate child mortality's impact on fertility based on Bongaart's model indices. From the different calculation result; observed child mortality's impacts on fertility were given below:

- Proportion of women married reduces fertility 33.5% in 1993–94, 6.8% in 2004 and 28.5% in 2007 where women lost their baby. On the other hand,

proportion of women married reduced fertility 46.7% in 1993–94, 17.1% in 2004 and 32.6% in 2007 where women did not lose their baby. So proportion of marriage for the women who lost their baby have less contribution in reducing fertility than the proportion of marriage for the women who did not lost their baby. Hence child losing mothers had less capable in reduction of fertility with compare to without child losing mother. Again index of contraception reduces fertility 35.8% in 1993–94, 51.4% in 2004 and 38.2% in 2007 where women lost their baby. On the other hand, index of contraception reduces fertility 43.7% in 1993–94, 58.7% in 2004 and 53.2% in 2007 where women did not lose their baby. So, index of contraception for child losing mother had less contribution in reduction of fertility with compare to child living mother. This indicates that child losing mothers were less interested to use contraceptive than without child losing mother. Furthermore, proportion of lactational infecundability reduces fertility 44.9% in 1993–94, 52.8% in 2004 and 52.6% in 2007 where women lost their baby. On the other hand, proportion of lactational infecundability reduces fertility 33.0% in 1993–94, 45.9% in 2004 and 46.0% in 2007 where women did not lose their baby. So, proportion of lactational infecundability of child losing mother had greater contribution in reduction of fertility with compare to child living mother. Hence child losing mother's duration of breastfeeding was longer than child living mother. So, it was clear that in reducing fertility, the effect of proportion marriage and use contraception for child living mother was greater but the effect of proportion lactational infecundability for child losing mother was greater.

- From table 7.5.2, we saw that the amount of decrement of fertility was about 9.2% during 1993–94 to 2004 and about 10.9% during 1993–94 to 2007 for the women who lost their baby. This was primarily caused by an increase in use of contraception and changing pattern of marriage. Again from table 7.4.3, we saw that the amount of decrement of fertility was about 6.5% during 1993–94 to 2004 and about 15.3% during 1993–94 to 2007 for the women who did not lost their baby. Hence from table 7.4.2 and 7.4.3 we observed that child losing mother's decrement of fertility was greater for the period of

1993–94 to 2004 but child living mother's decrement of fertility was greater for the period 1993–94 to 2007.

- From the application of Bongaart's model, we observed that projected TFR for the year 2020 will be 2.264 for the women who lost their baby; on the other hand projected TFR for the year 2020 will be 2.427 for the women who did not lost their baby. In both cases, it was assumed that government has taken programs to achieve contraceptive prevalence rate 60 percent. Further we observed that in order to achieve replacement level of fertility projected contraceptive prevalence rate (CPR) will be 78.0% for the women who lost their baby; on the other hand, projected contraceptive prevalence rate (CPR) will be 57.9% for the women who did not lost their baby. So, if 60% CPR achieved in 2020, TFR for the women who did not lost their baby will be higher than the women who lost their baby. Again in order to achieve replacement level of fertility, CPR for the women who lost their baby will be higher than the women who did not lost their baby.

- Table 7.7.2 showed that for the women who lost their baby, postponement of marriage were 0.4995 births in 1993–94, 0.5270 births in 2004 and 0.8815 births in 2007. Again widowhood, separation, not living together and divorced further reduces fertility by 0.2065, 0.2575 and 0.2220 births in 1993–94, 2004 and 2007 respectively. It also revealed that the effect of marriage pattern reduce fertility 16.4% in 1993–94, 19.3% in 2004 and 25.6% in 2007. Now table 7.7.3 shows that for the women who did not lost their baby, postponement of marriage in 1993–94, 2004 and 2007 was estimated to reduce fertility by 1.0150, 1.5532 and 0.8795 births respectively. Again widowhood, separation, not living together and divorced further reduces fertility by 0.2510, 0.2840 and 0.2190 births respectively. It also reveals that the effect of marriage pattern reduce fertility 29.16% in 1993–94, 38.98% in 2004 and 29.66% in 2007. Hence from table 7.7.2 and 7.7.3, we observed that postponement of marriage for the women who lost their baby contributes lower births in reduction of fertility than the women who did not lost their baby. Again widowhood, separation, not living together and divorced for the women who lost baby also contributes lower births in reduction of fertility with

compared to the women who did not lost baby. Furthermore, the effect of marriage pattern of the women who lost baby was less efficient to reduce fertility than the effect of marriage pattern of the women who did not lost baby.

7.9 Conclusion

The Bongaarts model of the proximate determinants of fertility was one of the most widely used tools in fertility analysis. From the present analysis it appeared that there was a downward trend in all the proximate indices. The amount of decrement of fertility was about 11.76% from 1993–94 to 2004 and it was about 20.58% from 1993–94 to 2007 for the women of BDHS. This analysis of the proximate determinants of fertility suggested that late marriage, divorce and widowhood, and contraceptive use were the key factors reducing the prevailing levels of fertility in Bangladesh from their biological maximum. The use and prevalence of contraception had been identified as an important determinant for the reduction in fertility that had to be achieved in the future. Contraceptive method-specific proportion of women must be increased. This study showed the advantage of analyzing fertility determinants at the aggregate level, but still the age-specific version of the proximate determinants model of fertility remained to be explored.

Chapter: Eight

Impact of Child Mortality on Reproductive Pattern



Chapter: Eight

Impact of Child Mortality on Reproductive Pattern

8.1 Introduction

The relationship between the infant and child mortality and fertility has been of considerable interest to social scientists primarily for two reasons. Firstly, the fertility and mortality processes are the driving forces governing population change. Secondly, the 'demographic transition', the change from a high fertility-high infant and child mortality environment to a low fertility-low mortality environment, which has occurred in developed countries, has been conjectured to result from the fertility response to the improved survival chances of offspring. Fundamental to either of these motivations is an understanding of the micro foundations of fertility behaviour in environments where there is significant infant and child mortality risk. The impact of infant and child mortality on fertility has been closely examined by demographers because of the net effect of mortality and fertility on the rate of population growth (Bongaarts and Bruce 2001; Lehrer 1984; Preston 1978). Because surveys rarely measure parents' expectations of mortality, most studies examine the influence of experienced mortality on subsequent fertility. Individual-level analyses tend to focus on the effect of the death of an index child, which is the child whose birth opens an interval, on the timing of a subsequent conception or birth. Analyses of high fertility populations consistently find that the death of an index child is associated with a shorter than expected birth interval, and similarly a higher probability of conception or birth (Chowdhury *et al.* 1976; Kuate Defo 1998; Park *et al.* 1998; Santow and Bracher 1984). Many countries have adhered to the simple scheme of demographic transition in which mortality declines first and then fertility decline follows with a lag. The very diversity of mortality and fertility declines in developing countries suggests that there can be nothing automatic or self-sustaining about the effects of mortality decline on fertility.

Bangladesh has been passing through a critical phase of demographic transition. The fertility show a declining trends since the mid-seventies, which can be observed from the estimates of the series of demographic surveys over the last three and a half decades, beginning with the Bangladesh Fertility Survey (BFS) in 1975. The

rapid rate of fertility decline during the period of 1971–1975 (6.3 children per woman) to 2004-2006 (2.7 children per woman) had become gradually decreasing. There was an initial rapid decline in fertility of near two children per women up to the early 1990s. Fertility then plateaued at around 3.3 births per woman for most of the 1990s. The BDHS 2007 survey, along with earlier rounds of the survey beginning in 1993, indicated that the decline in fertility has continued during the last three years, reaching 2.7 births per woman. Five successive BDH surveys had shown total fertility rates (TFR) was 3.4 in 1993-1994, 3.3 in 1996-1997, 3.3 in 1999-2000, 3.0 in 2004 and 2.7 in 2007 (NIPORT *et al.*, 2007). Over the last 25 years, there has been a decline of 78% in TFR an average decline of 3.1% per year. The pace of decline was quicker during the late 1980s to the early 1990s, and after that it had remained almost declining. For example, within a period of five years, starting from 1989 to 1993/94, fertility declined by 33% or an average 6.6% per year, while for the last six year period (2001-03 to 2004-06), it was around 10% per year. On the other hand, infant mortality trends also showed a declining trend since early seventies which can be observed from different demographic surveys. BDHS data indicated that decline in infant mortality had continued during last twenty years. Five successive BDH surveys had shown infant mortality rate (IMR) was 87 in 1993-1994, 82 in 1996-1997, 65 in 1999-2000, 65 in 2004 and 52 in 2007 (NIPORT *et al.*, 2007). We observed that around 70% decline in IMR over the last 25 years; yearly declining rate was 2.8%. But after 1995, declining trends in IMR is very slow; it was only 1.8% per year. So from the above information, we found both IMR and TFR was high in early seventies besides both indicator showed declining trends. IMR and TFR trends were gradually decreasing up to 1995, after that both indicators showed very slow declining trends. Comparatively fertility showed grater declining trends than infant mortality. In this chapter, we were trying to measure the impact of mortality on fertility in country level. Main objectives of this chapter was to make mortality and fertility processes at the driving forces in terms of population changes and change population from a high fertility-high mortality environment to low fertility-low mortality environment through demographic transition. For that reasons, independent variables were included that was include demographic and socio-economic factors. Demographic variables such as number and sex composition of living children, birth order number, previous birth interval, women age at marriage, mother age at first birth, breastfeeding, fertility preference, current pregnancy, knowledge of

contraception, and practice of contraception were included. Socio-economic variables included as place of delivery, family size, antenatal care, tetanus injections during pregnancy and exposure to media. The index of media exposure was constructed from data on whether a woman listens to radio, watches television or reads newspapers and magazines with some frequency.

8.2 Difficulties in Analyzing the Mortality-Fertility Relationship

Any study on the relationship between mortality and fertility must take into cognizance the key inherent difficulties associated in this kind of relation.

8.2.1 Perceptions and Agency

Child survival is only one of many uncertainties that must be faced in deciding family productive and reproductive strategies (Castle, 1994). The standard methods of economic and demographic inquiry are not at all well suited to measuring fundamental changes in a psychological context. Perceptions of mortality risks and of the efficacy of health interventions are doubtless very difficult to elicit. There are certain themes that have received very little research attention in demographic circles. There is the issue of perceptions of mortality risks as against the empirical risks themselves. There is the distinction between high risks and risks that, although high, might be controlled. There is an evolving definition and redefinition of child quality, in which parental health investments, newly perceived to be effective, eventually come to play a role. Finally, the decisive actions are played out not only at the individual level, but also at the level of political and public health institutions. All these factors contribute to the development of family-building strategies that stress design over fate, emphasize deeper investment in child quality, and lead ultimately to lower fertility.

8.2.2 Preferences and Unwanted Fertility

The fertility response to mortality decline cannot be easily disentangled from other factors that affect fertility preferences in general (whether for the number of children, their sex composition, or their spacing) and the costs (whether monetary, health-related, or linked to spousal bargaining) that are associated with the means of fertility control. Although debate continues about the measurement, meaning, and depth of fertility preferences, one aspect is clear: child replacement effects are likely to be stronger among families that have not yet exceeded their ideal family size and

weaker among families that have already experienced at least one unwanted birth. The emergence of replacement effects is thus linked, directly or indirectly, to the factors that shape fertility preference, govern the costs of fertility regulation, and thereby affect the proportion of families that have yet to reach, or have already exceeded, their desired family sizes. To a lesser extent, perhaps, insurance strategies are also affected by these factors.

8.2.3 Alternative Strategies can Co-exist

A further consideration is that the strategies of insurance and replacement behaviour, although conceptually distinct, have common roots in household constraints, preferences and perceptions. A range of such strategies can co-exist within any given community or be adopted by a given family at different points in its reproductive career (Preston, 1978b; Lloyd and Ivanov, 1988). Moreover, by constraining the options that are open to parents, the program environment may affect their mix of strategies. For example, parents might seek to combine replacement and insurance behaviour where reversible methods of contraception are unavailable.

8.2.4 The Nature of the Relationship Changes Over Time

Preston (1975) suggests that the extent to which dead children are replaced in a family is approximately U-shaped, with populations at the highest and lowest developmental levels exhibiting the strongest effects. Over the course of development, he argues, the importance of lactation interruption effects tends to be reduced in relative terms, and the significance of behavioural responses proportionately enhanced, as societies increasingly adopt parity-specific controls over childbearing. Furthermore, as mortality conditions improve and the demand for surviving children falls, parents are more likely to abandon pure insurance strategies and substitute them with various forms of replacement behaviour. Hence, over the course of a demographic transition, the dominant mechanism changes from a biological relationship associated with the truncation of breastfeeding to behavioural replacement, passing through an intermediate stage in which insurance strategies could be expected to hold influences.

✧ In this chapter, we were trying to measure the impact of mortality on fertility in country level. For that reasons, independent variables were included in this analysis that is include demographic and socio-economic factors. Demographic variables

such as number and sex composition of living children, birth order number, previous birth interval, women age at marriage, mother age at first birth, breastfeeding, fertility preference, current pregnancy, knowledge of contraception, and practice of contraception were included. Socio-economic variables included were place of delivery, family size, antenatal care, tetanus injections during pregnancy and exposure to media. The index of media exposure was constructed from data on whether a woman listens to radio, watches television or reads newspapers and magazines with some frequency.

8.3 Age Specific Fertility Rate

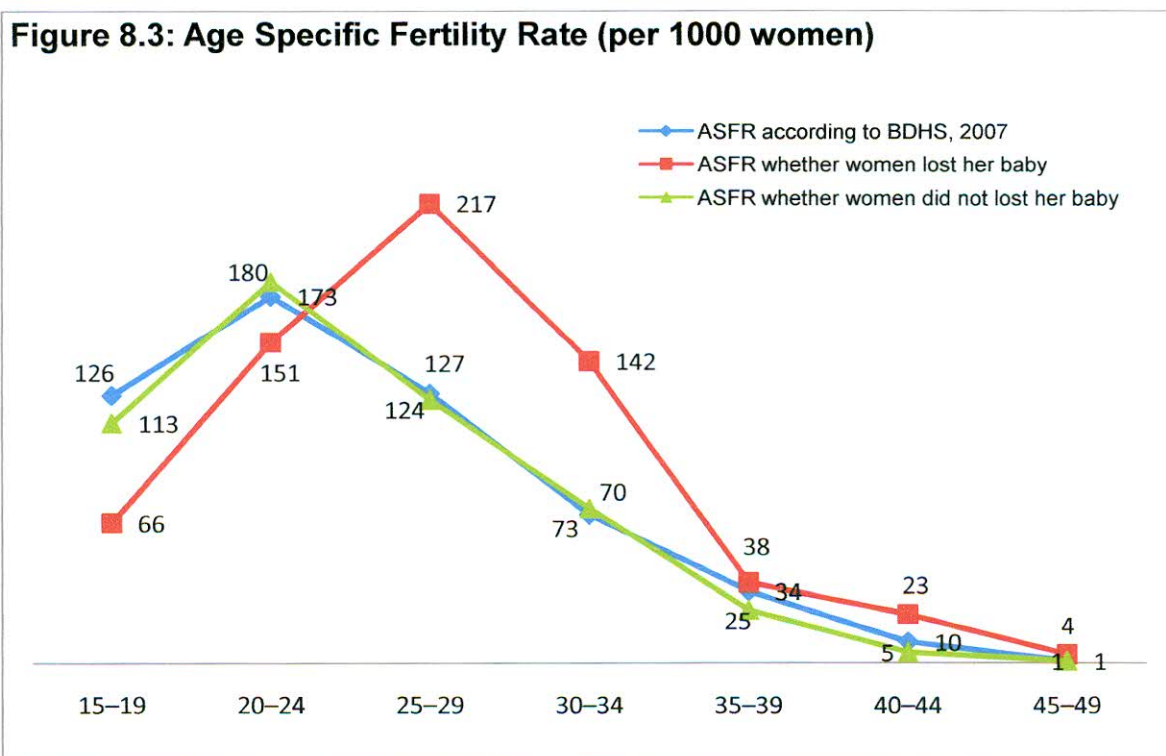
Age specific fertility rates give the current picture of the actual fertility performance in recent times by women of different age groups in the reproductive period within a population. The age specific fertility rates per 1000 women are presented in Table 8.3. It revealed that the level of fertility is still high in Bangladesh, though the age specific fertility rate had been decreasing over time in each age group.

Table 8.3: Age Specific Fertility Rate (per 1000 women), BDHS, 2007

Age group	ASFR according to BDHS, 2007	ASFR whether women lost her baby	ASFR whether women did not lost her baby
15–19	126	66	113
20–24	173	151	180
25–29	127	217	124
30–34	70	142	73
35–39	34	38	25
40–44	10	23	5
45–49	1	4	1
TFR	2.7	3.205	2.605

ASFR for the women who lose their baby in age group 15–19 and 20–24 were low because of these data were taken from the child losing women. In age group 45–49, fertility for women who lose their baby was higher than any other groups because child losing conditions mentally create a desire for more children. Beyond age group 30–34, the fertility performance for those women who lose their baby was slow down, which might be due to the fact that women who postpone their fertility might had become less fecund as the level of fecundity decreases with increasing age or might had even become sterile. The level of fertility was still high and seems to change little overtime for those women who did not lose their baby. It was observed that their

fertility increases up to age group 20–24 and then declined sharply. This implied that women who postpone their marriage to later ages try to recover the reproductive period already lost by producing on the average more children. Total fertility rate for BDHS 2007 data was 2.7 that means per woman had 2.7 children. Total fertility rate for those women who lose their baby was 3.205 which were higher than BDHS 2007 rate. Since women lost their child, for that reasons their ASFR was higher than other groups of women. Again total fertility rate for those women who did not lose their baby was 2.605 which were lower than BDHS 2007 rate. TFR for those women who did not lost their child means per women had 2.605 children.



8.4 Current Pregnancy

Pregnancy was must for child birth. Pregnancy was a sign for a woman to be a mother. Psychologically when a woman lost her baby then she wants to be a mother as early as possible. This was reflects in the Table 8.4.1. It reveals that 4.2 percent mothers were pregnant where they did not lose their baby. On the other hand, 9.1 percent mothers were pregnant where they lost their baby, which was doubled where mother did not lost baby. According to BDHS 2007 data we also found that 6.5 percent mothers were currently pregnant and 93.5 percent mothers were not pregnant.

Table 8.4.1: Percentage Distribution of Women who were pregnant, BDHS 2007

Pregnancy	Pregnant according to BDHS, 2007	Pregnant whether women lost her baby	Pregnant whether women did not lost her baby
Yes	6.5	9.1	4.2
No	93.5	90.9	95.8

Table 8.4.2: Percentage Distribution of Women's menstruation in last six weeks, BDHS 2007

Menstruation in last six weeks	Pregnant according to BDHS, 2007	Pregnant whether women lost her baby	Pregnant whether women did not lost her baby
Yes	70.2	65.4	72.3
No	29.8	34.6	27.7

Table 8.4.2 revealed that 29.8% women according to BDHS 2007 survey were not menstruated in last six weeks, whereas 34.6% women who lost their baby earlier were not menstruated in last six weeks and 27.7% women who did not lost their baby before were not menstruated in last six weeks. So higher portion of women who lost baby earlier had no menstruation in last six weeks that was they become pregnant. Therefore, we clear that highest portion of women who had child losing experiences become pregnant for want of baby.

8.5 Birth Order Number

Births of very high order might have mothers who were physically depleted at the time of conception and throughout pregnancy. Thus they were more likely than other children to suffer from conditions associated with high mortality risk such as fetal growth retardation and low birth weight. First order births were more likely to had a difficult birth process than later births, for that reason first born children's mortality was high in the country. Usually the relationship between birth order and mortality at early ages takes a U-shaped form. Moreover, bearing of more children at a young age involves substantial risks to the health of both the mother and child.

Table 8.5: Percentage Distribution of birth order number, BDHS, 2007

Birth Order number	Birth order number according to BDHS, 2007	Birth order number whether women lost her baby	Birth order number whether women did not lost her baby
1	22.1	2.4	28.9
2	25.2	6.2	31.2
3	18.5	12.9	19.3
4	13.8	18.9	10.8
5+	20.5	59.6	9.8

Table 8.5 expressed that first and second birth order number was higher than third and fourth birth order number according to BDHS 2007 data. This picture was almost same for those mothers who did not lost their baby. But reverse scenario were found in those mothers who lost their baby. First and second birth order number was very lower than third and fourth birth order number. Surprising information was that fifth and more birth order number for those women who lost their baby was tremendously high than any other groups. Five and five plus birth order number for child losing women group was 59.6%, which was tremendously higher than any other groups. Because of mothers were always tried to replace their dead child as early as possible. From the table it also observed that fifth and more birth order number for those women who did not lost their baby was very low (only 9.8 percent).

8.6 Previous Birth Interval

It was almost established that the length of the birth interval affects child mortality. Shorter previous intervals were associated with higher infant and child mortality rates. Some of the association between a child's death and a short subsequent birth interval could be confounded by the association between shorter previous birth intervals and a subsequent child death. If some women were more prone to shorter birth intervals, because of differentials in fecundity, sexual activity or contraceptive use, then child mortality may be a spurious factor. In this case it was important to control for the length of the previous birth interval in studying the association between child mortality and the length of subsequent birth intervals. Child mortality may be higher if there was a shorter subsequent interval. For a short subsequent birth interval to affect a child's death, the death should take place after the conception of the child who was born subsequently. To avoid the possibility of reverse causality, care should be taken in the modeling so as to limit the effect of the death to the period before the conception leading to the subsequent live birth.

Successive birth intervals were likely to be longer where infants were unwanted and experience higher mortality. Children born to older women were at greater risk of death, but their birth was often followed by longer birth intervals because of the mother's reduced fecundity. Other factors may tend to generate the association between death of a child and length of the birth interval. If maternal education or socio-economic status was higher, if birth order was lower, or place of residence was urban, infant mortality was likely to be lower and birth interval to be longer.

Table 8.6: Percentage Distribution of Previous Birth Interval, BDHS, 2007

Previous birth interval	Previous birth interval according to BDHS, 2007	Previous birth interval whether women lost her baby	Previous birth interval whether women did not lost her baby
< 24 months	18.4	25.4	15.5
24—60 months	54.2	54.1	54.6
60+ months	27.3	20.5	29.9

Table 8.6 revealed that previous birth interval for 24–60 months was mostly accepted. More than half of the total women had the previous birth interval between two to five years. When previous birth interval was below 24 months or 2 years among the women, it was large for those women who lost their baby. Again when previous birth interval was more than 60 months or 5 years among the women, it was highest for those women who did not lost their baby.

8.7 Women age at marriage

Age at first marriage has significant bearing on the number of children ever born alive. Age at marriage was an important factor influencing fertility in countries like Bangladesh where level of fertility was high. The earlier age at marriage exposes to an early first intercourse with a consequence to earlier age at first birth. Mothers with an earlier age at first birth were likely to end up in having many children. Delayed age at marriage does not contribute to decline in the level of fertility, but lower age at marriage can be linked with increased progression to next birth at short intervals. This implied that although delayed marriage was not directly associated with reduction in the level of fertility, it can act through increasing birth intervals to reduce the level of fertility.

Marriage in Bangladesh marks the point in a woman's life when childbearing becomes socially acceptable. Age at first marriage had a major effect on childbearing because women who marry early had on average, a longer period of exposure to the risk of becoming pregnant and a greater number of lifetime births. Marriage occurred early for women in Bangladesh: among 20 to 49 years old women 78 percent were married by age 18 and 88 percent were married by age 20. There had been a slow but steady increase over the past 25 years in the age at which Bangladeshi women first marry, from a median age of 14.1 years for women in their late forties to 16.4 years for those in their early twenties.

Table 8.7: Percentage Distribution of women age at marriage, BDHS, 2007

Women age at marriage	Women age at marriage according to BDHS, 2007	Women age at marriage whether women lost her baby	Women age at marriage whether women did not lost her baby
<15 years	59.3	75.2	57.5
15—19 years	32.1	21.6	33.5
19—24 years	7.2	2.8	7.6
24+ years	1.4	0.3	1.4

Table 8.7 expressed that more than 96 percent teenager's were get married where mother lost their baby. It was around 90 percent for BDHS 2007 data and 92 percent for those women who did not lost their baby. Above all, it was found that early marriage was a common scenario almost all over the country. Only 1.4 percent women get married at more than 24 years. It was also decreases for those women who lost their baby (0.3 percent).

8.8 Mother age at firth birth

Age at first birth was a direct effect on fertility. Early initiation of childbearing lengthens the reproductive period and subsequently increases fertility. In many countries, postponement of first births— reflecting an increase in the age at marriage— has contributed greatly to overall fertility decline. Moreover, bearing children at a young age involves substantial risks to the health of both the mother and child. Early childbearing also tends to restrict educational and economic opportunities for women. The median age at first birth was about 18 years across all age cohorts, except for women age 20–24 years whose median age at first birth was 19 years, indicating a slight increase in the age at first birth in recent years (BDHS, 2007).

The age of a mother has a direct relationship with the number of children ever born to a woman. For example, mothers aged 35-39 were 2.51 times less likely to have given birth with compared to mothers aged 45-49 in 2007. The trend was all most same for all five BDH surveys. The desired family size had an effect on children ever born, whereby mothers who desired a large family size (6+) were more likely to have more children than those who desired to had a small family.

Table 8.8: Percentage Distribution of mother age at firth birth, BDHS, 2007

Mother age at firth birth	Mother age at firth birth according to BDHS, 2007	Mother age at firth birth whether women lost her baby	Mother age at firth birth whether women did not lost her baby
<15 years	24.1	31.7	21.8
15—19 years	51.6	52.4	50.9
19—24 years	20.2	13.6	22.5
24+ years	4.1	2.2	4.7

Table 8.8 expressed that more than 84 percent teenagers give first birth where mother lost their baby, where it was below 80 percent for BDHS 2007 data and for those women who did not lost their baby. From the table it was also found that teenager mothers were very much risky for infant mortality all over the country. In age group 19–24 years, 13.6 percent women give their first birth when they lost their baby, 22.5 percent women give their first birth when they did not lost their baby and only 20.2 percent women give their first birth according to BDHS 2007 data. In age group 25–29 years, only 2.2 percent women give their first birth when they lost their baby earlier, 4.7 percent women give their first birth when they did not lost their baby earlier and 4.1 percent women give their first birth according to BDHS 2007 data.

8.9 Breastfeeding Status

Particularly during the first twelve months after a birth, the inhibiting effects of breastfeeding on fecundity were well established. In the absence of breastfeeding the postpartum amenorrheic period was about two months (Lloyd and Ivanov, 1988). Prolonged breastfeeding can extend the amenorrheic period for up to 19 months or more (Bongaarts and Potter 1983; Berhanu and Hogan, 1998). Even after the return of menstruation breastfeeding can continue to depress a woman's fecundity. The death of a breastfeeding infant prematurely ends lactation and shortens the length of the postpartum amenorrheic period. Separating replacement and physiological effects on the death of an index child [index child was the child whose birth opens an interval, on the timing of a subsequent conception or birth] was difficult to accomplish in populations where breastfeeding was common: many infant deaths were closely followed by the return of menstruation and thus an increased risk of conception will occur simply because of the termination of breastfeeding (Kuate Defo, 1998). As an alternative to focusing on the death of an index child, the death of a non-index child during a conception interval provides a measure of the replacement effect that was not confounded with the physiological effect of breastfeeding.

The duration of breast-feeding showed significant difference between the two fertility profiles in the last but one child. Those mothers with a prolonged breastfeeding showed a lower fertility status. A comparative study assessing differentials of fertility in two rural areas of Bangladesh, Matlab and Teknaf showed a variation in the natural fertility of the two populations. The differences in number of children ever born alive were explained by the difference in breast-feeding practice of

the two populations with median duration of 30 months for Matlab and 22 months for Teknaf.

Table 8.9: Percentage Distribution of Breastfeeding Status, BDHS, 2007

Breastfeeding status	Breastfeeding status according to BDHS, 2007	Breastfeeding status whether women lost her baby	Breastfeeding status whether women did not lost her baby
< 1 month	1.2	4.2	0.5
1—12 months	4.8	8.1	4.2
12—24 months	12.3	11.6	12.4
24+ months	81.7	76.1	83.0

From Table 8.9, we observed that 4.2 percent women who experiences losing baby, 0.5 percent women who did not lose baby and 1.2 percent women according to BDHS 2007 data had below 1 month duration of breastfeeding. Long duration of breastfeeding was 81.7 percent for the women of BDHS 2007 data, it was 76.1 percent for those women who lose baby before and it was 83.0 percent for those women who did not lose baby before. One year duration of breastfeeding was highest (8.1 percent) for those women, who had experiences of losing child; 4.2 percent for those women who did not lost child and it was 4.8 percent women for BDHS 2007 data.

8.10 Fertility Preference

A strong preference for sons may be an obstacle to fertility decline if couples continue having children after reaching their overall family-size goal because they were not satisfied with the sex composition of their children. Preference for sons was widespread in Bangladesh and that son preference affects fertility behavior all over the country. In Bangladesh both attitudes and behavior were vitally influenced by a long-standing preference for sons that was deeply rooted in the cultural traditions of the society. Women express a strong preference for having at least one son, and often at least two sons, among their children. The effect of son preference interacts with a woman's socio-economic characteristics, specifically urban/rural residence, literacy, and religion. The analysis estimates the effect of the sex composition of living children on the probability of a woman's having another child, controlling for the survival status of the last child and selected socio-demographic characteristics of the woman. Sometimes parents had a desire to had one daughter, but having more than one daughter was generally not considered desirable. Daughters face discrimination

in the medical treatment of illnesses and in the administration of vaccinations against serious childhood diseases. This study has attempted to look at the effects of child mortality and fertility preference on fertility status in overall context of the country encompassing as many confounding factors as possible.

Table 8.10: Percentage distribution of fertility preference, BDHS, 2007

Fertility preference	Fertility preference according to BDHS, 2007	Fertility preference whether women lost her baby	Fertility preference whether women did not lost her baby
Have another	33.7	35.8	26.8
Undecided	1.1	1.2	1.0
No more	56.4	43.6	63.1
Sterilized	15.9	11.0	6.3
Declared infecund	2.9	8.4	2.8

Table 8.10 revealed that 26.8 percent women who did not lose her baby wants another child; 33.7 percent of women according to BDHS 2007 data wants another child and highest number of women who lost her baby earlier wants another child that was 35.8 percent. This was why, because of that there was a tendency for wanting for child after losing a child. Again 63.1 percent of women who did not lose their child wants no more child, 56.4 percent of women of BDHS 2007 data wants no more child and 43.6 percent (which was lowest) women who lost their baby wants no more child. From data we saw that women who lost baby earlier they had desire for more children. Again 15.9 percent women of BDHS 2007 data wants to sterilized, 11.0 percent women who lost baby earlier wants to sterilize and 6.3 percent women who did not lost her baby wants to sterilize. We also find that 2.9 percent women of BDHS 2007 data were declared infecund, 8.4 percent women who lost baby earlier were declared infecund and 2.8 percent women who did not lost her baby were declared infecund.

8.11 Contraceptive Use

Contraception, or the deliberate purposeful effort by couples to break the usual biological links between coitus, conception and birth, was nearly always present in some form among some groups in even pre-modern populations. The analysis of fertility intentions was of fundamental importance for family planning program purposes and for population policy because it determines the demand for

contraception and the potential impact on the rate of reproduction. Demographic research has shown that socio-economic and cultural factors influence fertility through biological and behavioral mechanisms such as the use of contraception, which has a direct effect on fertility. Contraceptive use, which plays the major role in influencing fertility, was very successful in Bangladesh. As of BDHS 2007, 83.0% of married women in the country used any method of contraception. As a result of the high contraceptive prevalence, many women of reproductive age who were not wanting to stop or postpone child bearing and hence there was a very low unmet need for contraception.

Family planning programs support increases in the use of modern contraceptives can affect the number of maternal deaths in two ways. The most direct effect comes from the reduction in the number of births that occurs as contraceptive use increases. With fewer births, the risk of maternal death was lower and the total number of deaths was lower. Increasing contraceptive use may also had indirect benefits that reduce the average risk of mortality associated with each birth as a result of a change in the distribution of births toward fewer at-risk births. By reducing unintended pregnancies, contraception can also result in fewer abortions, which can carry a high mortality risk when there were complications.

Table 8.11: Percentage Distribution of Contraceptive Use, BDHS, 2007

Methods	Contraceptive Use according to BDHS, 2007	Contraceptive Use whether women lost her baby	Contraceptive Use whether women did not lost her baby
Any Modern method	43.2	33.5	50.6
Any Traditional Method	7.5	8.2	7.7
No Method	48.8	57.2	41.4

Table 8.11 expressed that 43.2 percent women of BDHS 2007 data used any modern method, 33.5 percent women who lost baby earlier use any modern method and 50.6 percent women who did not lost her baby use any modern method. In contraceptive use, any modern method was popular for those women who did not lost child earlier. Women who lost baby earlier comparatively less interested to use modern method for contraceptives. We also find that 57.2 percent of women who had experiences for losing child were no method use for contraception, 48.8 percent women of BDHS 2007 data and 41.4 percent women who did not lost baby earlier were not use any method for contraception.

Table 8.11.1: Percentage Distribution of Current use of Contraceptive by age, BDHS, 2007

Age group	Contraceptive Use according to BDHS, 2007			Contraceptive Use whether women lost her baby			Contraceptive Use whether women did not lost her baby		
	Any Modern Method	Any Traditional Method	No Method	Any Modern Method	Any Traditional Method	No Method	Any Modern Method	Any Traditional Method	No Method
15–19	35.2	4.0	60.8	28.2	1.4	70.4	50.9	3.9	45.2
20–24	44.2	5.0	50.7	35.8	5.3	58.8	51.2	5.0	43.7
25–29	52.0	5.3	42.2	41.4	6.6	51.5	56.4	5.2	37.9
30–34	52.1	7.9	39.6	48.5	5.2	45.4	55.9	9.1	34.6
35–39	47.4	12.7	39.0	38.7	10.2	48.9	52.7	13.6	33.2
40–44	34.8	12.3	52.1	29.2	11.6	57.9	38.1	12.6	48.9
45–49	24.7	7.5	67.1	21.6	7.1	70.3	28.5	7.5	63.6

Table 8.11.1 revealed that more than 70.4 percent teenagers use no method for contraception, where it was 60.8 percent for BDHS 2007 data and 45.2 percent for those women who did not lost their baby. From the table it was found that up to age group 35–39, modern methods user increases with the increases of age and then decreases sharply for the women of BDHS 2007 data, whereas this picture was same up to age group 30–35 both types of women where women had experiences in child mortality earlier or not. Among all three women groups, with increasing number of age group traditional method using tendencies were increases among the women except last two age groups 40–44 and 44–49. It was observed that women who lost baby earlier, always highest for using no method and always lowest for using either modern or traditional method in contraceptive using.

8.12 Family Size

The age at which childbearing begins has important demographic consequences for society as well as for the health and welfare of the mother and child. In many countries, postponement of first births – reflecting an increase in the age at marriage – has contributed greatly to overall fertility decline. Early initiation into childbearing was generally a major determinant of large family size and rapid population growth, particularly in countries where family planning was not widely practiced. The desired family size had an effect on children ever born, whereby mothers who desired a large family size (6+) were more likely to have more children than those who desired to had a small family size. Ideal family size for both men and women was slightly higher

in rural areas than urban areas and it was inversely related to education and household wealth. There were notable variations among administrative divisions for both men and women. Ideal family size for ever-married women was higher in Sylhet and Chittagong but lowest in Khulna and Rajshahi. Among both ever-married and currently married women the mean ideal family size was 2.3 children, which were 0.1 children lower than the mean ideal size found by the 2004 BDHS.

Table 8.12: Percentage Distribution of Family Size, BDHS, 2007

Family members	Family members according to BDHS, 2007	Family members whether women lost her baby	Family members whether women did not lost her baby
< 4 members	35.6	32.8	36.0
4—6 members	33.0	35.9	32.9
6+ members	31.4	31.3	31.1

From Table 8.12 we observed that according to BDHS 2007 data, 35.6 percent women had family members below 4, 33.0 percent women had family members between 4 to 6 and 31.4 percent women had family with more than 6 members. Among the women who lost baby earlier 32.8 percent women had family members below 4, 35.9 percent women had family members between 4 to 6 and 31.3 percent women had family with more than 6 members. Again the women who had no experiences about child mortality before 36.0 percent women had family members below 4, 32.9 percent women had family members between 4 to 6 and 31.1 percent women had family with more than 6 members. Among the three types of women group, highest portion of women who lost baby earlier had below 4 family members. All groups of women had same portion for having more than 6 family members.

8.13 Age at sterilization

Women who decided to get sterilized generally had the procedure early in their reproductive years. Seven in ten sterilized women had the procedure done before age 30. The median age of sterilization in 26.9 years and this has remained the same since 1993-94. Proportion of women who want to stop childbearing or were sterilized increased rapidly with the number of living children, from 15 percent of women with one child to 74 percent of women with two living children and over 90 percent of women with four or more children (BDHS, 2007).

Table 8.13: Percentage Distribution of Age at Sterilization, BDHS, 2007

Age group	Sterilization according to BDHS, 2007	Sterilized whether women lost her baby	Sterilized whether women did not lost her baby
< 25	34.8	27.0	37.4
25–29	33.1	34.3	32.2
30–34	22.7	28.5	20.9
35–39	7.2	4.9	8.2
40–44	1.3	3.3	1.0
45–49	0.8	2.6	0.2

Table 8.13 expressed that among the below 25 years women, lowest portion of women (27.0 percent) who had experiences in child mortality were sterilized and highest portion of women (37.4 percent) who had no experiences in child mortality were sterilized and 34.8 percent of women according to BDHS 2007 data were sterilized. From this table we saw that women who lost baby earlier were not interested in sterilization for want of having child. The following table also reveals that with increasing tendency in age, there was decreasing tendency in sterilization.

8.14 Desire for more children

There was a traditional thinking in the poor societies of Bangladesh that was daughters were provide help in housework before marriage but she was considered to be an economic liability to her parents mainly because of the heavy dowry payment demanded by the groom's family and the high cost of the wedding, which was generally the responsibility of the bride's family to bear. Socially, the utility of having daughters was small compared with their cost.

Among the demographic factors, sex of child, whether the child was wanted, and maternal age tend to mask the association between death and short birth intervals. If the child was female, she was less likely to die and the birth interval was likely to be shorter because of the desire to had another birth following the birth of a girl (assuming preference for a son). Though the following scenario exists in most of the countries, fertility has declined dramatically in some countries where son preference was still widespread—for example, in South Korea and China. Different research on the relationship between son preference and fertility was confounded by the observation that the link was weak in both high-fertility and low-fertility populations. In high-fertility societies, most couples continue to had children regardless of the number of sons and daughters they already have. In low-fertility societies, the

influence of son preference was also weak because few couples want to had more than one or two children even if they do not achieve their ideal number of sons and daughters. The effect of son preference on fertility was thought to be most pronounced in countries like Bangladesh that were in the middle of the fertility transition.

Table 8.14: Percentage Distribution of Desire for more children, BDHS, 2007

Desire for more children	Desire for more children according to BDHS, 2007	Desire for more children whether women lost her baby	Desire for more children whether women did not lost her baby
Wants within 2 years	12.1	6.9	8.2
Wants after 2 years	20.7	6.4	21.9
Wants, unsure timing	0.9	0.6	1.0
Undecided	1.1	1.0	1.1
Wants no more	56.4	68.5	60.2
Sterilization	5.9	8.0	5.9
Declared infecund	2.9	8.5	1.8

From Table 8.14 we observed that according to BDHS 2007 data, 12.1 percent women wants children within 2 years, 20.7 percent women wants children after 2 years, 2.0 percent women were undecided and unsure about timing, 56.4 percent women wants no more, 5.9 percent women were sterilized and 2.9 percent women were declared infecund. Among the women who lost baby earlier 6.9 percent women wants children within 2 years, 6.4 percent women wants children after 2 years, 1.6 percent women were undecided and unsure about timing, 68.5 percent women wants no more, 8.0 percent women were sterilized and 8.5 percent women were declared infecund. Again among the women who had no experiences for losing child, 8.2 percent women wants children within 2 years, 21.9 percent women wants children after 2 years, 2.1 percent women were undecided and unsure about timing, 60.2 percent women wants no more, 5.9 percent women were sterilized and 1.8 percent women were declared infecund. From the table it was clear that among the three types of women group highest portion of women who lost baby earlier wants no more babies where they were highest number in sterilization and also highest number in declared infecundity. So we can easily conclude that women having previous experiences in child mortality facing physical hazardous situation that make them either sterilized or infecund.

8.15 Antenatal Care

The quality of antenatal care depends on what it includes and this was crucial for maintaining the health of the mother and the unborn child. Important elements of antenatal care are: providing iron supplements, educating women on the signs of pregnancy complications, performing screening tests including urine and blood tests and measuring weight gain and blood pressure. The place where a woman receives antenatal care was important because it influences the frequency and quality of antenatal care received. It also helps policymakers decide how to allocate resources. The place where a woman receives antenatal care varies according to mother's age at birth and the child's birth order. Women in the lower wealth status were more likely to seek antenatal care from the public sector than the private sector. Moreover, the quality of care received by pregnant women varies by birth order, urban-rural residence, mother's education and household wealth status.

Table 8.15: Percentage Distribution of Antenatal visit for pregnancy, BDHS, 2007

Antenatal visit for pregnancy	Antenatal care according to BDHS, 2007	Antenatal care whether women lost her baby	Antenatal care whether women did not lost her baby
< 3 times	76.8	88.3	74.4
3–5 times	11.1	6.0	12.2
5+ times	12.1	5.0	13.4

Table 8.15 revealed that according to BDHS 2007 data, 76.8 percent women take at least three times antenatal visits for pregnancy, 11.1 percent women take 3 to 5 times antenatal visits for pregnancy and 12.1 percent women take more than 5 times antenatal visits for pregnancy. From the women who lost baby earlier, 88.3 percent women take at least three times antenatal visits for pregnancy, 6.0 percent women take 3–5 times antenatal visits for pregnancy and 5.0 percent women take more than 5 times antenatal visits for pregnancy. Again the women who did not lost any baby before, 74.4 percent women take at least three times antenatal visits for pregnancy, 12.1 percent women take 3–5 times antenatal visits for pregnancy and 13.4 percent women take more than 5 times antenatal visits for pregnancy. So, child mortality made women aware for taking at least three times antenatal visits for pregnancy.

8.16 Tetanus Injections during Pregnancy

Neonatal tetanus was a leading cause of neonatal deaths, especially in developing countries where a high proportion of deliveries were conducted at home or in places

where unhygienic conditions prevail. Tetanus injections were given to pregnant women to prevent neonatal tetanus. If a woman has received no previous TT injections, she needs two doses of TT during pregnancy for full protection. However, a woman may require only one or no TT injections during pregnancy if she has been vaccinated before, depending on the number and timing of past injections. A total of five doses give lifetime protection. Younger mothers and those with lower order pregnancies were more likely to have received two or more tetanus injections during last pregnancy than other women. The relationship between education and receiving two doses of tetanus injections during pregnancy was not strong.

Table 8.16: Percentage Distribution of Tetanus injections during Pregnancy, BDHS, 2007

Tetanus Injections during Pregnancy	Tetanus Injections during Pregnancy according to BDHS, 2007	Tetanus Injections during Pregnancy whether women lost her baby	Tetanus Injections during Pregnancy whether women did not lost her baby
1—3 doses	58.1	58.1	58.5
3—5 doses	33.2	26.8	34.2
5+ doses	8.8	15.1	7.3

Table 8.16 expressed that 58.1 percent women who lost baby earlier took 1–3 doses of tetanus injections during pregnancy, 26.8 percent took 3 to 5 doses of tetanus injections during pregnancy and rest of the 15.1 percent took more than 5 doses of tetanus injections during pregnancy. Again 58.1 percent women of BDHS 2007 data took 1–3 doses of tetanus injections during pregnancy, 33.2 percent took 3 to 5 doses rest of the 8.8 percent took more than 5 doses of tetanus injections during pregnancy. Moreover, 58.5 percent women who lost baby earlier took 1–3 doses of tetanus injections during pregnancy, 34.2 percent took 3–5 doses and 7.3 percent took more than 5 doses of tetanus injections during pregnancy. From the table we saw that among the all three groups of women equally take first three doses of tetanus injections during pregnancy. But more than 5 doses of tetanus injections took maximum portion of women who had experiences of child mortality before. So, early childhood mortality makes them aware for taking tetanus vaccines during pregnancy.

8.17 Conclusion

The relationship between childhood mortality and fertility was complex since it involves multiple dimensions that were difficult to disentangle empirically or even identify theoretically. Evidence existed that short birth intervals, birth order and

mother's age at birth had strong effects on infant and early child mortality. Women who lost their baby had more children per women than the women who did not lost baby before. ASFR of child losing women in the beginning of the fertile age group was very low. Because early married women give dead child. Live birth was the prerequisite condition for calculating ASFR. Since ASFR was very low in the initial fertile age group than other women groups. So we observed that teenage mothers give dead child in their first issues. Again among the groups of women ASFR increased up to age group 25–29 mostly then decreased sharply. ASFR for child losing women take highest value than other groups in late 30 years age. Women who lost baby earlier had a tendency to be pregnant for want of baby than other groups of women. First and second birth order number was very low for those women who lost baby before. Since losing child status creates physical complicacy among those women who lost baby earlier. For that reason, first and second birth order number decreased among women who lost baby earlier. Again fifth and more birth order number was highest for those women who lost baby before. This was why, because losing child may create psychological pressure for more children. The women who did not lost baby before had highest portion in 2 years duration of previous birth interval. Since child mortality may be higher, if there was a shorter subsequent interval. So women who lost baby earlier face more child mortality. Early marriage was very dangerous for infant and child mortality. Women who lost baby before get married in early ages. Among the women who lost baby earlier, more than 96 percent teenagers get marriage and get experiences in infant and child mortality. More than 80 percent teenage mothers give birth who had experiences in losing child. Since early initiation of childbearing lengthens the reproductive period and increases fertility. So child losing mother comparatively give more birth than other groups of women. With the increasing duration of breastfeeding period, there was a tendency to decreased portion of women who losing baby before. Short length of breastfeeding periods were preferred by the mother who lost baby earlier. Among the three groups of women, child losing mother was the highest portion for having another child. Lowest portion of women who lost baby before wants no more in their fertility preferences and declared infecundity was highest in earlier child losing mothers. Comparatively child losing women discourage contraceptive use than the women who did not lost child. Moreover, child losing women preferred no methods for contraceptives in every fertile age group. So we saw that for want of baby child

losing women use less contraceptives. Among the women groups, women who lost child earlier were most preferred modern methods in contraceptive using. For the influences of child mortality, child losing women were lower portions when family size was below 4 members. Initially earlier child losing women were not interested in sterilization for want of having child. It also revealed that increasing in age there was a decreasing tendency in sterilization. Early child mortality makes the women aware for that reason highest portion of women take at least three times antenatal visits for pregnancy. It was also finding that among the three groups of women, earlier child losing women were highest in number for taking tetanus injections during pregnancy.

There were effects of infant and child mortality on fertility, which depend mostly on mechanisms directly associated with births. The centrality of this particular relation in demographic research can hardly be exaggerated since it played a pivotal role in theories of fertility decline, particularly those associated with the demographic transition framework. To complicate matters even more, fertility and mortality were affected by common factors, which were normally unmeasured but leave indelible imprints on both processes.

Chapter: Nine

Direct and Indirect Effects of Selected Variables on Reproductive Pattern: Application of Path Model



Chapter: Nine

Direct and Indirect Effects of Selected Variables on Reproductive Pattern: Application of Path Model

9.1 Introduction

In the previous chapter, we tried to find out child mortality's impact on fertility. From that analysis we observed that there were influences of socio-demographic factors on fertility. It was unlikely that the relationship among many of those variables and total children ever born as well as fertility were straightforward. Now we need not find out direct and indirect influences of those selected variables on fertility because many of those variables were interrelated. For the purpose of examining the relative importance of all the variables simultaneously and by partly, we need to apply some multivariate technique. Two important multivariate techniques: Multiple Regression analysis and Discriminant analysis are difficult to apply when the dependent variables were categorical (dichotomous or polychotomous). In an analysis, dealing with dichotomous dependent variables, it is better to fit Linear Logistic Regression model and on the other hand for many other continuous variables, we shall use another well-recognized multivariate technique namely Path Analysis.

The specific nature of the determinants of fertility was intricate and complex. While fertility behavior influences population growth, which had consequences towards pressure on resources, employment situation, health and other social facilities and saving and investment, in turn, such consequences had great bearing on the socio-demographic, socio-economic variables that affect fertility behavior. Socio-demographic and socio-economic factors were in turn affected by demographic factors. These factors directly and indirectly affect the interaction processes. Socio-demographic variables directly influence fertility and socio-economic variables cannot directly influence fertility but must act on fertility through their effect on one or more of the intervening variables.

The interrelationships among socio-demographic, demographic and socio-economic variables were new phenomenon. Davis holds that the demographic changes were both reflective and behavioral (Kingsley Davis, 1959). Although numerous conceptual frameworks had been put forward in order to specify or

analyze the factors determining the levels and trends of fertility (Davis and Blake, 1965; Bongaart's, 1978 and Bongaart's and Potter, 1982), few analyzes had focused on the specific mechanisms through which socio-economic factors affect fertility (Bongaart's, 1978). One of the difficulties in such an analysis was that the independent variables affecting introduced for one of the variables, the influence of the other variable, on fertility would be substantially altered. The main objectives of this chapter was to examine the direct and indirect effects of selected variables on fertility of different women groups in order to observed the impact of infant and child mortality.

According to BDHS 2007 survey, data were divided in two groups whether women lost their child or not. Among the three groups of women, first group of women were those women according to BDHS 2007 survey, second group of women are those women who lost their baby according to BDHS 2007 survey and third group of women were those women who did not lost their baby according to BDHS 2007 survey. By examining direct and indirect effects of selected variables on fertility among three groups of women, we will try to find out child mortality's impact on fertility. In order to doing this task, first we calculated the direct and indirect effects of selected variables of the women groups where women lost their baby and it will compared with other groups of women. From this comparison, we might get how fertility influenced by child mortality. Here separated model (according to women groups) are presented for path analysis. Considered groups are Group 1 for those women according to BDHS 2007 survey, Group 2 for those women who lost their baby in BDHS 2007 survey, Group 3 for those women who did not lost their baby in BDHS 2007 survey.

9.2 Variables included in the Analysis

In the BDHS 2007 data, a number of socio-demographic, demographic and maternal health care service utilization variables were available. Among them, ten variables had been taken into consideration in this chapter in order to examine a correlation matrix and to construct a path model. Table 9.1.1 gave a detailed description of the variables. Birth order number, desire for more children, fertility preference, number of household members, age at sterilization, women age at marriage, mother's age at first birth, current pregnancy, contraceptive use. Finally, the number of children ever born to each women was used here as a measure of fertility. It had been assumed

here that these selected variables affect fertility behavior of women according to the hypothetical framework of Bongaart's and others (1984).

Table 9.2.1: Description of Variables Considered for Correction and Path analysis

Variables Name	Variable Level	Causal Order	Type of Variable	Codes and Categories
Birth order number	X_1	1	Dummy	1=1 2=2 3=3 4=4 5=5 and above
Desire for more children	X_2	2	Dummy	1 = Wants within 2 years 2 = Wants after 2 years 3 = Wants, unsure timing 4 = Undecided 5 = Wants no more 6 = Sterilization 7 = Declared infecund
Fertility preference	X_3	3	Dummy	1 = Have another 2 = Undecided 3 = No more 4 = Sterilized 5 = Declared infecund
Number of household members	X_4	4	Continuous	1 = <4 members 2 = 4—6 members 3 = 6+ members
Age at sterilization	X_5	5	Continuous	1 = <25 2 = 25 and above
Women age at marriage	X_6	6	Continuous	1 = <15 years 2 = 15—19 years 3 = 19—24 years 4 = 24+ years
Mother age at first birth	X_7	7	Continuous	1 = <15 years 2 = 15—19 years 3 = 19—24 years 4 = 24+ years
Currently pregnant	X_8	8	Dummy	1 = No 2= Yes
Contraceptive use	X_9	9	Dummy	1 = No 2= Yes
Total children ever born	X_{10}	10	Continuous	1 = ≤ 2 2 = 3 and above

It was documented that the current age of women has a high correlation with their fertility and fertility variations may be observed due to characteristics of women with age cohort 10–49 years (S. M. Shafiqul Islam, 1995). It was revealed that fertility

increases with higher order cohorts of women, which we had shown in chapter five above. Thus, the correlation and the path analysis had been applied for 10–49 years age cohorts of women.

9.3 Correlation Analysis

At first we construct a correlation matrix, in order to examine the quantitative relationship between selected variables and cumulative fertility. The correlation coefficient measures the degree of closeness of the linear relationship between two variables. When two variables were seen to be correlated, it was tempting to infer a cause and effect relationship between them. But it must be remembered that such measures tell us nothing about the causality (Liberatrua, 1983).

9.4 Path Analysis

In the previous chapter we had examined the simultaneous effects and evaluated the infant and child mortality's impact on fertility. But we did not examine the direct and indirect effects of the selected variables. Thus, we were interested to identify their causal links by a multivariate technique, which was path model analysis. Path analysis was essentially a method for reducing the intercorrelation matrix for a specified set of variables, on the basis of a network (framework) postulated causal relationships, to measure strength of the several causal relationships¹. The path analytic solutions were not predictive, though they were explanatory of process. In path model the causal linkages and directions were determined by known factors and knowledge, the strength of the different causal links were only to be ascertained². Path analysis was a standardized multiple regression analysis (using a standardized form of dependent and predictor variables, with mean zero and unit variance) in which a chain of relationships among the variables, arranged in an orderly manner, was examined through a series of regression equations.

Path analysis helped in estimating the magnitude of the linkages between interrelated variables and provides information about the underlying causal process. The technique explores a chain of relationships among the variables by using standardized regression coefficients of a set of regressions. However, the fundamental

¹ K S Srikantan, *The Family Planning Programme in the Socio-economic Context* (New York: The Population Council, 1977), pp. 71–85.

² K Visweswara Rao, *BIOSTATISTICS A Manual of Statistical Methods for Use in Health, Nutrition and Anthropology* (New Delhi: Jaypee Brothers Medical Publishers (P) Ltd, 1996), pp. 520–545.

task here was to construct a path diagram in which direction (indicated by arrowheads) should be causally meaningful. This study employs a recursive path model relating to population and development variables.

9.4.1 Analytical Technique

This technique was developed and used by Wright (1921), Li (1955), Duncan (1966), Kendall & O'Murdeartaigh (1977), Shan (1977), Ahmed (1982), Miller & Stokes (1985), Murthy (1990), Sharma & Rutherford (1990) and Islam & Khan (1992). Path model analysis gives us scope to study the direct and indirect effects of variables. It was not a method for discovering causes, but a method applies to a causal model on the basis of prior knowledge and theoretical consideration.

The assumptions that underlie the application of path analysis were:

- i. the association between the dependent and the explanatory variable was linear;
- ii. the error term had an independent distribution with zero and unit variance (i.e. constant variance);
- iii. the explanatory variables were independent of the error term.

Given the above assumption, the method of path analysis reduces to the system of one or more multiple linear regression analysis. By the help of reduced multiple regression analysis, the path coefficients were estimated. Path coefficients were the standardized regression coefficients in a system of linear regression equations, including the direct effects of on independent variable on the dependent variable. To estimate the total effect, we used Alwin and Hauser's (1975) methods. The residual path coefficients can also be estimated from the regression equation as square roots of $(1-R^2)$, where R^2 (unadjusted) was the multiple correlation coefficients (square) of the regression equation.

9.4.2 Model specification

In the path diagram, the causal links among the variables were assumed to be a conceptual framework conceived in advanced. It was to be noted that data set has no role to play in deciding either the causal links between the variables or the variables to be included in the path analysis. According to the causal ordering of

variables, we may denote the one set of selected variables into three groups (exogenous, endogenous and dependent) that were given below:

- X_1 = Birth order number
- X_2 = Desire for more children
- X_3 = Fertility preference
- X_4 = Number of household members
- X_5 = Age at sterilization
- X_6 = Women age at marriage
- X_7 = Mother age at first birth
- X_8 = Currently pregnant
- X_9 = Contraceptive use
- X_{10} = Total children ever born

According to causal ordering of variables, we may divide the selected set of variables into three groups that were given below:

Exogenous Variables	X_1, X_2, X_3, X_4, X_5
Endogenous Variables	X_6, X_7, X_8, X_9
Dependent Variable	X_{10}

The given model was a recursive path model in which each variable was measured to be dependent upon all prior causal variables. Under additional assumption of linearity and additively the system of equation for the model (depend on Total Fertility Rate) can be written as:

$$X_6 = P_{61}X_1 + P_{62}X_2 + P_{63}X_3 + P_{64}X_4 + P_{65}X_5 + P_{6s}R_s$$

$$X_7 = P_{71}X_1 + P_{72}X_2 + P_{73}X_3 + P_{74}X_4 + P_{75}X_5 + P_{76}X_6 + P_{7u}R_u$$

$$X_8 = P_{81}X_1 + P_{82}X_2 + P_{83}X_3 + P_{84}X_4 + P_{85}X_5 + P_{86}X_6 + P_{87}X_7 + P_{8v}R_v$$

$$X_9 = P_{91}X_1 + P_{92}X_2 + P_{93}X_3 + P_{94}X_4 + P_{95}X_5 + P_{96}X_6 + P_{97}X_7 + P_{98}X_8 + P_{9w}R_w$$

$$X_{10} = P_{101}X_1 + P_{102}X_2 + P_{103}X_3 + P_{104}X_4 + P_{105}X_5 + P_{106}X_6 + P_{107}X_7 + P_{108}X_8 \\ + P_{109}X_9 + P_{10z}R_z$$

Where, P_{ji} 's were path coefficients from X_i to X_j and R_s , R_u , R_v , R_w and R_z were random disturbance terms. This system of equations was known as structural equations. This set of selected variables gives the estimates of path coefficients and helps in understanding the important links between various variables considered in the causal model. Now all the variables were transformed into normal forms by subtracting the respective means and dividing by the respective standard deviation. The regression coefficients thus obtained were the path coefficients.

9.5 Group 1: (Analysis for the women of BDHS 2007 data)

Table 9.5.1 represented the means ($\bar{X}$) and standard deviations (S.D.) of the variables included for the age cohort 10–49 years age of women according to BDHS 2007 survey. Table 9.5.2 produce the results of zero order correlation coefficients of various socio-economic variables which help us to get the non causal (correlation) relationship among exogenous variables. Path coefficients were shown in figure 9.1 and the different types of effects were presented in table 9.5.5. Also table 9.5.6 was shown their percentage value. In Path Analysis, we obtain path coefficients direct, indirect, implied effect of the selected explanatory variables for total fertility rate for those women according to BDHS 2007 survey.

Table 9.5.1: Number of women (N), minimum value (Min.), maximum value (Max.), Mean ($\bar{X}$) and standard deviation (S.D.) of variables.

Variables Name	Variable Level	N	Min.	Max.	$\bar{X}$	S.D.
Birth order number	X_1	9849	1	5	2.85	1.439
Desire for more children	X_2	10182	1	7	3.98	1.728
Fertility preference	X_3	10182	1	5	2.43	1.101
Number of household members	X_4	10996	1	3	1.96	0.817
Age at sterilization	X_5	10996	1	2	1.95	0.227
Women age at marriage	X_6	10996	0	1	0.12	0.329
Mother age at first birth	X_7	10996	0	1	0.41	0.492
Currently pregnant	X_8	10996	0	1	0.07	0.247
Contraceptive use	X_9	10996	0	1	0.51	0.500
Total children ever born	X_{10}	10996	0	1	0.47	0.499

Table 9.5.2: Zero Order Correlation Coefficients of Selected Variables.

Variables	X ₁	X ₂	X ₃	X ₄	X ₅	X ₆	X ₇	X ₈	X ₉	X ₁₀
X ₁	1	0.540 (**)	0.538 (**)	0.240 (**)	-0.105 (**)	-0.190 (**)	-0.194 (**)	-0.116 (**)	-0.022 (*)	0.869 (**)
X ₂		1	0.975 (**)	0.073 (**)	-0.291 (**)	-0.136 (**)	-0.238 (**)	-0.049 (**)	0.192 (**)	0.531 (**)
X ₃			1	0.053 (**)	-0.356 (**)	-0.132 (**)	-0.219 (**)	-0.083 (**)	0.146 (**)	0.527 (**)
X ₄				1	0.026 (**)	0.037 (**)	-0.002	-0.023 (**)	0.015	0.186 (**)
X ₅					1	0.053 (**)	0.067 (**)	0.063 (**)	-0.234 (**)	-0.141 (**)
X ₆						1	0.444 (**)	.024 (**)	0.006	-0.196 (**)
X ₇							1	0.091 (**)	-0.100 (**)	-0.287 (**)
X ₈								1	-0.271 (**)	-0.150 (**)
X ₉									1	0.067 (**)
X ₁₀										1

*** Correlation was significant at the 0.01 level (1-tailed).

** Correlation was significant at the 0.05 level (1-tailed).

According to the Table 9.5.2, the strongest significant relationship were seen to be between birth order number (X₁) and desire for more children (X₂), birth order number (X₁) and fertility preference (X₃), birth order number (X₁) and number of household members (X₄), birth order number (X₁) and total children ever born (X₁₀), desire for more children (X₂) and fertility preference (X₃), desire for more children (X₂) and age at sterilization (X₅), desire for more children (X₂) and mother age at first birth (X₇), desire for more children (X₂) and total children ever born (X₁₀), fertility preference (X₃) and age at sterilization (X₅), fertility preference (X₃) and total children ever born (X₁₀), age at sterilization (X₅) and contraceptive use (X₉), women age at

marriage (X_6) and mother age at first birth (X_7), currently pregnant (X_8) and contraceptive use (X_9) with r-values of 0.540, 0.538, 0.240, 0.869, 0.975, -0.291, -0.238, 0.531, -0.356, 0.527, -0.234, 0.444, -0.287 and -0.271 respectively. The stronger relationships were seen to be between birth order number (X_1) and age at sterilization (X_5), birth order number (X_1) and women age at marriage (X_6), birth order number (X_1) and mother age at first birth (X_7), birth order number (X_1) and currently pregnant (X_8), desire for more children (X_2) and women age at marriage (X_6), desire for more children (X_2) and contraceptive use (X_9), fertility preference (X_3) and women age at marriage (X_6), fertility preference (X_3) and contraceptive use (X_9), number of household members (X_4) and total children ever born (X_{10}), age at sterilization (X_5) and total children ever born (X_{10}), age at sterilization (X_5) and total children ever born (X_{10}), women age at marriage (X_6) and total children ever born (X_{10}), mother age at first birth (X_7) and contraceptive use (X_9), currently pregnant (X_8) and total children ever born (X_{10}) with the r-values of -0.105, -0.190, -0.194, -0.116, -0.136, 0.192, -0.132, 0.192, 0.186, -0.141, -0.196, -0.100, -0.150 respectively. Again weak relationships were observed between birth order number (X_1) and contraceptive use (X_9), desire for more children (X_2) and number of household members (X_4), desire for more children (X_2) and currently pregnant (X_8), fertility preference (X_3) and number of household members (X_4), fertility preference (X_3) and currently pregnant (X_8), number of household members (X_4) and age at sterilization (X_5), number of household members (X_4) and women age at marriage (X_6), number of household members (X_4) and currently pregnant (X_8), age at sterilization (X_5) and mother age at first birth (X_7), age at sterilization (X_5) and mother age at first birth (X_7), age at sterilization (X_5) and currently pregnant (X_8), women age at marriage (X_6) and currently pregnant (X_8), mother age at first birth (X_7) and currently pregnant (X_8), contraceptive use (X_9) and total children ever born (X_{10}) with the r-values of -0.022, 0.073, -0.049, 0.053, -0.083, 0.026, 0.037, -0.023, 0.053, 0.067, 0.063, 0.024, 0.091, 0.067 respectively. All the relationships were significant with the exception of women age at marriage (X_6) and contraceptive use (X_9), number of household members (X_4) and mother age at first birth (X_7), number of household members (X_4) and contraceptive use (X_9) with r-values were 0.006, -0.002 and 0.015 respectively. The various relationships examined in this section were in fact, quite complex and as a result, path model will be applied to identify more precisely the underlying empirical causation. The analysis was taken up in the following section.

9.5.1 Results and discussion of the path model analysis

The systems of the fitted equations were as follows:

$$X_6 = -0.228 X_1 - 0.031 X_2 + 0.055 X_3 + 0.097 X_4 + 0.033 X_5$$

P Value (0.000) (0.524) (0.282) (0.000) (0.004)

$$X_7 = -0.122 X_1 - 0.099 X_2 + 0.137 X_3 + 0.015 X_4 + 0.026 X_5 + 0.465 X_6$$

P Value (0.000) (0.024) (0.002) (0.115) (0.012) (0.000)

$$X_8 = -0.205 X_1 + 0.443 X_2 - 0.284 X_3 - 0.015 X_4 + 0.066 X_5 - 0.016 X_6$$

P Value (0.000) (0.000) (0.000) (0.154) (0.000) (0.178)

$$-0.034 X_7$$

(0.004)

$$X_9 = -0.129 X_1 + 1.420 X_2 - 1.343 X_3 - 0.023 X_4 - 0.283 X_5 + 0.038 X_6$$

P Value (0.000) (0.000) (0.000) (0.020) (0.000) (0.000)

$$-0.035 X_7 - 0.301 X_8$$

(0.001) (0.000)

$$X_{10} = 0.862 X_1 + 0.028 X_2 - 0.032 X_3 + 0.007 X_4 - 0.037 X_5 - 0.016 X_6$$

P Value (0.000) (0.297) (0.239) (0.214) (0.000) (0.006)

$$-0.004 X_7 + 0.009 X_8 + 0.006 X_9$$

(0.538) (0.114) (0.334)

Under the assumption of causal ordering, presented earlier, a set of recursive regression equations were fitted. Utilizing these regressions the standardized Beta coefficients (Path coefficients) and the residual path coefficients were estimated. All together, the path model has 35 paths for cohort of women. The t-test was used to identify the estimated path coefficients that were significant. Various path coefficients were shown in figure 9.1. Out of 35 hypothesized paths, 24 paths were found to be statistically significant at 5% level of significant. The discussion that follows on direct and indirect effects was based on these significant coefficients only. It worth mentioning, that the elimination of the non-significant paths has only a small effect on the power of explanation of the model. Coefficient of determination (R^2) and residual path coefficient of the regression equations in respect of the corresponding dependent variables were presented in the following table:

Table 9.5.3: Coefficient of determination (R^2) and residual path coefficient of the regression equations for the dependent variables

Dependent Variables Name	Variable Level	Coefficient of Determination (R^2)	Residual path coefficient
Birth order number	X_1		
Desire for more children	X_2		
Fertility preference	X_3	0.953	0.217
Number of household members	X_4	0.081	0.958
Age at sterilization	X_5	0.209	0.889
Women age at marriage	X_6	0.047	0.976
Mother age at first birth	X_7	0.247	0.867
Currently pregnant	X_8	0.042	0.978
Contraceptive use	X_9	0.210	0.889
Total children ever born	X_{10}	0.755	0.495

It was important to note that for the ever-married women, the total set of independent variables linked by the causal relationship explain 75.5 percent ($R^2 = 0.755$) of the variance in cumulative fertility that was total children ever born followed by about 4.7 percent of the variance for women age at marriage, 24.7 percent of variance for mother age at first birth, 4.2 percent of variance for currently pregnancy and 21.0 percent of variance for contraceptive use. 95.3 percent and 21.0 percent of variance for fertility preference and age at sterilization, 8.1 percent of variance for number of household members.

Figure 9.1: Path Diagram (Women for BDHS 2007 data)

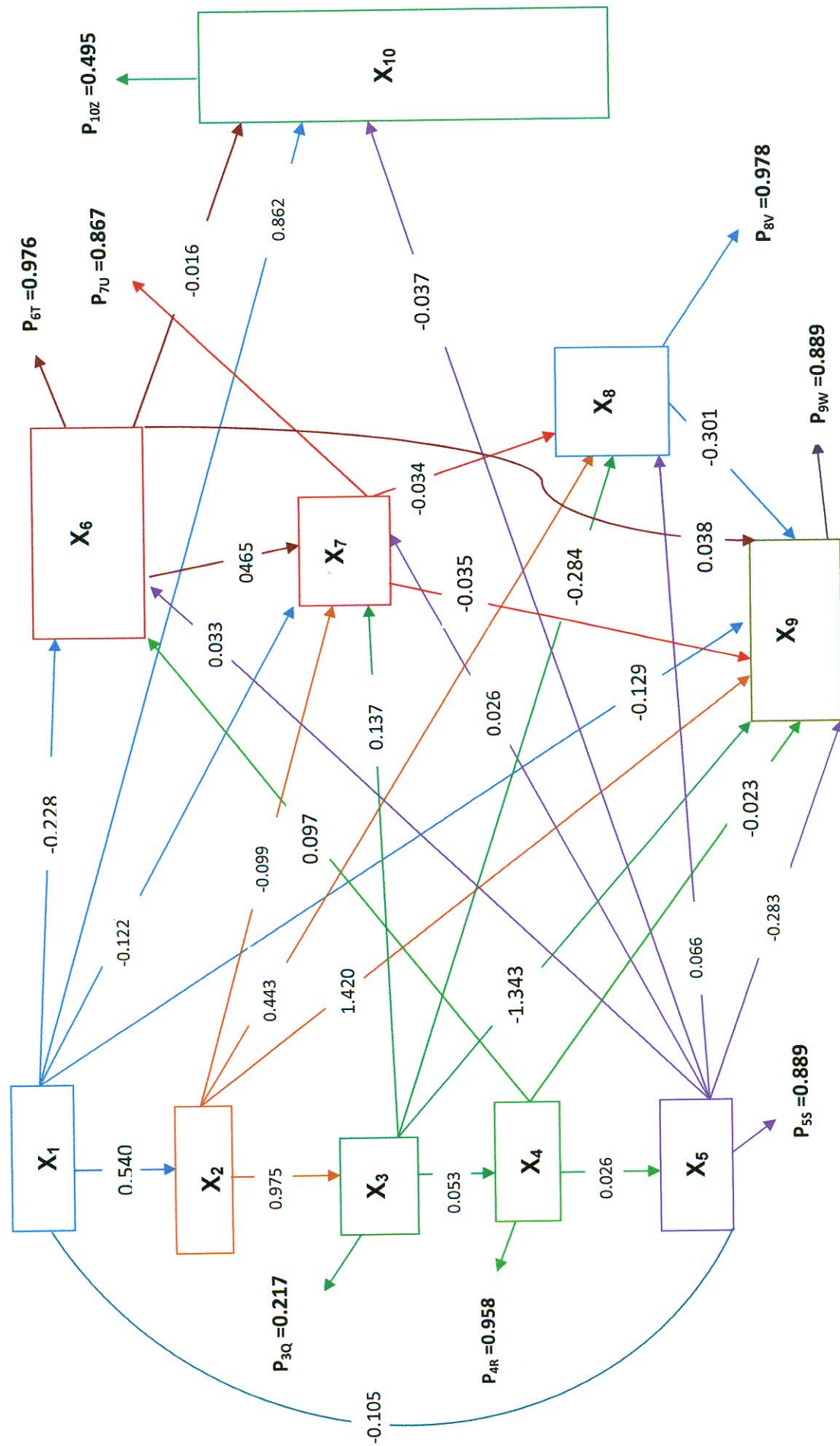


Table 9.5.4: Coefficients of variables in standard form, in reduced form and structural equations of model of socio-demographic and demographic determinants of fertility, (Women for BDHS 2007 data)

Exogenous Variable						
	X ₆	X ₇	X ₇	X ₈	X ₈	X ₈
X ₁	-0.228	-0.228	-0.122	-0.194	-0.201	-0.205
X ₂	-0.031	-0.113	-0.099	0.447	0.446	0.443
X ₃	0.055	0.163	0.137	-0.290	-0.288	-0.284
X ₄	0.097	0.060	0.015	-0.019	-0.016	-0.015
X ₅	0.033	0.041	0.026	0.064	0.065	0.066
X ₆	---	---	0.465	---	-0.032	-0.016
X ₇	---	---	---	---	---	-0.034
X ₈	---	---	---	---	---	---
X ₉	---	---	---	---	---	---

Exogenous Variable									
	X ₉	X ₉	X ₉	X ₉	X ₁₀	X ₁₀	X ₁₀	X ₁₀	X ₁₀
X ₁	-0.072	-0.065	-0.068	-0.129	0.864	0.860	0.860	0.861	0.862
X ₂	1.288	1.289	1.287	1.420	0.040	0.039	0.039	0.036	0.028
X ₃	-1.259	-1.261	-1.257	-1.343	-0.043	-0.042	-0.042	-0.040	-0.032
X ₄	-0.015	-0.018	-0.018	-0.023	0.005	0.006	0.007	0.007	0.007
X ₅	-0.302	-0.303	-0.302	-0.283	-0.039	-0.039	-0.038	-0.039	-0.037
X ₆	---	0.032	0.043	0.038	---	-0.018	-0.016	-0.016	-0.016
X ₇	---	---	-0.025	-0.035	---	---	-0.004	-0.004	-0.004
X ₈	---	---	---	-0.301	---	---	---	0.007	0.009
X ₉	---	---	---	---	---	---	---	---	0.006

The direct, indirect and total effects of each of the selected explanatory (independent) variables were presented in the table 9.5.5. Observing the table 9.5.5, we were seeing that fertility preference (X₃), age at sterilization (X₅), women age at marriage (X₆), mother age at first birth (X₇) were found to had significant direct negative effects, while birth order number (X₁), desire for more children (X₂), number of household members (X₄), currently pregnant (X₈), contraceptive use (X₉) were found to had significant direct positive effects on the number of children ever born or clearly on fertility.

Total effects of fertility preference (X₃), age at sterilization (X₅), women age at marriage (X₆), mother age at first birth (X₇) were negatively significant while the remaining predictor variables that were used in the path analysis (five variables: X₁, X₂, X₄, X₈, X₉) were positively significant. This indicate that higher age at first marriage and women age at first birth had fewer number of children ever born to them as compared with those having early age at first marriage and mother age at first birth.

It was observed that birth order number (X₁), desire for more children (X₂), number of household members (X₄), currently pregnant (X₈), contraceptive use (X₉) were positively related with fertility. Birth order number (X₁) indirect effect on fertility through women age at marriage (X₆) was positive but currently pregnant (X₈) and

contraceptive use (X_9) was negative. Desire for more children (X_2) indirect effect on fertility through women age at marriage (X_6), currently pregnant (X_8) and contraceptive use (X_9) was positive. Fertility preference (X_3) had indirect effect on fertility through women age at marriage (X_6), currently pregnant (X_8) and contraceptive use (X_9) was negative. Number of household members (X_4) had indirect effect on fertility through age at sterilization (X_5) and women age at marriage (X_6) was negative. Age at sterilization (X_5) had indirect effect on fertility through women age at marriage (X_6) and contraceptive use (X_9) was negative but currently pregnant (X_8) was positive. Women age at marriage (X_6) had indirect effect on fertility through mother age at first birth (X_7) was negative. Currently pregnant (X_8) had indirect effect on fertility through contraceptive use (X_9) was negative.

From the tables 9.5.5 and 9.5.6, stated above, birth order number (X_1) had total positive effect 0.864 on fertility (total children ever born), of which about 0.5% was mediated through age at first marriage (X_6) and mother age at first birth (X_7); about 0.115% mediated through currently pregnant (X_8) and 0.115% was mediated through contraceptive use (X_9) in the opposite direction. Desire for more children (X_2) had total positive effect 0.040 on fertility (total children ever born), of which about 2.5% was mediated through age at first marriage (X_6) and mother age at first birth (X_7); about 7.5% mediated through currently pregnant (X_8) and 20.0% was mediated through contraceptive use (X_9) in the same direction. Fertility preference (X_3) had total negative effect 0.043 on fertility (total children ever born), of which about 2.3% was mediated through age at first marriage (X_6) and mother age at first birth (X_7); about 4.6% mediated through currently pregnant (X_8) and 18.6% was mediated through contraceptive use (X_9) in the opposition direction. Number of household members (X_4) had total positive effect 0.005 on fertility (total children ever born), of which about 11.1% was mediated through age at first marriage (X_6) and 11.1% was mediated through mother age at first birth (X_7) in the opposition direction. Age at sterilization (X_5) had total negative effect 0.039 on fertility (total children ever born), of which about 2.4% was mediated through mother age at first birth (X_7); about 4.9% was mediated through contraceptive use (X_9) in the opposition direction and about 2.4% mediated through currently pregnant (X_8) in the same direction. Women age at marriage (X_6) had total negative effect 0.018 on fertility (total children ever born), of which about 11.1% was mediated through mother age at first birth (X_7) in the opposition direction. Mother age at first birth (X_7) had total negative effect 0.004 on

fertility (total children ever born). Currently pregnant (X_8) had total positive effect 0.007 on fertility (total children ever born), of which about 18.2% was mediated through contraceptive use (X_9) in the opposition direction. Contraceptive use (X_9) had total positive effect as well as direct effect 0.006 on fertility or total children ever born.

Table 9.5.5: Analysis of effects in a model of socio-demographic and demographic determinants of fertility, (Women for BDHS 2007 data)

Endogenous Variable	Exogenous Variable	Total Association	Total Effect	Non-Causal Effect	Indirect effect via				Direct Effect
					X_6	X_7	X_8	X_9	
X_6	X_1	-0.190	-0.228	0.038	---				-0.228
	X_2	-0.136	-0.031	-0.131	---				-0.031
	X_3	-0.132	0.055	-0.187	---				0.055
	X_4	0.037	0.097	-0.060	---				0.097
	X_5	0.053	0.033	0.020	---				0.033
X_7	X_1	-0.194	0.228	-0.422	-0.106				-0.122
	X_2	-0.238	-0.113	-0.125	-0.014				-0.099
	X_3	-0.219	0.163	-0.382	0.026				0.137
	X_4	-0.002	0.060	-0.062	0.045				0.015
	X_5	0.067	0.041	0.026	0.015				0.026
	X_6	0.444	0.465	-0.021	---				0.465
X_8	X_1	-0.116	-0.194	0.078	0.007	0.004			-0.205
	X_2	-0.049	0.447	-0.496	0.001	0.003			0.443
	X_3	-0.083	-0.290	0.207	-0.002	-0.004			-0.284
	X_4	-0.023	-0.019	-0.004	-0.003	-0.001			-0.015
	X_5	0.063	0.064	-0.001	-0.001	-0.001			0.066
	X_6	0.024	-0.032	0.056	---	-0.016			-0.016
	X_7	0.091	-0.034	0.125	---	---			-0.034
X_9	X_1	0.010	-0.072	0.082	-0.007	0.003	0.061		-0.129
	X_2	0.009	1.288	-1.279	-0.001	0.002	-0.133		1.420
	X_3	0.015	-1.259	1.274	0.002	-0.004	0.086		-1.343
	X_4	0.008	-0.015	0.023	0.003	0.000	0.005		-0.023
	X_5	0.016	-0.302	0.318	0.001	-0.001	-0.019		-0.283
	X_6	0.009	0.032	-0.023	---	-0.011	0.005		0.038
	X_7	0.011	-0.025	0.036	---	---	0.010		-0.035
	X_8	-0.007	-0.301	0.294	---	---	---		-0.301
X_{10}	X_1	0.869	0.864	0.005	0.004	0.000	-0.001	-0.001	0.862
	X_2	0.531	0.040	0.491	0.001	0.000	0.003	0.008	0.028
	X_3	0.527	-0.043	0.570	-0.001	0.000	-0.002	-0.008	-0.032
	X_4	0.186	0.005	0.181	-0.001	-0.001	0.000	0.000	0.007
	X_5	-0.141	-0.039	-0.102	0.000	-0.001	0.001	-0.002	-0.037
	X_6	-0.196	-0.018	-0.178	---	-0.002	0.000	0.000	-0.016
	X_7	-0.287	-0.004	-0.283	---	---	0.000	0.000	-0.004
	X_8	-0.150	0.007	-0.157	---	---	---	-0.002	0.009
	X_9	0.067	0.006	0.061	---	---	---	---	0.006

*Non-Causal Effect = Total Association – Total Effect.

Table 9.5.6: Percentage of the total absolute effect on fertility through endogenous variables of ever-married women, Bangladesh

Endogenous Variable	Exogenous and Endogenous Variable	Indirect effect via				Direct Effect
		X ₆	X ₇	X ₈	X ₉	
X ₁₀	X ₁	0.461	0.000	0.115	0.115	99.308
	X ₂	2.500	0.000	7.500	20.000	70.000
	X ₃	2.326	0.000	4.651	18.604	74.419
	X ₄	11.111	11.111	0.000	0.000	77.778
	X ₅	0.000	2.439	2.439	4.878	90.244
	X ₆	---	11.111	0.000	0.000	88.889
	X ₇	---	---	0.000	0.000	100.000
	X ₈	---	---	---	18.182	81.818
	X ₉	---	---	---	---	100.000

9.5.2 Findings

This study had attempted to show empirically the causal links between the selected variables and construction of some indices on one hand, and the total fertility rate (TFR) on the other. The relationship between and within the variables were examined by applying path analysis. It had found that fertility preference, age at sterilization, women age at marriage, mother age at first birth were found to had significant direct negative effects while birth order number, desire for more children, number of household members, currently pregnant, contraceptive use were found to had significant direct positive effects on the number of children ever born. Thus rising the age at first marriage, mother age at first birth was likely to lower fertility on a national scale. Encouraging women to sterilization also contribute to a reduction of fertility. Since current pregnancy and contraceptive use had shown positive direct effect on fertility or children ever born. Therefore, these results had an important policy implication, was that the raising contraceptive use will be important for lowering fertility faster than at present. The results suggest that application of contraceptive method must be increased all over the country.

9.6 Group 2: (Analysis for those women who lost their baby according to BDHS 2007 survey)

Table 9.6.1 represented the means ($\bar{X}$) and standard deviations (S.D.) of the variables included for the age cohort 10–49 years age of women who lost their baby according to BDHS 2007 survey. Table 9.6.2 produce the results of zero order correlation coefficients of various socio-economic variables which help us to get the non causal (correlation) relationship among exogenous variables. Path coefficients

were shown in figure 9.2 and the different types of effects were presented in table 9.6.5. Also table 9.6.6 was shown their percentage value. In Path Analysis, we obtain path coefficients direct, indirect, implied effect of the selected explanatory variables for total fertility rate for those women who lost their baby according to BDHS 2007 survey.

Table 9.6.1: Number of women (N), minimum value (Min.), maximum value (Max.), Mean (X) and standard deviation (S.D.) of variables.

Variables Name	Variable Level	N	Min.	Max.	($\bar{X}$)	S.D.
Birth order number	X_1	2621	1	5	4.06	1.145
Desire for more children	X_2	3388	1	7	3.79	1.917
Fertility preference	X_3	3388	1	5	2.37	1.200
Number of household members	X_4	3768	1	3	1.97	0.817
Age at sterilization	X_5	3768	1	2	1.95	0.223
Women age at marriage	X_6	3768	0	1	0.11	0.317
Mother age at first birth	X_7	3768	0	1	0.48	0.500
Currently pregnant	X_8	3768	0	1	0.10	0.302
Contraceptive use	X_9	3768	0	1	0.37	0.482
Total children ever born	X_{10}	3768	0	1	0.61	0.487

Table 9.5.2: Zero Order Correlation Coefficients of Selected Variables.

Variables	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}
X_1	1	0.534 (**)	0.479 (**)	0.330 (**)	-0.015	-0.134 (**)	-0.124 (**)	-0.162 (**)	0.080 (**)	0.758 (**)
X_2		1	0.972 (**)	0.096 (**)	-0.287 (**)	-0.237 (**)	-0.497 (**)	-0.172 (**)	0.272 (**)	0.754 (**)
X_3			1	0.063 (**)	-0.338 (**)	-0.224 (**)	-0.473 (**)	-0.242 (**)	0.228 (**)	0.715 (**)
X_4				1	0.059 (**)	0.007	-0.025	0.001	0.067 (**)	0.104 (**)
X_5					1	0.069 (**)	0.125 (**)	0.079 (**)	-0.307 (**)	-0.143 (**)
X_6						1	0.370 (**)	0.082 (**)	-0.061 (**)	-0.259 (**)
X_7							1	0.216 (**)	-0.204 (**)	-0.617 (**)
X_8								1	-0.257 (**)	-0.298 (**)
X_9									1	0.290 (**)
X_{10}										1

** Correlation was significant at the 0.01 level (1-tailed).

* Correlation was significant at the 0.05 level (1-tailed).

According to the Table 9.6.2, the strongest significant relationships were seen to be between birth order number (X_1) and desire for more children (X_2), birth order number (X_1) and fertility preference (X_3), birth order number (X_1) and total children ever born (X_{10}), desire for more children (X_2) and fertility preference (X_3), desire for more children (X_2) and mother age at first birth (X_7), desire for more children (X_2) and total children ever born (X_{10}), fertility preference (X_3) and mother age at first birth (X_7), fertility preference (X_3) and total children ever born (X_{10}), mother age at first birth (X_7) and total children ever born (X_{10}) with r-values of 0.534, 0.479, 0.758, 0.972, -0.497, 0.754, -0.473, 0.715 and -0.617 respectively. The stronger relationships were seen to be between birth order number (X_1) and number of household members (X_4), birth order number (X_1) and women age at marriage (X_6), birth order number (X_1) and mother age at first birth (X_7), birth order number (X_1) and currently pregnant (X_8), desire for more children (X_2) and age at sterilization (X_5), desire for more children (X_2) and women age at marriage (X_6), desire for more children (X_2) and currently pregnant (X_8), desire for more children (X_2) and contraceptive use (X_9), fertility preference (X_3) and age at sterilization (X_5), fertility preference (X_3) and women age at marriage (X_6), fertility preference (X_3) and currently pregnant (X_8), fertility preference (X_3) and contraceptive use (X_9), number of household members (X_4) and total children ever born (X_{10}), age at sterilization (X_5) and mother age at first birth (X_7), age at sterilization (X_5) and contraceptive use (X_9), age at sterilization (X_5) and total children ever born (X_{10}), women age at marriage (X_6) and mother age at first birth (X_7), women age at marriage (X_6) and total children ever born (X_{10}), mother age at first birth (X_7) and currently pregnant (X_8), mother age at first birth (X_7) and contraceptive use (X_9), currently pregnant (X_8) and contraceptive use (X_9), currently pregnant (X_8) and total children ever born (X_{10}), contraceptive use (X_9) and total children ever born (X_{10}) with r-values of 0.330, -0.134, -0.124, -0.162, -0.287, -0.237, -0.172, 0.272, -0.338, -0.224, -0.242, 0.228, 0.104, 0.125, -0.307, -0.143, 0.370, -0.259, 0.216, -0.204, -0.257, -0.298 and 0.290 respectively. Again weak relationships were observed between birth order number (X_1) and contraceptive use (X_9), fertility preference (X_3) and number of household members (X_4), number of household members (X_4) and age at sterilization (X_5), number of household members (X_4) and contraceptive use (X_9), age at sterilization (X_5) and women age at marriage (X_6), age at sterilization (X_5) and currently pregnant (X_8), women age at marriage (X_6) and currently pregnant (X_8), women age at marriage

(X₆) and contraceptive use (X₉) with r-values of 0.080, 0.063, 0.059, 0.067, 0.069, 0.079, 0.082 and -0.061 respectively. All the relationships were significant with the exception of birth order number (X₁) and age at sterilization (X₅), number of household members (X₄) and women age at marriage (X₆), number of household members (X₄) and mother age at first birth (X₇), number of household members (X₄) and currently pregnant (X₈) with r-values were -0.015, 0.007, -0.025 and 0.001 respectively.

The various relationships examined in this section were in fact, quite complex and as a result, path model will be applied to identify more precisely the underlying empirical causation. The analysis was taken up in the following section.

9.6.1 Results and discussion of the path model analysis

The systems of the fitted equations were as follows:

$$X_6 = -0.142 X_1 + 0.013 X_2 - 0.052 X_3 + 0.052 X_4 + 0.027 X_5$$

P Value	(0.000)	(0.883)	(0.546)	(0.017)	(0.226)
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$$X_7 = -0.082 X_1 + 0.001 X_2 + 0.048 X_3 + 0.015 X_4 + 0.037 X_5 + 0.415 X_6$$

P Value	(0.001)	(0.989)	(0.544)	(0.465)	(0.074)	(0.000)
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$$X_8 = -0.250 X_1 + 0.681 X_2 - 0.624 X_3 + 0.007 X_4 + 0.036 X_5 + 0.011 X_6$$

P Value	(0.000)	(0.000)	(0.000)	(0.752)	(0.106)	(0.621)
---------	---------	---------	---------	---------	---------	---------

$$-0.031 X_7$$

	(0.164)
--	---------

$$X_9 = -0.065 X_1 + 1.330 X_2 - 1.322 X_3 + 0.011 X_4 - 0.365 X_5 + 0.015 X_6$$

P Value	(0.006)	(0.000)	(0.000)	(0.586)	(0.000)	(0.457)
---------	---------	---------	---------	---------	---------	---------

$$-0.027 X_7 - 0.242 X_8$$

	(0.182)	(0.000)
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$$X_{10} = 0.659 X_1 + 0.469 X_2 - 0.317 X_3 - 0.057 X_4 + 0.003 X_5 + 0.007 X_6$$

P Value	(0.000)	(0.000)	(0.000)	(0.000)	(0.860)	(0.640)
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$$-0.006 X_7 - 0.022 X_8 + 0.054 X_9$$

	(0.678)	(0.116)	(0.000)
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Under the assumption of causal ordering, presented earlier, a set of recursive regression equations were fitted. Utilizing these regressions the standardized Beta coefficients (Path coefficients) and the residual path coefficients were estimated. All together, the path model had 35 paths for cohort of women who lost their baby

according to BDHS 2007 survey. The t-test was used to identify the estimated path coefficients that were significant. Various path coefficients were shown in figure 9.2. Out of 35 hypothesized paths, 17 paths were found to be statistically significant at 5% level of significant. The discussion that follows on direct and indirect effects was based on these significant coefficients only. It worth mentioning, that the elimination of the non-significant paths had only a small effect on the power of explanation of the model. Coefficient of determination (R^2) and residual path coefficient of the regression equations in respect of the corresponding dependent variables were presented below:

Table 9.6.3: Coefficient of determination (R^2) and residual path coefficient of the regression equations for the dependent variables

Dependent Variables Name	Variable Level	Coefficient of Determination (R^2)	Residual path coefficient
Birth order number	X_1		
Desire for more children	X_2		
Fertility preference	X_3	0.940	0.245
Number of household members	X_4	0.136	0.929
Age at sterilization	X_5	0.177	0.907
Women age at marriage	X_6	0.026	0.986
Mother age at first birth	X_7	0.184	0.903
Currently pregnant	X_8	0.063	0.968
Contraceptive use	X_9	0.222	0.882
Total children ever born	X_{10}	0.587	0.643

It was important to note that for the ever-married women who lost their baby according to BDHS 2007 survey, the total set of independent variables linked by the causal relationship explain 58.7 percent ($R^2= 0.587$) of the variance in cumulative fertility that was total children ever born followed by about 2.6 percent of the variance for women age at marriage, 18.4 percent of variance for mother age at first birth, 6.3 percent of variance for currently pregnancy and 22.2 percent of variance for contraceptive use. 94.0 percent and 17.7 percent of variance for fertility preference and age at sterilization, 13.6 percent of variance for number of household members.

Figure 9.2: Path Diagram (Women who lost their baby according to BDHS 2007 data)

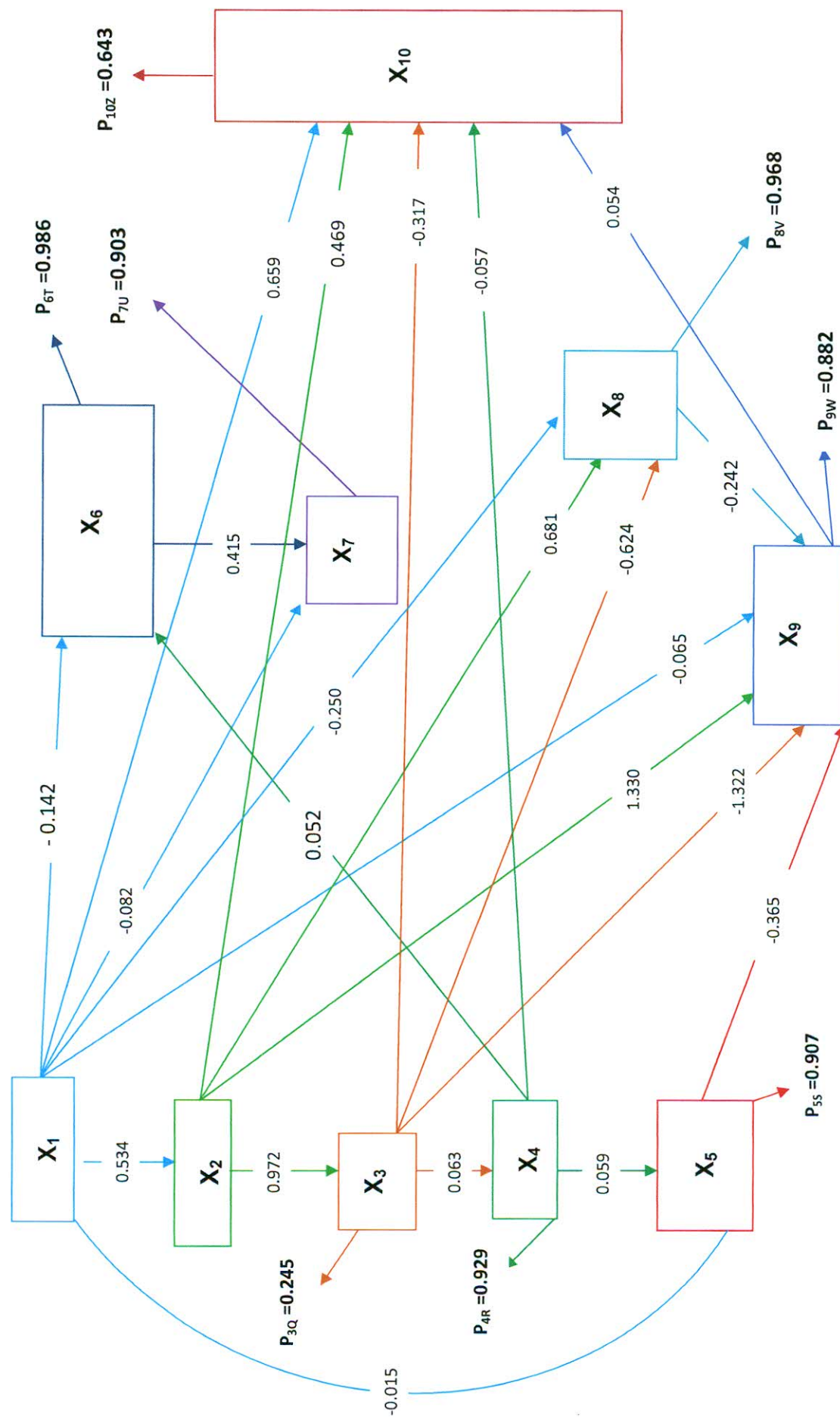


Table 9.6.4: Coefficients of variables in standard form, in reduced form and structural equations of model of socio-demographic and demographic determinants of fertility, (Women who lost their baby according to BDHS 2007 survey)

Exogenous Variable						
	X ₆	X ₇	X ₇	X ₈	X ₈	X ₈
X ₁	-0.142	-0.141	-0.082	-0.248	-0.248	-0.250
X ₂	0.013	0.006	0.001	0.680	0.680	0.681
X ₃	-0.052	0.027	0.048	-0.625	-0.625	-0.624
X ₄	0.052	0.036	0.015	0.006	0.006	0.007
X ₅	0.027	0.048	0.037	0.034	0.035	0.036
X ₆	---	---	0.415	---	-0.002	0.011
X ₇	---	---	---	---	---	-0.031
X ₈	---	---	---	---	---	---
X ₉	---	---	---	---	---	---

Exogenous Variable									
	X ₉	X ₉	X ₉	X ₉	X ₁₀	X ₁₀	X ₁₀	X ₁₀	X ₁₀
X ₁	-0.004	-0.003	-0.005	-0.065	0.664	0.665	0.665	0.656	0.659
X ₂	1.165	1.165	1.165	1.330	0.516	0.516	0.516	0.540	0.469
X ₃	-1.172	-1.172	-1.171	-1.322	-0.366	-0.366	-0.365	-0.387	-0.317
X ₄	0.009	0.009	0.009	0.011	-0.057	-0.057	-0.057	-0.056	-0.057
X ₅	-0.374	-0.375	-0.374	-0.365	-0.018	-0.018	-0.018	-0.017	0.003
X ₆	---	0.004	0.012	0.015	---	0.005	0.007	0.008	0.007
X ₇	---	---	-0.019	-0.027	---	---	-0.006	-0.008	-0.006
X ₈	---	---	---	-0.242	---	---	---	-0.035	-0.022
X ₉	---	---	---	---	---	---	---	---	0.054

The direct, indirect and total effects of each of the selected explanatory (independent) variables were presented in the table 9.6.5.

Observing the table 9.6.5, we were seeing that fertility preference (X₃), number of household members (X₄), mother age at first birth (X₇), currently pregnant (X₈), were found to had significant direct negative effects, while birth order number (X₁), desire for more children (X₂), age at sterilization (X₅), women age at marriage (X₆), contraceptive use (X₉) were found to had significant direct positive effects on the number of children ever born or clearly on fertility.

Total effects of fertility preference (X₃), number of household members (X₄), age at sterilization (X₅), mother age at first birth (X₇), currently pregnant (X₈) were negatively significant while the remaining predictor variables that were used in the path analysis (four variables: X₁, X₂, X₆, X₉) were positively significant. This indicate that higher age of women at first birth and age at sterilization had fewer number of children ever born to them as compared with those having early mother age at first birth.

Table 9.6.5: Analysis of effects in a model of socio-demographic and demographic determinants of fertility, (Women who lost their baby according to BDHS 2007 survey)

Endogenous Variable	Exogenous Variable	Total Association	Total Effect	Non-Causal Effect	Indirect effect via				Direct Effect
					X ₆	X ₇	X ₈	X ₉	
X ₆	X ₁	-0.134	-0.142	0.008	---				-0.142
	X ₂	-0.237	0.013	-0.250	---				0.013
	X ₃	0.224	-0.052	0.276	---				-0.052
	X ₄	0.007	0.052	-0.045	---				0.052
	X ₅	0.069	0.027	0.042	---				0.027
X ₇	X ₁	-0.124	-0.141	0.017	-0.059				-0.082
	X ₂	-0.497	0.006	-0.503	0.005				0.001
	X ₃	-0.473	0.027	-0.500	-0.021				0.048
	X ₄	-0.025	0.036	-0.061	0.021				0.015
	X ₅	0.125	0.048	0.077	0.011				0.037
	X ₆	0.370	0.415	-0.045	---				0.415
X ₈	X ₁	-0.162	-0.248	0.086	0.000	0.002			-0.250
	X ₂	-0.172	0.680	-0.852	0.000	-0.001			0.681
	X ₃	-0.242	-0.625	-0.383	0.000	-0.001			-0.624
	X ₄	0.001	0.006	-0.005	0.000	-0.001			0.007
	X ₅	0.079	0.034	0.045	-0.001	-0.001			0.036
	X ₆	0.082	-0.002	0.084	---	-0.013			0.011
	X ₇	0.216	-0.031	0.247	---	---			-0.031
X ₉	X ₁	0.080	-0.004	0.084	-0.001	0.002	0.060		-0.065
	X ₂	0.272	1.165	-0.893	0.000	0.000	0.165		1.330
	X ₃	0.228	-1.172	1.400	0.000	-0.001	0.151		-1.322
	X ₄	0.067	0.009	0.058	0.000	0.000	-0.002		0.011
	X ₅	-0.307	-0.374	0.067	0.001	-0.001	-0.009		-0.365
	X ₆	0.061	0.004	0.057	---	-0.008	-0.003		0.015
	X ₇	-0.204	-0.019	-0.185	---	---	0.008		-0.027
	X ₈	-0.257	-0.242	-0.015	---	---	---		-0.242
X ₁₀	X ₁	0.758	0.664	0.094	-0.001	0.000	0.009	-0.003	0.659
	X ₂	0.754	0.516	0.238	0.000	0.000	-0.024	0.071	0.469
	X ₃	0.715	-0.366	1.081	0.000	-0.001	0.022	-0.070	-0.317
	X ₄	0.104	-0.057	0.161	0.000	0.000	-0.001	0.001	-0.057
	X ₅	-0.143	-0.018	-0.125	0.000	0.000	-0.001	-0.020	0.003
	X ₆	-0.259	0.005	-0.264	---	-0.002	-0.001	0.001	0.007
	X ₇	-0.617	-0.006	-0.611	---	---	-0.002	-0.002	-0.006
	X ₈	-0.287	-0.035	-0.252	---	---	---	-0.013	-0.022
	X ₉	0.290	0.054	0.236	---	---	---	---	0.054

*Non-Causal Effect = Total Association – Total Effect.

It was observed that birth order number (X₁), desire for more children (X₂), age at sterilization (X₅), women age at marriage (X₆), contraceptive use (X₉) were positively related with fertility. Birth order number (X₁) had indirect effect on fertility through currently pregnant (X₈) was positive but women age at marriage (X₆) and contraceptive use (X₉) was negative. Desire for more children (X₂) had

indirect effect on fertility through currently pregnant (X_8) was negative but contraceptive use (X_9) was positive. Fertility preference (X_3) had indirect effect on fertility through mother age at first birth (X_7) and contraceptive use (X_9) was negative but currently pregnant (X_8) was positive. Number of household members (X_4) had indirect effect on fertility through currently pregnant (X_8) was negative but contraceptive use (X_9) was positive. Age at sterilization (X_5) had indirect effect on fertility through currently pregnant (X_8) and contraceptive use (X_9) was negative. Women age at marriage (X_6) had indirect effect on fertility through mother age at first birth (X_7) and currently pregnant (X_8) was negative but contraceptive use (X_9) was positive. Mother age at first birth (X_7) had indirect effect on fertility through currently pregnant (X_8) and contraceptive use (X_9) was negative. Currently pregnant (X_8) had indirect effect on fertility through contraceptive use (X_9) was negative.

From the tables 9.6.5 and 9.6.6, stated above, birth order number (X_1) had total positive effect 0.664 on fertility (total children ever born), of which about 0.148% was mediated through age at first marriage (X_6) and 0.446% was mediated through contraceptive use (X_9) in the opposite direction but about 1.339% mediated through currently pregnant (X_8) in the same direction. Desire for more children (X_2) had total effect 0.516 on fertility (total children ever born), of which about 4.580% was mediated through currently pregnant (X_8) in the opposition direction but 12.588% was mediated through contraceptive use (X_9) in the same direction. Fertility preference (X_3) had total negative effect 0.366 on fertility (total children ever born), of which about 0.244% was mediated through mother age at first birth (X_7), 18.6% was mediated through contraceptive use (X_9) in the opposition direction but 4.6% mediated through currently pregnant (X_8) in the same direction. Number of household members (X_4) had total negative effect 0.057 on fertility (total children ever born), of which about 1.695% was mediated through contraceptive use (X_9) in the same direction but 1.695% was mediated through currently pregnant (X_8) in the opposition direction. Age at sterilization (X_5) had total negative effect 0.018 on fertility (total children ever born), of which about 4.167% was mediated through currently pregnant (X_8) and 83.333% was mediated through contraceptive use (X_9) in the opposition direction. Women age at marriage (X_6) had total positive effect 0.005 on fertility (total children ever

born), of which about 20% was mediated through mother age at first birth (X_7) and 10% was mediated through currently pregnant (X_8) in the opposition direction but 10% was mediated through contraceptive use (X_9) in the same direction . Mother age at first birth (X_7) had total negative effect 0.006 on fertility (total children ever born) of which about 20% was mediated through currently pregnant (X_8) and 20% was mediated through contraceptive use (X_9) in the opposition direction. Currently pregnant (X_8) had total negative effect 0.035 on fertility (total children ever born), of which about 37.145% was mediated through contraceptive use (X_9) in the opposition direction. Contraceptive use (X_9) had total positive effect as well as direct effect 0.054 on fertility or total children ever born.

Table 9.6.6: Percentage of the total absolute effect on fertility through endogenous variables of ever-married women who lost their baby according to BDHS 2007 survey

Endogenous Variable	Exogenous and Endogenous Variable	Indirect effect via				Direct Effect
		X_6	X_7	X_8	X_9	
X_{10}	X_1	0.148	0.000	1.339	0.446	98.065
	X_2	0.000	0.000	4.580	12.588	83.156
	X_3	0.000	0.244	5.379	17.115	77.506
	X_4	0.000	0.000	1.695	1.695	96.610
	X_5	0.000	0.000	4.167	83.333	12.500
	X_6	---	20.000	10.000	10.000	70.000
	X_7	---	---	20.000	20.000	60.000
	X_8	---	---	---	37.143	62.857
	X_9	---	---	---	---	100.000

9.6.2 Findings

This study had attempted to show empirically the causal links between the selected variables. The relationship between and within the variables were examined by applying path analysis. It had found that fertility preference, number of household members, mother age at first birth, currently pregnancy were found to had significant direct negative effects, while birth order number, desire for more children, age at sterilization, women age at marriage, contraceptive use were found to had significant direct positive effects on the number of children ever born. Thus increasing fertility preference, mother age at first birth was likely to lower fertility. Encouraging women for rising women age at first marriage, sterilization to reduce fertility. As the analysis data for that women group who lost their baby, so that analysis expressed birth order number and desire for more

children will be increase for fertility. Since contraceptive use had shown positive direct effect on fertility or children ever born, so raising contraceptive use will be important for lowering fertility. Current pregnancy appears to had a significant direct negative effect on fertility which means that mother who had losing child experiences were found to had higher fertility. Mothers always try to replace their dead child as early as possible.

9.7 Group 3: (Analysis for those women who did not lost their baby according to BDHS 2007 survey)

Table 9.7.1 represented the means ($\bar{X}$) and standard deviations (S.D.) of the variables included for the age cohort 10–49 years age of women who did not lost their baby according to BDHS 2007 survey. Table 9.7.2 produce the results of zero order correlation coefficients of various socio-economic variables which help us to get the non causal (correlation) relationship among exogenous variables. Path coefficients were shown in figure 9.3 and the different types of effects were presented in table 9.7.5. Also table 9.7.6 was shown their percentage value. In Path Analysis, we obtain path coefficients direct, indirect, implied effect of the selected explanatory variables for total fertility rate for those women who did not lost their baby according to BDHS 2007 survey.

Table 9.7.1: Number of women (N), minimum value (Min.), maximum value (Max.), Mean ($\bar{X}$) and standard deviation (S.D.) of variables.

Variables Name	Variable Level	N	Min.	Max.	$\bar{X}$	S.D.
Birth order number	X_1	7288	1	5	2.42	1.275
Desire for more children	X_2	7821	1	7	3.78	1.749
Fertility preference	X_3	7821	1	5	2.30	1.099
Number of household members	X_4	8375	1	3	1.95	0.823
Age at sterilization	X_5	8375	1	2	1.95	0.215
Women age at marriage	X_6	8375	0	1	0.14	0.315
Mother age at first birth	X_7	8375	0	1	0.46	0.499
Currently pregnant	X_8	8375	0	1	0.07	0.261
Contraceptive use	X_9	8375	0	1	0.53	0.499
Total children ever born	X_{10}	8375	0	1	0.34	0.475

Table 9.7.2: Zero Order Correlation Coefficients of Selected Variables.

Variables	X ₁	X ₂	X ₃	X ₄	X ₅	X ₆	X ₇	X ₈	X ₉	X ₁₀
X ₁	1	0.545 (**)	0.545 (**)	0.248 (**)	-0.136 (**)	-0.169 (**)	-0.165 (**)	-0.114 (**)	0.032 (**)	0.862 (**)
X ₂		1	0.975 (**)	0.056 (**)	-0.297 (**)	-0.116 (**)	-0.242 (**)	-0.033 (**)	0.229 (**)	0.499 (**)
X ₃			1	0.038 (**)	-0.363 (**)	-0.110 (**)	-0.218 (**)	-0.068 (**)	0.185 (**)	0.499 (**)
X ₄				1	0.011	0.047 (**)	0.007	-0.019 (*)	0.005	0.204 (**)
X ₅					1	0.052 (**)	0.067 (**)	0.064 (**)	-0.213 (**)	-0.162 (**)
X ₆						1	0.439 (**)	0.015	0.000	-0.172 (**)
X ₇							1	0.098 (**)	-0.137 (**)	-0.256 (**)
X ₈								1	-0.299 (**)	-0.140 (**)
X ₉									1	0.104 (**)
X ₁₀										1

** Correlation was significant at the 0.01 level (1-tailed).

*) Correlation was significant at the 0.05 level (1-tailed).

According to the Table 9.7.2, the strongest significant relationship were seen to be between birth order number (X₁) and desire for more children (X₂), birth order number (X₁) and fertility preference (X₃), birth order number (X₁) and number of household members (X₄), birth order number (X₁) and total children ever born (X₁₀), desire for more children (X₂) and fertility preference (X₃), desire for more children (X₂) and age at sterilization (X₅), desire for more children (X₂) and mother age at first birth (X₇), desire for more children (X₂) and contraceptive use (X₉), desire for more children (X₂) and total children ever born (X₁₀), fertility preference (X₃) and age at sterilization (X₅), fertility preference (X₃) and mother age at first birth (X₇), fertility preference (X₃) and total children ever born (X₁₀),

number of household members (X_4) and total children ever born (X_{10}), age at sterilization (X_5) and contraceptive use (X_9), women age at marriage (X_6) and mother age at first birth (X_7), mother age at first birth (X_7) and total children ever born (X_{10}), currently pregnant (X_8) and contraceptive use (X_9) with r-values of 0.545, 0.545, 0.248, 0.862, 0.975, -0.297, 0.242, 0.229, 0.490, -0.363, -0.218, 0.499, 0.204, -0.213, 0.439, -0.256 and -0.299 respectively. Again the stronger significant relationship were seen to be between birth order number (X_1) and age at sterilization (X_5), birth order number (X_1) and women age at marriage (X_6), birth order number (X_1) and mother age at first birth (X_7), birth order number (X_1) and currently pregnant (X_8), desire for more children (X_2) and women age at marriage (X_6), fertility preference (X_3) and women age at marriage (X_6), fertility preference (X_3) and contraceptive use (X_9), age at sterilization (X_5) and total children ever born (X_{10}), women age at marriage (X_6) and total children ever born (X_{10}), mother age at first birth (X_7) and contraceptive use (X_9), currently pregnant (X_8) and total children ever born (X_{10}), contraceptive use (X_9) and total children ever born (X_{10}) with r-values of -0.136, -0.169, -0.165, -0.114, -0.116, -0.110, 0.185, -0.162, -0.172, -0.137, -0.140 and 0.104 respectively. And weak relationship were observed between birth order number (X_1) and contraceptive use (X_9), desire for more children (X_2) and number of household members (X_4), desire for more children (X_2) and currently pregnant (X_8), fertility preference (X_3) and number of household members (X_4), fertility preference (X_3) and currently pregnant (X_8), number of household members (X_4) and women age at marriage (X_6), number of household members (X_4) and currently pregnant (X_8), age at sterilization (X_5) and women age at marriage (X_6), age at sterilization (X_5) and mother age at first birth (X_7), age at sterilization (X_5) and currently pregnant (X_8), women age at marriage (X_6) and currently pregnant (X_8), mother age at first birth (X_7) and currently pregnant (X_8) with r-values of 0.032, 0.056, -0.033, 0.038, -0.068, 0.047, -0.019, 0.052, 0.067, 0.064 and 0.098 respectively. All the relationships were significance, with the exception of number of household members (X_4) and age at sterilization (X_5), number of household members (X_4) and mother age at first birth (X_7), number of household members (X_4) and contraceptive use (X_9), women age at marriage (X_6) and contraceptive use (X_9) with r-values were 0.011, 0.007, 0.005, 0.015 and 0.000 respectively.

The various relationships examined in this section were in fact, quite complex and as a result, path model will be applied to identify more precisely the underlying empirical causation. The analysis was taken up in the following section.

9.7.1 Results and discussion of the path model analysis

The systems of the fitted equations were as follows:

$$X_6 = -0.220 X_1 - 0.067 X_2 + 0.109 X_3 + 0.109 X_4 + 0.037 X_5$$

P Value	(0.000)	(0.265)	(0.079)	(0.000)	(0.006)
---------	---------	---------	---------	---------	---------

$$X_7 = -0.095 X_1 - 0.157 X_2 + 0.187 X_3 + 0.011 X_4 + 0.03 X_5 + 0.479 X_6$$

P Value	(0.000)	(0.003)	(0.001)	(0.325)	(0.054)	(0.000)
---------	---------	---------	---------	---------	---------	---------

$$X_8 = -0.235 X_1 + 0.372 X_2 - 0.155 X_3 - 0.002 X_4 + 0.080 X_5 - 0.025 X_6$$

P Value	(0.000)	(0.000)	(0.012)	(0.880)	(0.000)	(0.064)
---------	---------	---------	---------	---------	---------	---------

$$-0.032 X_7$$

	(0.019)
--	---------

$$X_9 = -0.086 X_1 + 1.364 X_2 - 1.267 X_3 - 0.042 X_4 - 0.249 X_5 + 0.047 X_6$$

P Value	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
---------	---------	---------	---------	---------	---------	---------

$$-0.039 X_7 - 0.320 X_8$$

	(0.002)	(0.000)
--	---------	---------

$$X_{10} = 0.866 X_1 - 0.007 X_2 - 0.030 X_3 + 0.024 X_4 - 0.043 X_5 - 0.018 X_6$$

P Value	(0.000)	(0.829)	(0.371)	(0.000)	(0.000)	(0.014)
---------	---------	---------	---------	---------	---------	---------

$$-0.004 X_7 + 0.013 X_8 - 0.003 X_9$$

	(0.580)	(0.051)	(0.653)
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Under the assumption of causal ordering, presented earlier, a set of recursive regression equations were fitted. Utilizing these regressions the standardized Beta coefficients (Path coefficients) and the residual path coefficients were estimated. All together, the path model had 35 paths for cohort of women who did not lost their baby according to BDHS 2007 survey. The t-test was used to identify the estimated path coefficients that were significant. Various path coefficients were shown in figure 9.3. Out of 35 hypothesized paths, 24 paths

were found to be statistically significant at 5% level of significant. The discussion that follows on direct and indirect effects was based on these significant coefficients only. It worth mentioning, that the elimination of the non-significant paths had only a small effect on the power of explanation of the model. Coefficient of determination (R^2) and residual path coefficient of the regression equations in respect of the corresponding dependent variables were presented below:

Table 9.7.3: Coefficient of determination (R^2) and residual path coefficient of the regression equations for the dependent variables

Dependent Variables Name	Variable Level	Coefficient of Determination (R^2)	Residual path coefficient
Birth order number	X_1		
Desire for more children	X_2		
Fertility preference	X_3	0.957	0.207
Number of household members	X_4	0.086	0.956
Age at sterilization	X_5	0.227	0.879
Women age at marriage	X_6	0.042	0.979
Mother age at first birth	X_7	0.252	0.865
Currently pregnant	X_8	0.052	0.974
Contraceptive use	X_9	0.199	0.895
Total children ever born	X_{10}	0.743	0.507

It was important to note that for the ever-married women who did not lost their baby according to BDHS 2007 survey, the total set of independent variables linked by the causal relationship explain 74.3 percent ($R^2= 0.743$) of the variance in cumulative fertility that was total children ever born followed by about 4.2 percent of the variance for women age at marriage, 25.2 percent of variance for mother age at first birth, 5.2 percent of variance for currently pregnancy and 19.9 percent of variance for contraceptive use. 95.7 percent and 22.7 percent of variance for fertility preference and age at sterilization, 8.6 percent of variance for number of household members.

Figure 9.3: Path Diagram (Women who did not lost their baby according to BDHS 2007 data)

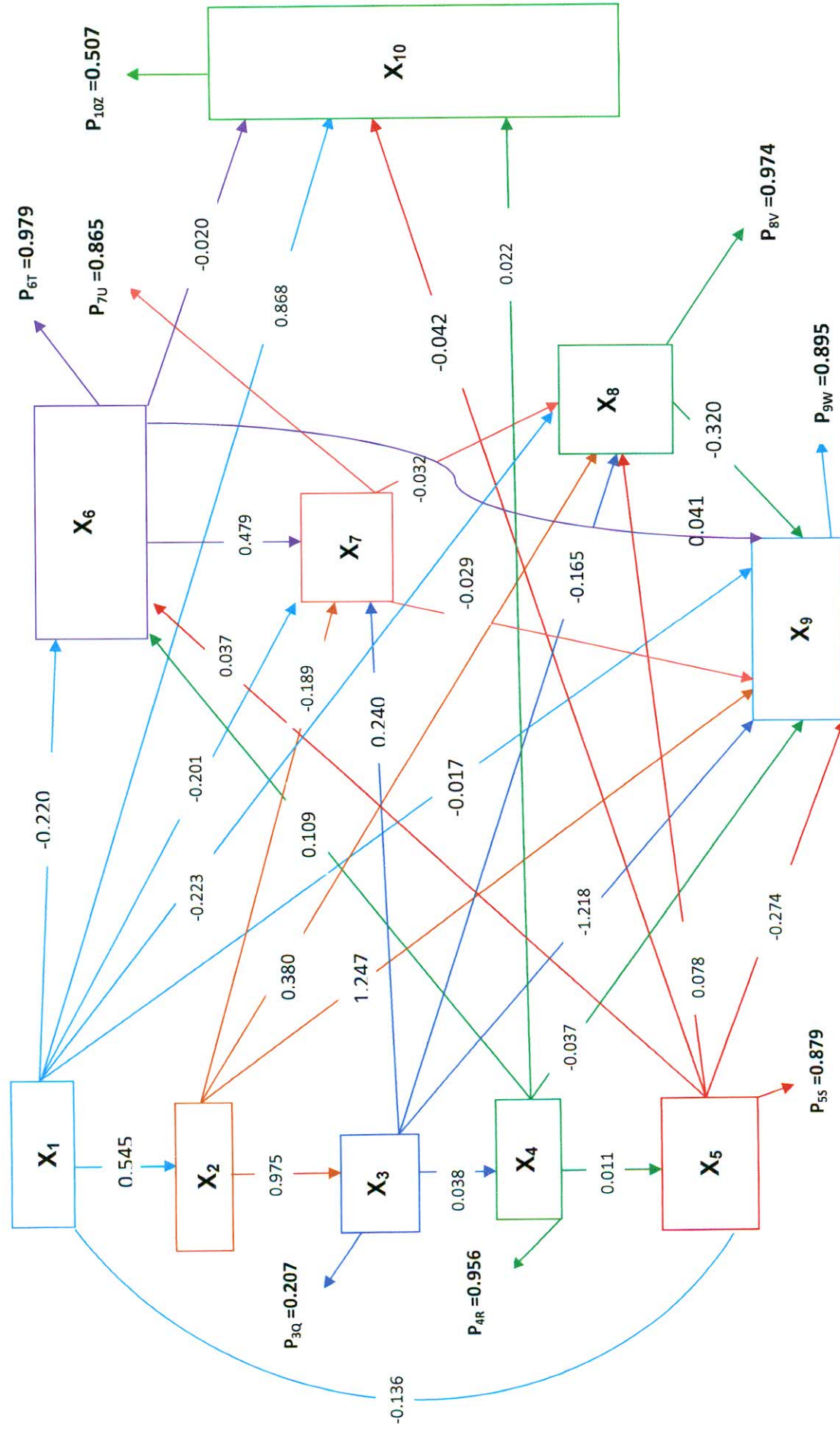


Table 9.7.4: Coefficients of variables in standard form, in reduced form and structural equations of model of socio-demographic and demographic determinants of fertility, (Women who did not lose their baby according to BDHS 2007 survey)

Exogenous Variable						
	X ₆	X ₇	X ₇	X ₈	X ₈	X ₈
X ₁	-0.220	-0.201	-0.095	-0.223	-0.232	-0.235
X ₂	-0.067	-0.189	-0.157	0.380	0.377	0.372
X ₃	0.109	0.240	0.187	-0.165	-0.161	-0.155
X ₄	0.109	0.063	0.011	-0.007	-0.002	-0.002
X ₅	0.037	0.041	0.023	0.078	0.080	0.080
X ₆	---	---	0.479	---	-0.041	-0.025
X ₇	---	---	---	---	---	-0.032
X ₈	---	---	---	---	---	---
X ₉	---	---	---	---	---	---

Exogenous Variable									
	X ₉	X ₉	X ₉	X ₉	X ₁₀	X ₁₀	X ₁₀	X ₁₀	X ₁₀
X ₁	-0.017	-0.008	-0.011	-0.086	0.868	0.863	0.863	0.866	0.866
X ₂	1.247	1.249	1.245	1.364	-0.004	-0.005	-0.006	-0.011	-0.007
X ₃	-1.218	-1.223	-1.217	-1.267	-0.031	-0.029	-0.028	-0.026	-0.030
X ₄	-0.037	-0.042	-0.041	-0.042	0.022	0.024	0.024	0.024	0.024
X ₅	-0.274	-0.275	-0.275	-0.249	-0.042	-0.041	-0.041	-0.042	-0.043
X ₆	--	0.041	0.055	0.047	---	-0.020	-0.018	-0.018	-0.018
X ₇	--	---	-0.029	-0.039	---	---	-0.004	-0.004	-0.004
X ₈	--	---	---	-0.320	---	---	---	0.014	0.013
X ₉	--	---	---	---	---	---	---	---	-0.003

The direct, indirect and total effects of each of the selected explanatory (independent) variables were presented in the table 9.7.5. Observing the table 9.7.5, we were seeing that desire for more children (X₂), fertility preference (X₃), age at sterilization (X₅), women age at marriage (X₆), mother age at first birth (X₇), contraceptive use (X₉) were found to had significant direct negative effects, while birth order number (X₁), number of household members (X₄), currently pregnant (X₈) were found to had significant direct positive effects on the number of children ever born or clearly on fertility.

Total effects of desire for more children (X₂), fertility preference (X₃), age at sterilization (X₅), women age at marriage (X₆), mother age at first birth (X₇), contraceptive use (X₉) were negatively significant while the remaining predictor variables that were used in the path analysis (four variables: X₁, X₄, X₈) were positively significant. This indicate that higher age at first marriage, age of women at first birth and age at sterilization had fewer number of children ever born to them as compared with those having early marriage and early mother age at first birth.

Table 9.7.5: Analysis of effects in a model of socio-demographic and demographic determinants of fertility, (Women who did not lose their baby according to BDHS 2007 survey)

Endogenous Variable	Exogenous Variable	Total Association	Total Effect	Non-Causal Effect	Indirect effect via				Direct Effect
					X ₆	X ₇	X ₈	X ₉	
X ₆	X ₁	-0.169	-0.220	0.051	---				-0.220
	X ₂	-0.116	-0.067	-0.049	---				-0.067
	X ₃	-0.110	0.109	-0.219	---				0.109
	X ₄	0.047	0.109	-0.062	---				0.109
	X ₅	0.52	0.037	0.015	---				0.037
X ₇	X ₁	-0.165	-0.201	-0.036	-0.106				-0.095
	X ₂	-0.242	-0.189	-0.053	-0.032				-0.157
	X ₃	-0.218	0.240	-0.458	0.053				0.187
	X ₄	0.007	0.063	-0.056	0.052				0.011
	X ₅	0.067	0.041	0.026	0.018				0.023
	X ₆	0.439	0.479	-0.040	---				0.479
X ₈	X ₁	-0.114	-0.223	0.109	0.009	0.003			-0.235
	X ₂	-0.033	0.380	-0.413	0.003	0.005			0.372
	X ₃	-0.068	-0.165	0.067	-0.004	-0.006			-0.155
	X ₄	-0.019	-0.007	-0.012	-0.005	0.000			-0.002
	X ₅	0.064	0.078	-0.014	-0.002	0.000			0.080
	X ₆	0.015	-0.041	0.056	---	-0.016			-0.025
	X ₇	0.098	-0.032	0.130	---	---			-0.032
X ₉	X ₁	0.032	-0.017	0.049	-0.009	0.003	0.075		-0.086
	X ₂	0.229	1.247	-1.018	-0.002	0.004	-0.119		1.364
	X ₃	0.185	-1.218	1.403	0.005	-0.006	0.050		-1.267
	X ₄	0.005	-0.037	0.042	0.005	-0.001	0.001		-0.042
	X ₅	-0.213	-0.274	0.061	0.001	0.000	-0.026		-0.249
	X ₆	0.000	0.041	-0.041	---	-0.014	0.008		0.047
	X ₇	-0.137	-0.029	-0.108	---	---	0.010		-0.039
	X ₈	-0.299	-0.320	0.021	---	---	---		-0.320
X ₁₀	X ₁	0.862	0.868	-0.006	0.005	0.000	-0.003	0.000	0.866
	X ₂	0.499	-0.004	0.503	0.001	0.001	0.005	-0.004	-0.007
	X ₃	0.499	-0.031	0.530	-0.002	-0.001	-0.002	0.004	-0.030
	X ₄	0.204	0.022	0.182	-0.002	0.000	0.000	0.001	0.024
	X ₅	-0.162	-0.042	-0.120	-0.001	0.000	0.001	0.001	-0.043
	X ₆	-0.172	-0.020	-0.152	---	-0.002	0.000	0.000	-0.018
	X ₇	-0.256	-0.004	-0.252	---	---	0.000	0.000	-0.004
	X ₈	-0.140	0.014	-0.154	---	---	---	0.001	0.013
	X ₉	0.104	-0.003	0.107	---	---	---	---	-0.003

*Non-Causal Effect = Total Association – Total Effect.

It was observed that birth desire for more children (X₂), fertility preference (X₃), age at sterilization (X₅), women age at marriage (X₆), mother age at first birth (X₇), contraceptive use (X₉) were positively related with fertility. Birth order number (X₁) had indirect effect on fertility through currently pregnant (X₈) was negative but women age at marriage (X₆) was positive. Desire for more children (X₂) had indirect effect on fertility through contraceptive use (X₉) was negative but women age at marriage (X₆), mother age at first birth (X₇) and currently pregnant

(X_8) was positive. Fertility preference (X_3) had indirect effect on fertility through women age at marriage (X_6), mother age at first birth (X_7) and currently pregnant (X_8) was negative but contraceptive use (X_9) was positive. Number of household members (X_4) had indirect effect on fertility through women age at marriage (X_6) was negative but contraceptive use (X_9) was positive. Age at sterilization (X_5) had indirect effect on fertility through currently pregnant (X_8) and contraceptive use (X_9) was positive but women age at marriage (X_6) was negative. Women age at marriage (X_6) had indirect effect on fertility through mother age at first birth (X_7) was negative. Currently pregnant (X_8) had indirect effect on fertility through contraceptive use (X_9) was positive.

Table 9.7.6: Percentage of the total absolute effect on fertility through endogenous variables of ever-married women who did not lose their baby according to BDHS 2007 survey

Endogenous Variable	Exogenous and Endogenous Variable	Indirect effect via				Direct Effect
		X_6	X_7	X_8	X_9	
X_{10}	X_1	0.572	0.000	0.343	0.000	99.085
	X_2	5.556	5.556	27.778	22.222	38.889
	X_3	5.128	2.564	5.128	10.256	76.923
	X_4	7.407	0.000	0.000	3.704	88.889
	X_5	2.174	0.000	2.174	2.174	93.478
	X_6	---	10.000	0.000	0.000	90.000
	X_7	---	---	0.000	0.000	100.000
	X_8	---	---	---	7.143	92.857
	X_9	---	---	---	---	100.000

From the tables 9.6.5 and 9.6.6, stated above, birth order number (X_1) had total positive effect 0.868 on fertility (total children ever born), of which about 0.572% was mediated through age at first marriage (X_6) in the same direction but 0.343% mediated through currently pregnant (X_8) in the opposition direction. Desire for more children (X_2) had total negative effect 0.004 on fertility (total children ever born), of which about 5.556% was mediated through age at first marriage (X_6), 5.556% was mediated through mother age at first birth (X_7) and 27.778% was mediated through currently pregnant (X_8) in the same direction but 22.222% was mediated through contraceptive use (X_9) in the opposition direction. Fertility preference (X_3) had total negative effect 0.031 on fertility (total children ever born), of which about 5.128% was mediated through age at first marriage (X_6), 2.564% was mediated through mother age at first birth (X_7) and 5.128% was mediated

through currently pregnant (X_8) in the opposition same direction but 10.256% was mediated through contraceptive use (X_9) in the same direction. Number of household members (X_4) had total positive effect 0.022 on fertility (total children ever born), of which about 3.704% was mediated through contraceptive use (X_9) in the same direction but 5.128% was mediated through age at first marriage (X_6) in the opposition direction. Age at sterilization (X_5) had total negative effect 0.042 on fertility (total children ever born), of which about 2.174% was mediated through currently pregnant (X_8) and 2.174% was mediated through contraceptive use (X_9) in the same direction but 2.175% was mediated through age at first marriage (X_6) in the opposition direction. Women age at marriage (X_6) had total positive effect 0.020 on fertility (total children ever born), of which about 10% was mediated through mother age at first birth (X_7) in the opposition direction. Mother age at first birth (X_7) had total negative effect 0.004 on fertility or total children ever born. There was no indirect effect for mother age at first birth on fertility. Currently pregnant (X_8) had total positive effect 0.014 on fertility (total children ever born), of which about 37.145% was mediated through contraceptive use (X_9) in the same direction. Contraceptive use (X_9) had total negative effect as well as direct effect 0.003 on fertility or total children ever born.

9.7.2 Findings

This study had attempted to show empirically the causal links between the selected variables and the relationship between and within the variables were examined by applying path analysis. It was found that desire for more children, fertility preference, age at sterilization, women age at marriage, mother age at first birth, contraceptive use were found to had significant direct negative effects, while birth order number, number of household members, currently pregnant were found to had significant direct positive effects on the number of children ever born. Increasing women age at first marriage and mother age at first birth were likely to lower fertility. Encouraging women to sterilization, fertility preference and contraceptive use contribute to a reduction of fertility. Since current pregnancy and birth order number had shown positive direct effect on fertility or children ever born. Therefore, these results had an important policy implication, was that the women birth order number and current pregnancy will be shrink in order to decrease fertility faster than at present.

9.8 Conclusion

For the women group who lost their baby earlier– fertility preference, number of household members, mother age at first birth, currently pregnancy were found to had significant direct negative effects, while the women who did not lost their baby– desire for more children, fertility preference, age at sterilization, women age at marriage, mother age at first birth, contraceptive use were found to had significant direct negative effects on fertility. Women group according to BDHS 2007 survey show that fertility preference, age at sterilization, women age at marriage, mother age at first birth were found to had significant direct negative effects on fertility. Therefore, we observed that age at sterilization and contraceptive use was essential to reduce fertility for those women who did not lost their child earlier, while it was not necessary for those women who lost baby earlier. Again number of household member and current pregnancy was important to lowering fertility for those women who lost baby before, whereas it was less important for those women who did not lost baby earlier. So, mothers always try to replace their dead child as early as possible. From this finding we got evidence in favour of the statement “where there was more mortality there was more fertility”. Finally we concluded that encouraging all groups of women for rising contraceptive prevalence rate (CPR), mother age at first birth and women age at first marriage in order to reduce fertility.

Chapter: Ten

Summary, Conclusion and Policy Recommendations



Chapter: Ten

Summary, Conclusion and Policy Recommendations

10.1 Introduction

Infant and child mortality is a sensitive indicator of the socio-economic, nutritional standard and health condition prevailing in a community. This estimate is used for monitoring and evaluating population and health programs and policies. It is also important for monitoring programs towards the PRSP and MDGs to reduce child mortality. We can easily assess overall health situation of a society by calculating infant and child mortality status. Infant and child mortality may vary between different socio-economic status, these variations may be employed in explaining differentials, in deciding priorities for child health action in designing intervention programs and in assessment and monitoring of child health problems and programs. Socio-economic factors have strong influence on mortality levels. Moreover, a minimum number of public health programs such as immunization, better water supplies and improved sanitation can reduce mortality rapidly. The present dissertation attempted to investigate the level and trends of infant and child mortality followed by differential study with respect to some socio-economic, demographic and maternal health care service utilization characteristics, the bivariate analysis is used to examine significant association of socio-economic, environmental and demographic factors as the determinants of infant and child mortality. The analysis further wants to identify the factors affecting infant and child mortality at national level. This study also attempts to observe the level and trends of reproductive pattern, fertility situation of Bangladesh, child mortalities impact on reproductive pattern. Lastly try to investigate direct and indirect effect of selected variables on fertility for three groups of women in order to find out the infant and child mortalities impact on reproductive pattern. All these investigations have been based on data from BDHS 2007. The purpose of this chapter is to summarize the findings which were found in the previous chapters and to draw some policy implications and recommendations.

10.2 Summary of Findings

In chapter three, we investigated level, trends and differentials of infant and child mortality. The levels, trends, and differentials in infant and child mortality provide an

opportunity to evaluate the performance of population and health programs and policies. Between the periods 1989-1993 and 2002-2006, neonatal mortality declined by about 30% from 52 deaths per 1000 live births to 37 per 1000 and 10% declined from immediate past survey. Post-neonatal mortality declined by about 60% from 35 deaths per 1000 live births to 15 per 1000 and it was 38% declined from immediate past survey. Child mortality rate was declined by about 70% from 50 deaths per 1000 live births to 14 per 1000 and it was 42% declined from last BDHS survey. The infant mortality rate (IMR) appeared to have dropped sharply in the early 1900s, but barely dropped from 198 infant deaths per 1,000 live births to 145 deaths during the five decades between 1921 and 1971. In the immediate aftermath of Bangladesh's independence, the IMR actually increased to 145. But since then the IMR had fallen secularly and rapidly, reaching a level of 98 by 1989 and 52 in 2007.

This chapter provided the differentials of neonatal, post-neonatal and child mortality. Bivariate analysis had been used for examining the effects of socioeconomic, demographic and maternal health care service utilization variables on infant and child mortality in Bangladesh. Here mortality data analysis was conducted through bivariate analysis. Bivariate analysis was particularly important to check for the mortality differentials with respect to the different levels of each of the selected independent variables. The results showed that

- ❑ Post-neonatal and infant mortality were highest in Sylhet division and child mortality was highest in Chittagong divisions.
- ❑ Infant and child mortality in urban areas were about two times lower than rural areas.
- ❑ Parent's educations had significant effect on infant and child mortality. Parents having no or primary education faced higher level of infant and child mortality.
- ❑ Occupation of father was found significant for post-neonatal and child mortality. Neonatal, post-neonatal and child mortality rates were significantly lower for high standard of living of mothers.
- ❑ Electricity and household goods were very much associated with low infant and child mortality.
- ❑ Household annual income or wealth status of the families was inversely associated with infant and child mortality. Pit latrine users had higher infant and child mortality where toilet with flush had very low mortality.

- ❑ A significant portion of infant and child died when source of drinking water is tube well or borehole.
- ❑ In every stage of child mortality, he baby faced higher risk than she baby.
- ❑ Infant and child mortality was very high in first birth order of a mother, because of mothers were physically depleted at the time of conception and throughout pregnancy.
- ❑ Both neonatal and post-neonatal mortality was observed highest for the children whose previous birth interval was greater than 24 months.
- ❑ Breastfeeding status had played significant role to reduce infant and child mortality. Neonatal mortality was very high when mother did not breastfeed her baby, on the other hand post neonatal mortality was high when mother breastfeed her baby from 1 to 12 months only.
- ❑ 15-19 age group mothers' age at the birth of a child had significant influence on neonatal and post-neonatal mortality.
- ❑ The neonatal and infant mortality was found higher in small families (<4 members).
- ❑ 90% neonatal mortality occurred when place of delivery was in home. Besides all types of child mortality had highest risk when place of delivery was home, whether it was very low when baby born in hospital.
- ❑ Timing of first antenatal check during pregnancy, Tetanus injections during pregnancy and numbers of antenatal visit during pregnancy was significant for all the three mortality cohorts.
- ❑ Lowest infant and child mortality was observed for mother's exposure to mass media.

In chapter four, child mortality levels were calculated by Brass indirect technique which showed that the estimates of children probability of dying imply relatively high mortality. The sex ratios at birth of children ever born were close the expected value of 1.05, the average parities increase monotonically and proportions of children dead also increase. Children probability of dying was increases and probability of surviving was decreases with the rises of both age of mother and duration of marriage. The estimates of child mortality levels fairly consistent for the two sexes and indicates child mortality had been falling. Researcher also identified that child mortality high in those age groups (20–24, 25–29) where fertility rates were high. Again child mortality levels were low where fertility rates were also low.

In chapter five, main objective was to find out the factors which were affecting infant and child mortality. By applying logistic regression analysis in 4 groups (neonatal mortality group, post-neonatal mortality group, infant mortality group and child mortality group) in order to observed the effect of the socio-economic, demographic and maternal health care service utilization variables on risk of dying of children in the previous year. In the neonatal mortality group, out of all the variables that were included in the logistic regression, division, father's education, main roof materials, main wall materials, main floor materials, wealth status, sex of child, birth order number, age of mother at first birth, duration of breastfeeding, place of delivery, timing of first antenatal check and tetanus injection before pregnancy appeared to be the most significant factors in determining the likelihood of dying before reaching the first month of life. This group suggested that in order to lower neonatal mortality, it was essential to provide greater attention to increase education of lower educated women. Alternatively, the reproductive health program should pay special attention to the need of lower educated women. Similarly, it was very important for the Bangladesh government to take action to provide with electricity those households that did not use electricity in order to decrease neonatal mortality. Thus, according to the findings of this study, high risk of neonatal mortality in Bangladesh could be exists in those families where it was situated in rural areas, where parent's education was low, father's were businessmen, mother's were either worker or service holder, absence of radio in the house, sources of drinking water was open places, toilet with flush based sanitation system, new born babies were female, children were born within short birth intervals, women age at first marriage was 15—19 years, mother age at first birth is below 15 years, duration of breastfeeding was above 1 month, household with 4—6 members and which do not use electricity.

In the post-neonatal mortality group, out of all the variables that were included in the logistic regression, division, mother's education, mother's occupation, electricity, main wall materials, wealth status, type of cooking fuel, sex of child, previous birth interval and tetanus injection before pregnancy appeared to be the most significant factors in determining the likelihood of dying before reaching one to eleven months of life. According to the findings of this study, high risk of post-neonatal mortality in Bangladesh could be exists in those families where it was situated in rural areas, where parent's education was low, father's were businessmen, mother's were either worker or service holder, absence of radio in the house, sources of drinking water

was open places, toilet with flush based sanitation system, new born babies were female, children were born within short birth intervals, women age at first marriage was 15—19 years, mother age at first birth was below 15 years, duration of breastfeeding was above 1 month, household with 4—6 members and which did not use electricity.

In the infant mortality group, out of all the variables that were included in the logistic regression, division, father's education, father's occupation, refrigerator as household goods, main roof materials, sanitation system, sex of child, birth order number, age of mother at first birth, number of household members appeared to be the most significant factors in determining the likelihood of dying before reaching the first birth day of life. According to the findings, high risk of infant mortality in Bangladesh could be exists in those families where it was situated in rural areas, where mother's education was low, father's were agriculture, mother's were either worker or service holder, absence of radio in the house, thatch/palm leaf based house, sources of drinking water was open places, flush based sanitation system, agricultural crop and animal dung and others based cooking fuel, new born babies were female, children were born within very short or very long birth intervals, mother age at first birth was below 15 years, duration of breastfeeding was below one year or above two years, household with more than 4 members, place of delivery with medical facilities, where mother had no media exposure and which families use electricity.

In the child mortality group, out of all the variables that were included in the logistic regression, place of residence, mother's education, father's occupation, religion, wealth status, sources of drinking water, birth order number, previous birth interval, age of women at first birth, age at first marriage and mother's media exposure appeared to be the most significant factors in determining the likelihood of dying before reaching the first five years of life. According to the findings of this study, high risk of child mortality in Bangladesh could be exists in those families where it was situated in rural areas, where parent's education was low, father's were farmer, mother's were either worker or service holder, absence of radio and refrigerator in the house, thatch/palm leaf based house, without pipe based sources of drinking water, without flush based sanitation system, new born babies were male, children's were born with very short and very long birth intervals, women age at first marriage was below 15 years, mother age at first birth was also below 15 years,

duration of breastfeeding was below 1 month, household with 4—6 members and which families did not use electricity.

In chapter six, we reviewed the level, trends and differentials of reproductive pattern of Bangladesh. Fertility in Bangladesh was declining over the past 36 years by observing the trends in fertility. The trends in the crude birth rates from 1974 to 2010 indicated that the crude birth rates fluctuated around 34 per 1000 population throughout the period until 1989 then fertility had been declining moderately. Total fertility rate had declined about 60 percent from 6.3 births per women in the period 1975 to 2.7 births for the period 2007. It was truly an exceptionally steep decline. Period fertility approach revealed that the level of fertility was still very high in Bangladesh although the age specific fertility rate had been decreasing over time in each age group. Moreover, the completed family size in case of cohort fertility will give the level of fertility of a particular cohort and it indicated that the mean number of children ever born per ever married women had been declining over time and it was slightly lower on recent years in each age group. In Bangladesh, the norm of early and universal marriage still prevails. Most of the first marriage occurred within a short of life. The age patterns of marriage occur within a short span of life. The age patterns of marriage and the contraceptive use have changed in a positive direction, the negative impact of which had fallen on fertility. The change in marital fertility that had taken place in the country overtime was contributed less by the change in marital fertility in comparison to the change in marriage pattern. Also the effect of change of marriage pattern in reducing fertility level perhaps had increased over time.

Almost all studies had shown that selected background variables have positive or negative effect on reproductive behaviour. From the analysis, the regional differentials reveal the regional variation in fertility and those might be the result of education, occupation, religion, urbanization and economic condition of that area. The urban-rural differentials of fertility show that the rural fertility was higher than the urban. Level of education may effectively reduce reproductive performance of the women in Bangladesh. Besides these socio-economic variables that was women and men labour force participation influence fertility negatively. Again, it was usually seen that those who were engaged in mental work have less number of children, as compared with those who were in physical labour. Socio-cultural variables religion and birth status of women prove that in our rural and superstitious society such variables help to increase fertility. Age at marriage had a reducing effect on fertility

furthermore the increase of the age at marriage and age at first birth might effectively reduce reproductive performance of the women in Bangladesh.

In chapter seven, we investigated the fertility situation of Bangladesh and identify the impact of infant and child mortality on fertility by applying Bongaart's model. The Bongaarts model of the proximate determinants of fertility is one of the most widely used tools in fertility analysis. The result shows that

- ❑ From the analysis it appeared that there was a downward trend in all the proximate indices. The amount of decrement of fertility was about 12% from 1993–94 to 2004 and it was about 21% from 1993–94 to 2007 for the women of BDHS.
- ❑ This analysis of the proximate determinants of fertility suggested that late marriage, divorce and widowhood, and contraceptive use were the key factors reducing the prevailing levels of fertility in Bangladesh from their biological maximum.
- ❑ The use and prevalence of contraception had been identified as an important determinant for the reduction in fertility that has to be achieved in the future. Contraceptive method-specific proportion of women must be increased.

From the comparative analysis between two women groups where women lost their baby and did not lost baby, researcher observe child mortality's impact on fertility based on Bongaart's model indices. From the calculation, observed child mortality's impacts on fertility were given below:

- ❑ Proportion of marriage for the women who lost their baby had less contribution in reducing fertility than the proportion of marriage for the women who did not lost their baby. So child losing mother's proportion of marriage was less capable in reduction of fertility with compare to without child losing mother.
- ❑ Proportion of lactational infecundability of child losing mother had greater contribution in reduction of fertility with compare to child living mother. Hence child losing mother's duration of breastfeeding was longer than child living mother.
- ❑ The effect of proportion marriage and use contraception for child living mother was greater but the effect of proportion lactational infecundability for child losing mother was greater.

- ❑ Postponement of marriage for the women who lost their baby contributes lower births in reduction of fertility than the women who did not lost their baby.
- ❑ Again widowhood, separation, not living together and divorced for the women who lost baby also contributes lower births in reduction of fertility with compared to the women who did not lost baby.
- ❑ The effect of marriage pattern of the women who lost baby was less efficient to reduce fertility than the effect of marriage pattern of the women who did not lost baby.
- ❑ Child losing mother's decrement of fertility is greater for the period of 1993–94 to 2004 but child living mother's decrement of fertility was greater for the period 1993–94 to 2007.
- ❑ From the application of Bongaart's model, if 60% CPR achieved in 2020, TFR for the women who did not lost their baby will be higher than the women who lost their baby.
- ❑ Again from the application of Bongaart's model, In order to achieve replacement level of fertility, Contraceptive Prevalence Rate (CPR) for the women who lost their baby will be higher than the women who did not lost their baby.

In chapter eight, we explore the impact of infant and child mortality on reproductive pattern, by using percentage distribution of some selected fertility related variables. The relationship between childhood mortality and fertility was complex since it involves multiple dimensions that were difficult to disentangle empirically or even identify theoretically. Evidence exists that short birth intervals, birth order and mother's age at birth have strong effects on infant and early child mortality. Women who lost their baby had more children per women than the women who did not lost baby before. The result shows that

- ❑ ASFR for child losing teenage mothers were very low.
 - Since live birth was the prerequisite condition for ASFR. So we conclude that teenage mothers might give dead child in their first issues.
 - Again among the groups of women ASFR increases up to age group 25–29 mostly then decreases sharply.
 - ASFR for child losing women took highest value than other groups in late 30 years age.

- ❑ First and second birth order number was very low for those women who lost baby before. Since losing child status creates physical complicacy among those women who lost baby earlier. Again fifth and more birth order number was highest for those women who lost baby before. This is why, because losing child may create psychological pressure for more children.
- ❑ The women who did not lost baby before had highest portion in 2 years duration of previous birth interval.
- ❑ Women who lost baby before get married in early ages. Among the women who lost baby earlier, more than 96 percent teenagers got marriage and got experiences in infant and child mortality.
- ❑ More than 80 percent teenage mothers gave birth who had experiences in losing child. So child losing mother comparatively gave more birth than other groups of women.
- ❑ With the increasing duration of breastfeeding period, there was a tendency to decreases portion of women who losing baby before. Short length of breastfeeding periods were preferred by the mother who lost baby earlier.
- ❑ Child losing mothers were the highest portion for having another child but lowest portion for wants no more in their fertility preferences and declared infecundity is highest in earlier child losing mothers.
- ❑ Child losing women discourage contraceptive use than the women who did not lost child. Among the women groups, women who lost child earlier were most preferred modern methods in contraceptive using.
- ❑ For the influences of child mortality, child losing women were lower portions when family size was below 4 members.
- ❑ Initially earlier child losing mother were not interested in sterilization for want of having child. It also revealed that increasing in age there was a decreasing tendency in sterilization.
- ❑ Early child mortality makes the women aware for that reason highest portion of women take at least three times antenatal visits during pregnancy.
- ❑ Early child losing mothers were highest in number for taking tetanus injections during pregnancy.

Chapter nine had attempted to show empirically the causal links between the selected variables and construction of some indices on one hand, and the total

fertility rate (TFR) on the other. The relationship between and within the variables of the three women groups according to BDHS 2007 survey were examined by applying path analysis.

Women group where women have child losing and living experiences before

- ☐ Fertility preference, age at sterilization, women age at marriage, mother age at first birth were found to have significant direct negative effects
- ☐ Birth order number, desire for more children, number of household members, currently pregnancy and contraceptive use were found to have significant direct positive effects on the number of children ever born.
- ☐ Rising the age at first marriage, mother age at first birth was likely to lower fertility on a national scale.
- ☐ Encouraging women to sterilization also contribute to a reduction of fertility.
- ☐ Since current pregnancy and contraceptive use had shown positive direct effect on fertility or children ever born. Therefore, these results had an important policy implication, is that the raising contraceptive use will be important for lowering fertility faster than at present.
- ☐ The results suggested that application of contraceptive method must be increased all over the country.

Second women group where women have only child losing experiences before

- ☐ Fertility preference, number of household members, mother age at first birth, currently pregnancy were found to have significant direct negative effects,
- ☐ Birth order number, desire for more children, age at sterilization, women age at marriage, contraceptive use were found to had significant direct positive effects on the number of children ever born.
- ☐ Increasing fertility preference, mother age at first birth was likely to lower fertility.
- ☐ Encouraging women for rising women age at first marriage, sterilization to reduce fertility.
- ☐ Birth order number and desire for more children will be increase for reducing fertility.
- ☐ Contraceptive use had shown positive direct effect on fertility or children ever born, so raising contraceptive use will be important for lowering fertility.

- ❑ Current pregnancy appeared to have had a significant direct negative effect on fertility which means that mothers who have losing child experiences are found to have higher fertility. Mothers always try to replace their dead child as early as possible.

Third women group where women have only child living experiences before

- ❑ It was found that desire for more children, fertility preference, age at sterilization, women age at marriage, mother age at first birth, contraceptive use is found to have significant direct negative effects.
- ❑ Birth order number, number of household members, currently pregnant is found to have significant direct positive effects on the number of children ever born.
- ❑ Increasing women age at first marriage and mother age at first birth were likely to lower fertility.
- ❑ Encouraging women to sterilization, fertility preference and contraceptive use contribute to a reduction of fertility. Since current pregnancy and birth order number had shown positive direct effect on fertility or children ever born.

From the above discussion in chapter nine, we found that

- ❑ For the women group who lost their baby earlier– fertility preference, number of household members, mother age at first birth, currently pregnancy were found to have significant direct negative effects,
- ❑ For the women who did not lose their baby– desire for more children, fertility preference, age at sterilization, women age at marriage, mother age at first birth, contraceptive use were found to have significant direct negative effects on fertility.
- ❑ Women group according to BDHS 2007 survey show that fertility preference, age at sterilization, women age at marriage, mother age at first birth were found to have significant direct negative effects on fertility.
- ❑ Therefore, we observed that age at sterilization and contraceptive use was essential to reduce fertility for those women who did not lose their child earlier, while it was not necessary for those women who lost baby earlier.
- ❑ Again number of household member and current pregnancy was important to lowering fertility for those women who lost baby before, whereas it was less important for those women who did not lose baby earlier.

- ❑ So, mothers always try to replace their dead child as early as possible. From this finding we got evidence in favour of the statement “where there is more mortality there is more fertility”.
- ❑ Finally we conclude that encouraging all groups of women for rising contraceptive prevalence rate (CPR), mother age at first birth and women age at first marriage in order to reduce fertility.

10.3 Major Findings

This study had identified the population subgroups in which children and reproductive mother have the higher risk of premature death. According to the discussions of this dissertation some major findings had been identified that would help to understand the actual situation of infant and child mortality and reproductive pattern in Bangladesh.

- ❑ Neonatal mortality declined 30%, post-neonatal mortality declined 60% and child mortality declined 70% in between the period 1989–93 to 2002–06. Infant Mortality Rate (IMR) barely dropped from 198 deaths per 1000 live births to 145 deaths during 1921 and 1971. But since then IMR had fallen rapidly reaching a level of 98 in 1989 and 52 in 2007.
- ❑ Residence in rural areas, parents illiteracy, fathers low level of working status, household without electricity, household with open or hanging latrines, without tube-well based sources of drinking water, poor housing conditions, early marriage, teenage motherhood, mothers with higher birth order and with short birth interval, mothers without mass media facilities, more than six members family, mothers whose birth giving place at home were responsible for infant and child mortality.
- ❑ Children probability of dying increases with the rises of both age of mother and duration of marriage. Child mortality levels were high in those age groups where fertility rates also high.
- ❑ Total Fertility Rate (TFR) had been declined over 60% from 6.3 births per woman in 1975 to 2.7 births per woman in 2007.
- ❑ The age pattern of marriage and the contraceptive use had changed in a positive direction in reducing fertility. Rural fertility was higher than urban fertility. Educated women can effectively reduce their reproductive

performance. Professional worker fathers had less children than physical worker fathers.

- ❑ Proximate determinants of fertility showed downward trends for all proximate indices. Late marriage, divorce, widowhood and contraceptive use were the key factors to reduce the level of fertility.
- ❑ If 60% Contraceptive Prevalence Rate (CPR) achieved in 2020, TFR will be lower for those mothers where child mortality occurs than child living mothers.
- ❑ In order to achieve replacement level of fertility, contraceptive prevalence rate (CPR) for those mothers who face child mortality will be greater than child living mothers.
- ❑ Age Specific Fertility Rate (ASFR) for below 25 ages, first and second birth order number, long length of breastfeeding were very low for those mothers who face child mortality earlier. They discourage contraceptive use and there was a decreasing tendency in sterilization for child losing mothers. Moreover, declared infecundity was highest for them.
- ❑ Age at sterilization and contraceptive use was essential for those mothers where child mortality occurs. Encourage all women for rising contraceptive prevalence rate (CPR), mother age at first birth and women age at first marriage in order to reduce fertility.

10.4 Policy Implication and Recommendation

The main purpose of this thesis has to identify not only the level, trends, differentials and determinants of infant and child mortality and reproductive pattern but also infant and child mortality's impact on reproductive pattern in Bangladesh. The findings of this dissertation may have some policy implications and recommendations that would help the planners and policy makers to achieve substantial improvement in the area of infant and child survival and women reproductive health. According to the discussions of this dissertation some policy implications and recommendations have been suggested that would help the government and other policy makers to take proper initiative to promote child survival and women reproductive health in Bangladesh.

- ❑ Infant and child mortality will be reducing to enhance both mothers and fathers education and empowerment of women. That means, we observed that infant and child mortality were lower among the educated parents than

that of illiterate parents. So, policy to expand educational opportunities for illiterate parents would increase the access of people to informal and improve their ability to make good idea of child care, which should be help to reduce infant and child mortality.

- ❑ Electrification particularly in the rural areas has been one of the priorities of the government development plan. So continuing of electrification is expected to result in further improvement in infant and child mortality in Bangladesh.
- ❑ To provide proper and hygienic sanitation and drinking water facilities both in rural and urban areas. Encourage people to build hygienic sanitary toilet at home. Pure drinking water in the household is very much essential, so that children do not suffer from infectious diseases liked diarrhoea. So government should take necessary steps in this regard to take necessary steps for child survival.
- ❑ Decentralized health care centre and special care for both neonatal baby and pregnant mothers. Housing conditions should improve to decrease infant mortality in rural areas. Health care facilities should be extending up to rural areas where communication system is no easier.
- ❑ Place of delivery is an important indicator if infant and child risk of dying. Mother's access to trained birth attendants should be improved in order to save lives of infants at early ages and keep sound reproductive health of mother after giving a birth.
- ❑ To expand effective programs to reduce teenage child bearing would lower neonatal mortality tremendously.
- ❑ To reduce higher birth order and discouraging short birth spacing through effective use of family planning method and to eliminate son preference and also improving mothers education about maternal and child health.
- ❑ To encourage mothers for breastfeeding to their children during neonatal, post-neonatal and childhood period. It will increase baby's nutritional status.
- ❑ Birth should be reduced to very young (teenage mothers) mother for postponement of premature birth, unwanted pregnancies, unstable material unions and to older mothers to avoid pregnancy complication due to reduction in reproductive capacity and other biological factors to higher pregnancy older.

- ❑ Mass media like radio, television, newspaper or magazine have a tremendous effect on mother's awareness towards mortality. Mass media campaign is required for strengthening for the awareness of the people about the demerits of early age pregnancy, demerits of consecutive births with short interval, advantage of antenatal care during pregnancy, advantage of immunization vaccines for mothers and children, beneficial effects of breastfeeding and also maintaining hygienic environments.

10.5 Suggestion for Further Research

The present study has mainly focused child mortality and impact of child mortality on reproductive pattern in Bangladesh. This study did not cover the entire gamut of child mortality and reproductive pattern specially determinants of child mortality and fertility. This study was conducted by BDHS socio-economic, demographic and maternal healthcare service utilization variables for mortality and fertility analysis. But data were not collected through field survey for opinion and a comparative study towards child mortality and impact of child mortality on reproductive pattern in Bangladesh. There were enough scopes for future researchers to address those areas which were not covered in the present study. Awareness and poverty implication towards child mortality and fertility might be an interesting issue for further study. In this study there was an attempt to find out impact of child mortality on reproductive pattern by using frequency distribution and using path model analysis in order to find out the intensity of those selected variables. There might be a scope for model fitting among the selected variables to observe the direction or tendency of the selected variables towards child mortality's impact on reproductive pattern in Bangladesh. On the analytical point of view, this study based on Frequency distribution, Cross table analysis, Brass model analysis, Multiple logistic regression analysis, Bongaart's model analysis and Path model analysis. Other techniques in demography such as Life table analysis, Principle Component Analysis (PCA), Indirect Techniques, Odd ratio analysis, Discriminant Analysis etc. might be used in the future studies to analyze infant and child mortality and reproductive pattern in Bangladesh. Moreover, there was a scope for further research why age specific fertility rate (ASFR) for child losing mothers were very low than child living mothers in the beginning of fertile age.

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