

Birth Spacing, Breastfeeding Pattern and Child Survival in Bangladesh



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Doctor of Philosophy *in* *Population Science*

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Dedicated

To

My Parents

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Abstract

Birth spacing is a major determinant for evaluating family building process due to its direct relationship with fertility. The mean duration of successive birth intervals is obviously related to the fertility rate, the longer the interval consequently the lower the fertility. Breast feeding and post-partum amenorrhoea (PPA) have also been a matter of rapidly growing interest, as they are important not only for maternal and child health but also for its fertility reducing effect through PPA. Hence for a complete understanding of the process of family building, in Bangladesh, it is imperative to analyze the birth spacing, breastfeeding pattern and PPA as well as their differentials and determinants in context of female population of Bangladesh. This study also examines the influence of birth spacing on child survival.

The data used for the completion of this work, is extracted from the Bangladesh Demographic and Health Survey (BDHS) conducted in 2003-2004. The BDHS recorded enormous data on complete birth history of 11440 ever married women of the age group 10-49, which are very useful for studying birth interval. The study considers first to fifth birth intervals as it covers most of the range of fertility experience of Bangladeshi women. Since data on breastfeeding were available only for the last child, the study of breastfeeding and post partum amenorrhoea is based on information for last birth.

The study reveals that the distribution of first to fifth birth interval is largely positively skewed lying somewhere between 12 to 23 months for first births and for subsequent birth in the duration 24 to 35 months. Both Chi-square statistic and Cox proportional hazard model demonstrate that age, women age at marriage, couples education, respondent work status, residence, socio-economic status, contraceptive use and watch

TV have significant influence on first birth interval but subsequent birth showed miscellaneous results. Moreover, survival status of previous child showed highly significant effect on second to fifth birth intervals. But the variable religion has no significant orientation at all. To study the quantum and tempo of fertility life table technique is employed and demonstrates that the mean birth interval for marriage to first birth is 24 months but for subsequent birth the interval lies between ranges 30 to 32 months. The differential analysis of quantum and tempo of fertility reveals that educated women have shorter first but longer subsequent birth interval. Urban mother have shorter first birth interval is lower but longer subsequent birth interval is higher than rural mother. The birth interval is higher (25 months) when age at marriage is less than or equal to 15 years, but lower (21 months) when age at marriage is 15 years and above. But for higher order births age at marriage has no differential effect. The summarized results speculate that child survival status affects timing of birth not only for first two or three orders but also for higher orders, but at a smaller pace, for women whose previous child is death birth interval is much lower than those whose previous child is alive.

Determinants and differential of breastfeeding and post partum amenorrhoea are also performed using life table analysis and Cox Proportional Hazard model. The results indicates that breastfeeding is virtually universal (98.3 percent) and homogeneously prolonged in Bangladesh. The mean duration of breastfeeding is about 32 months. To see the effects of socio-demographic variables on breastfeeding we fitted three model- the first one to see the effect of demographic variables, second one to see the effects of socio-economic variables and lastly to see the combined effect of these two variables. The study results divulge that demographic variables have more influence than other variables. Finally the proportional hazard analysis has identified that administrative division,

religion, maternal education, working status, current age, age at marriage, parity; contraceptive use and place of delivery have significant effect on the duration of breast feeding. The overall mean duration of PPA was found to be 8.51 months and the length increases with increase in the parity. The mean length of PPA significantly varies by place of residence, region, mother's education, work status, sex of previous child, breastfeeding status, parity, delivery status and age of mother. The Cox proportional hazard model suggested that duration of breastfeeding has strong positive influence on duration of PPA among all included explanatory variables.

The study also analyzed the relationship between the length of preceding birth interval and child survival and their effect on age specific probability of death of index child. The preceding birth interval and child survival are significantly correlated and probability of survival is much lower for less preceding birth interval (<12 months) and also a lesser extent at higher birth interval (84+ months). To see the effect of preceding birth interval and socio-demographic factors on child survival status four separate logistic regression models (neonatal, post neonatal, mortality between 12-35 months and child mortality) are fitted. These models reveal that among the socio-demographic variables, preceding birth interval, breast feeding status and mother's education has strong significant effect on mortality but the variables birth order and mother's age at birth has little or no significant effect.

Therefore, the study results emphasize that it is need to encourage women to have longer birth interval, not only to limit family size, but also to guarantee good health of mother and the child. Education is a consistently a dominant factor and such formal and informal education should encourage women to differ marriage and prolong breast feeding.

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22 August 2009

Certificate

This is to certify that the thesis entitled “Birth Spacing, Breastfeeding Pattern and Child Survival in Bangladesh” is a record of original research work, for the degree of Doctor of Philosophy in Population Science done by Mrs. Shamima Akter, Department of Population Science and Human Resource Development at the University of Rajshahi, Bangladesh.

I further certify that the research work has not previously been published or submitted elsewhere for any other degree or diploma.

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22 August 2009

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This desertation entitled "Birth Spacing, Breastfeeding Pattern and Child Survival in Bangladesh" submitted by Mrs. Shamima Akter, Reg. No. 2768 in the Department of Population Science and Human Resource Development at the University of Rajshahi, for the fulfillment of the requirements for the degree of Doctor of Philosophy is based on research work carried out under joint supervision.

To the best of my knowledge, this work neither in part nor in full has been submitted to any other University or institution for the award of any degree.

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Declaration

I do hereby declare that the thesis entitled "Birth Spacing, Breastfeeding Pattern and Child Survival in Bangladesh" submitted to the Department of Population Science and Human Resource Development, University of Rajshahi, Bangladesh for the award of the degree of Doctor of Philosophy in Population Science is a record of original and independent research work done by me under the supervision of Dr. J.A.M. Shoquillur Rahman, Associate Professor, Department of Population Science and Human Resource Development, University of Rajshahi and Professor Samad Abedin, Head, Dept. of Business Administration, International Islamic University Chittagong, Dhaka Campus and it has not been submitted elsewhere for any other degree or diploma.

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CHAPTER ONE

INTRODUCTION

Chapter One

Introduction

1.1 Background of the Study

Differences in a country's fertility levels can be attributed to the differences in the length of the reproductive life of women and differences in the length of time between births when women are exposed to the risk of conception. Analysis of those factors influencing the span and those affecting the spacing of fertility has proven useful, since in many cases they appear to vary quite substantially across populations (Rodriguez and others, 1984). In recent years, policy makers and planners have focused a great deal of attention on the birth interval and its determinants. The reasons are that not only does the number of births a woman may have during her reproductive span depend on the spacing between the births but also there is a significant link between birth spacing and maternal and child health (Miller and others, 1992). Thus the spacing of births through a deliberately prolonged interval between births and a delay in child bearing following marriage could be logical alternative strategies for fertility control.

The lengths of time between marriage and giving birth to the first child and the interval between births have a crucial role in women's reproductive health. The number of children a woman can have during her reproductive life depends on the spacing of births. The length of exposure time to conception is well recognized as a main determinant of fertility. It plays the major role in Bongaarts and Davis and Blake's theories of fertility (Zinab and Agha, 2005) as well as other models of fertility determinants. Prolonged interval between births-through contraceptive uses - is the major means for neutralizing

the effect of duration of marriage on fertility. Birth spacing also known to it's significantly affect on the health of mother and children. Birth interval has contribution to fertility outcome and significant bearing in maternal and child health through sibling competition, maternal depletion, and interval effect.

There is renewed programmatic interest in the effects of birth spacing on infant, child, and maternal health and survival because family planning programs have the potential to affect the timing of pregnancies. There is limited empirical evidence on the intervening process through which preceding/subsequent birth intervals operate to influence perinatal, infant, and child mortality. The adverse consequences of a short interval for infant and child survival and maternal mortality and morbidity have been attributed to the biological effects related to the "maternal depletion syndrome" or more generally the woman not fully recuperating from one pregnancy before supporting the next one (which, may lead, for example, to anemia and premature rupture of membranes) (Conde-Agudelo, 2004, and Dewey and Cohen, 2004).

Other mechanisms that have been hypothesized to possibly contribute to a detrimental effect of a short preceding interval on infant and child survival are (1) behavioral effects associated with competition between siblings (e.g., competition for parental time or material resources among closely spaced siblings), (2) the inability (or lack of desire) to give a child adequate attention if his or her birth came sooner than desired; and (3) disease transmission among closely spaced siblings. Several of these have been discussed extensively in the literature (e.g., Davanzo et al., 1983; National Research Council, 1989; Miller, 1991). Much less attention has been given to why very long intervals might have an adverse effect; Conde-Agudelo and Belizán (2000) provide a nice discussion about this. Note that some of these mechanisms, e.g., maternal depletion, apply to preceding

pregnancies regardless of the outcome, though they may depend on the duration of the preceding pregnancy, while others, e.g., competition and spread of disease, will only come into play if the preceding child is still alive.

There are a number of reasons why there may appear to be a relationship between pregnancy and birth-spacing on the one hand and pregnancy, infant, child, and maternal outcomes on the other hand without the effect being causal. For example, holding constant the length of time between a preceding birth and the conception of the index pregnancy, the shorter the duration of index pregnancy, the shorter will be the interval between births. Since prematurity increases the risk of infant mortality, a shorter gestation of pregnancy could be a reason why a short preceding inter birth interval is related to infant mortality. Or inter birth intervals may be long because there is an intervening non-live birth, and the types of women who have non-live births may also be less healthy or give birth to less healthy children. As another example, if women who are less careful about their own and their children's health tend to the ones who have shorter intervals, an apparent effect of short intervals when no other variables are adjusted for may actually reflect these other factors. Other possibilities are that longer breastfeeding both improves infants' survival chances and lengthens the intervals following their birth. This could explain a relationship between the length of the subsequent pregnancy interval and the survival of the child born at the beginning of that interval.

Birth intervals in human population offers is an interesting, fruitful and at the same time an intriguing area of scientific enquiry. Many of the retrospective surveys on fertility and family planning undertaken in the developing as well as in the developed countries in recent years have compiled information on fertility histories of the women included in the survey. These include data on the timing of various significant events in the life cycle of a

woman, such as her marriages, separations, widowhood and divorce and the dates (usually the month and the calendar year are recorded) of first, second, and the last live birth. These data permits computation and analysis of birth intervals which can be categorized in to two broad types: the closed interval, which is the interval between two successive live births of a woman and the open interval, which is the interval from the date of the last live birth to the date of the survey, computed for each woman. These interval data computed for each woman can be aggregated over women in terms of frequency distributions classified by a number of variables, such as distributions by birth orders; between marriage and first child, first and second child, etc and the distribution of open intervals by the age of the woman reckoning the intervals before or after specified ages; by duration of marriage and various socio-economic variables, such as religion, education, contraceptive usage etc..

The length of the first-birth interval is of special importance in fertility since the first birth can be considered to be the start of parenthood, and thereby the beginning of the reproductive process. Trussell & Menken (1978) demonstrated that the length of the first birth subsequently influences the spacing and child bearing pattern of a family. Several socio-demographic variables have been found to influence significantly the length of the first birth interval (Rao, 1987; Rao and Balakrisnan, 1988; Nath et al., 1993). A large number of studies on closed birth intervals (CBI, the interval between consecutive births), demonstrating the birth spacing patterns of different populations, exist in the demographic literature. Closed birth intervals are also helpful in estimating fertility parameters that are not directly observable. However they are not a sensitive measure of fertility and CBI distributions can be obtained in quite different ways under different sampling frames.

Most research using closed birth intervals looks at their distribution under different sampling frames, and the significance of observations often depends as much on the way in which data are collected as on the values themselves (Wolfers, 1968). Many researchers (Menken & Sheps, 1972; Sheps & Menken, 1972, 1973; Sing et al. 1979; Pathak & Panday, 1990; Pandey et al., 1990) have remarked on the effects of the method of ascertainment and choice of sampling frame on distributions of birth intervals. Usually the distributions exhibit the variations in the length of closed birth intervals among females for specific parities. These variations show the ‘between’ variation among females and have two major causes: (i) variation due to random nature of the phenomenon and (ii) variation due to variation in certain fertility parameters among females (Yadava & Sharma, 2006).

To understand these, it is necessary to conceptualize the closed birth interval as the sum of its components. In societies where the incidence of the deliberate termination of pregnancy is rare, a closed birth interval of order ‘i’, i.e the interval between the i th and $(i+1)$ th birth (or for that matter of any order), is considered to be three mutually exclusive components 1) the period of postpartum amenorrhea following the i th birth order of child (say X_i), 2) the duration of the menstruating interval between the two births , i.e. the interval after the end of the postpartum amenorrhoea period and the time of conception leading to the $(i+1)$ th birth (say Y_i); 3) the gestation period associated with the $(i+1)$ th birth (say G_i). Thus if Z_i denotes the i th order closed birth interval, then $Z_i = X_i + Y_i + G_i$

In the study of fertility, two dimensions are important: how frequently women have children and how many women of a given parity birth order proceed to the next parity (Srinivasan, 1979). A study of closed birth intervals will be adequate only for the analysis of fertility change in the first dimension. Srinivasan (1972) demonstrated that the open

birth interval could be used in the measurement of fertility in the second dimension. In the context of a marital history sample survey of females, the open birth interval (OBI) is the time interval from last birth to the survey date. If a female has had no previous birth, then the starting date of the interval is the marriage. The open birth interval is used as an inverse measure of fertility (Srinivasan, 1972). In studies where dependent variable is an ongoing process, such as fertility and an independent variable is measured at one point in time such as current income level, establishing temporal association between two variables becomes problematic. What is clearly needed is some measure of the recent fertility experience that is as close in time to the date of survey as possible. One such measure is the open birth interval. This is acceptable as a recent measure of fertility on the grounds that a sub-sample of women with a short average interval necessarily has higher recent fertility than a sub-sample of women with a longer average interval. Further, survey research experience with non-sampling error due to factors like recall lapse, illiteracy of the women/respondent, absence of vital records etc. indicate that particulars regarding the recent births could be obtained with relatively greater accuracy and could be more reliable and dependent upon than any information pertaining to events in the remote past. Distributions of open birth intervals from fertility surveys also can be used to estimate closed birth interval distributions, as Feeney and Ross (1984) demonstrated. Thus OBI distributions are potentially useful measures of fertility.

Studies from many parts of the world consistently demonstrate that breastfeeding is associated with delayed return of menstrual cycles and ovulation, reduced fecund-ability and longer birth intervals (Aguirre and Jones, 2005). The contraceptive effect of breastfeeding is the most important determinants of growth rate in traditional populations which do not have access to modern forms of contraception. However, women who

continue to breastfeed for 1-2 years and remain amenorrheic still have good protection against fertility with a longer duration of postpartum amenorrhea (Karim and Hajian, 2002; Short, 1993). Since the length of postpartum amenorrhea is quite variable and depends on several factors, including maternal age and parity, as well as duration and frequency of suckling, it is important to document the pattern and determination of postpartum amenorrhea in different populations for practical implications in the primary health care setting (Karim and Hajian, 2002).

There is a renewed programmatic interest in the effects of birth spacing on infant, child and maternal health and survival because family planning programs have the potential to affect the timing of pregnancies and birth interval of women. Every year nearly 11 million children die before their fifth birth day; 99 percent of these deaths occur in developing countries (UNICEF, 2003). The relationship between short birth intervals and high infant and child mortality has been established in a wide range of populations (Miller et al., 1992; Miller, 1991; Winikoff, 1983; Millman and Cooksey, 1987; Rutstein, 2000, 2003a, 2003b). In addition several studies (Rutstein, 2000), in a cross country analysis, show that very long intervals (at least five years in length) are associated a slight increase in mortality. However, few studies of the effects of birth spacing have adequately adjusted for potentially confounding factors such as prematurity, breastfeeding, wheather the birth was intended and socio-economic factors.

Every year over 54 million women suffer from complications during pregnancy and child birth. Of those, about 1.5 million die; 99 percent of these deaths occur in the developing countries (WHO, 1993; WHO and United Nations Children's Fund, 1996). Many studies have shown that the infant and child mortality is affected by a number of socio-economic and demographic factors, (Syamala, 2004; Rahman, et al., 2005). However, there have

been only a few studies (Conde-Agudelo and Belizan, 2000) of the effects of pregnancy spacing on maternal morbidity and mortality and also their effects on child survival. This suggests that very short intervals may be associated with some types of morbidities, and that very long intervals may be associated with poorer outcomes also. In this study we assess the extent of birth spacing, breast feeding pattern and child survivorship in Bangladesh and to see the fertility pattern with respect to birth intervals of various cohorts and also identified the factors that affects the birth interval patterns.

In this study along with birth spacing variables three more variables are discussed: namely breastfeeding, postpartum amenorrhoea and child survival status in Bangladesh. The variables breastfeeding affect amenorrhoea period of a mother and child survival status of a new born baby, which in turn affects birth spacing. More specifically, it considers that breastfeeding provide evidence about the protective effects against infectious diseases and its role in improving child survival through increased birth spacing. It is also well established that breastfeeding has direct effect on amenorrhoea period and ultimately delayed birth spacing. The variables considered, followed by a simplified framework for a systematic discussion of relevant issues.

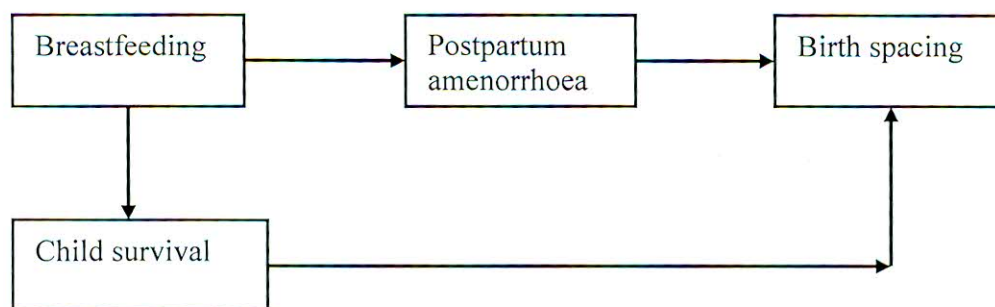


Figure 1.1: A framework for the interrelation ship between birth spacing, breastfeeding, postpartum amenorrhoea and child survival.

1.2 Literature Review

Birth spacing is an important aspect of the fertility behavior of a human population. For the last few decades, demographers have directed considerable attention towards the study of human fertility through the analysis of birth interval data. Some have been attracted to this field, because of opportunities it provides for analytic model-building involving theories of stochastic process and renewal theory. Brass (1985), Dandeker (1963), Henry (1958), Srinivasan (1966, 1967, 1980), Sing (1963), Rodriguez and Hobcraft (1980), and many others have put considerable attention on this line. A good number of studies have been done in the area of birth interval and reproductive health of mother in child bearing ages (i.e ages between 15 to 49). Most of the researchers concentrated on studying the levels, differentials and patterns of birth interval and their effects on infant and child mortality, pregnancy outcomes and maternal morbidity using tabular analysis, logistic regression analysis, hazard regression model and life table techniques. Here some of the previous works of Bangladesh as well as other countries have been presented in resume form.

Rodriguez and Hobcraft (1980) studied the application of life table techniques to the analysis of birth intervals, using data from the Colombian National Fertility Survey conducted in 1976. They found that the mean birth interval for Colombian women was very low for first birth which was 12.6 months and for subsequent births (2-6) this interval was between 21 to 23 months. They also studied the differential pattern of birth spacing for various socio-demographic variables like place of residence, education, work status, mortality, breast feeding, and contraception and found that they had substantial effect. They suggested a multivariate analysis like proportional hazards approach to improve our understanding of the determinants of the quantum and tempo of fertility.

Hobcraft, et al. (1983) provided evidence of birth spacing effects on infant and child mortality in a multivariate context by adjusting for the educational level of the mothers. These results suggested that delaying a child's birth by a minimum of two years could almost have the risk of dying before the age of five. The results on birth spacing effects, impressive as they are in their magnitude and persuasiveness, do not, however, provide direct proof of the advantages of breast-feeding. This is so because prolonged birth spacing can be achieved by breast-feeding, and contraceptive use, or a combination of both.

Rindfuss et al (1984) studied child spacing in Asia and their similarities and differences by using data on World Fertility Survey. They found that there are significant and important differences in the patterns of child spacing for five Asian countries that are examined. Age at first birth significantly reduces the tempo of fertility in almost all the segments examined. Urban residence had a consistent pattern of effects; the effects changes across segments within intervals, accelerating the tempo in the early segments within intervals and delaying it in the later segments. Education seems to be relatively unimportant except at the later segments of the higher birth orders, where number rather than timing consideration are paramount. Finally, with the exception of Korea, sex of the birth initiating the interval is rarely important.

Adewuyi and Isiugo-Abanihe (1990) examined the effect of various important characteristics of married women who are in their prime child bearing ages. Showed that age of the women have significant independent effect on birth spacing. The effect of age with birth interval is found to be positive. They suggested that older women tend to have birth intervals of 25 months and above more often than younger women do.

Salway et al. (1993) used data from the Matlab Family Planning-Health Services Project, Bangladesh to explore changes in duration of post-partum amenorrhea, breast feeding and birth intervals over the period 1978-1989. The trend in birth intervals among different socio-demographic groups of women was also examined. The median birth interval was found to have increased among all educational groups, with better educated women having longer birth intervals. Examining birth intervals by mother's age and number of living children provides an indication of whether the increasing birth interval for the whole population is due to women ceasing child bearing, spacing birth, or a combination of the two. This is because young women and those of low parity are likely to be between births, rather than that at the end of their reproductive careers. Among the youngest women (15-24) years, the median birth interval increased from 36 months in 1978-1979 to 43 months in 1986-1987. It was also found that women with no living sons had increasing birth intervals over the time period, though to a smaller extent than other sub-groups.

Rajaram et al (1994) studied birth interval dynamics in Goa using data from a sample survey conducted in 1984 in the state of Goa by international Institute of Population Sciences. Life table and proportional hazard models are used to analyze the data. They found that Proportional Hazard model are consistent with those obtained from univariate life table analysis. The main sources of variation in the timing of first birth are the age at marriage, level of education, use of contraception and socio-economic status of the household of a woman comes from. Women who reside in rural areas and those who are Hindus tend to have longer first interval due to low level of education and marriage. Expectedly women who have only child at the time of survey have longer first birth interval than those who have more than one child. Similarly, the timing of second and

fifth births vary according to women's age at start of the interval, contraceptive use, survival status of the previous child, educational level and socio-economic status.

Islam and Islam (1995) have examined birth spacing pattern differentials and dynamics in Bangladesh by using data of BFS, 1989. In this study three types of birth intervals have been considered. It has been observed that the overall interval between marriages to first birth is on the average, around two and half a years. The overall closed (last) and open birth intervals are, on the average, around three or four years respectively. Some differential effects of age and parity on both closed and open birth intervals are documented and increase with increase of age of mothers. Education seems to have no substantial effect on closed birth interval. However the open birth interval and the interval between marriage and first birth vary with the level of education. Birth intervals decrease with the increase of the age of first marriage.

Alam (1995) estimated the effect of birth spacing on infant and early childhood mortality for 3729 singleton births in 1983-84 followed for 3 years in rural Bangladesh and showed that a preceding birth interval of less than 15 months was associated with a greater mortality risk in the post –neonatal period for children with an older sibling who survived infancy.

Chakrabarty and others (1996) studied differential pattern of birth interval in Bangladesh using data from the 1989 Bangladesh Contraceptive Prevalence Survey. Using the Product Limited method it was found that survival status of the index child seems to have a very strong effect on birth spacing. The next explanatory variable that seems to have a strong effect on birth spacing is the age of the mother at the birth of the child. Other

explanatory variable such as education of the mother, sex of index child, residence and birth order do not seem to have much influence on birth interval.

Ronsmans, C (1996) examined the associations between short birth spacing and child mortality in rural Senegal and discuss the potential direct effects of efforts to delay births on child mortality in this community. The study used longitudinal data in a cohort of 4852 children born between 1983-1989. The associations between birth spacing and child mortality are examined using logistic and Cox proportional hazards regression models and found that the probability of dying before age five was 224 per 1000 live births. The median between births was 33 months and only 12% of the birth intervals are less than 24 months in length. The odds of dying in the neonatal and post neo-natal period is 2.27 and 2.12 times higher respectively for children born after preceding birth interval of one year or less compared to children born after longer intervals. Children born within two years of a subsequent birth are at 4.09 times higher risk of dying in the second year of life than children whose mother gave birth more than 2 years after the index child.

Majumder et al. (1997) investigated infant and child mortality determinants in Bangladesh. From the data of the 1989 Bangladesh Fertility Survey, aggregate deaths reported at ages 0-12 and 13-60 months are used to estimate infant and child mortality. Multivariate analysis showed that preceding birth interval length followed by survival status of the immediately preceding child are the most important factors associated with differential infant and child mortality risks, sex of the index child and mother's and father's education are also significant.

Islam (1999) studied adolescent child bearing pattern using data come from 1996/97 BDHS, and tried to find out birth interval pattern of adolescents ever married mother in

Bangladesh. He showed that just over 10 percent of ever married adolescent females gave birth within a year of marriage and 52 percent did so within two years. The median interval from the time of marriage to first birth is just under two years. In contrast, about 7 percent of ever married adolescent females had a second birth within a one year of first birth and about 40 percent within two years. The median interval from the time of the first birth to the second birth is 2.1 years for adolescent mothers.

Nath et al. (1999) studied the effects of women's status on the first birth interval in Indian urban society. This study examined the influence of certain aspects of the status of married women- education, employment, role in family decision making, and age at marriage along with three socio-economic variables-per capita income of the family, social position of the household, and the caste system- on the duration of the first birth interval in an urban Hindu society of the North-East Indian state of Assam. The data were analyzed by applying life table and hazard regression techniques. The results indicate that a female's age at marriage, education, current age, role in decision making, and the per capita income of the household are the main covariates that strongly influence the length of the first birth interval of Hindu females of urban Assam. Of all the covariates studied, a female's education appears to be a key mediating factor, through its influence on her probability of employment outside the home and thereby an earned income and on her role in family decision making. Unlike other Indian communities, the effect of the caste system does not have a significant role on first-birth timing in this urban Hindu society.

Nath et al. (2000) examined second and third closed birth intervals in traditional Indian society with respect to effects of four socio-ecological correlates: (1) sexes of the consecutive sibs, (2) per capita monthly household income, (3) sub-caste, and (4) type of

household (presence of 'grand mother' helper). It is found that on average birth interval closed by boy-boy are longer than those closed by girl-girl. Birth spacing tends to be longer among upper income and craftsman sub-caste mother. The presence of a grandmother in the household shortens spacing. These findings are compatible with an evolutionary based reproductive decision making process.

Mhairi and Ruth (2002) investigated the demographic consequences of reduction in women's work load following the installation of water points, specifically the variation in length of first birth interval. First birth interval is closely linked with lifetime fertility in non-contracepting populations, longer intervals being associated with lower fertility. Using life tables and multivariate hazard modeling techniques correlates of the length of the first birth interval are identified. Covariates including age at marriage, season of marriage, village ecology, and access to improved water supply influence the timing of the first birth. When entered into a model as a time varying covariate, access to water taps is associated with an immediate increased probability of birth.

Zheng Zhenzhen (2000) examined the delay between first marriage and first live birth in China among a sample of women who married between 1980 and 1992. Most couples in China only use contraception after the first child is born. Most sample women had their first child within 2 years of marriage. However, there are significant rural-urban differences in the first birth interval, indicating that there was most probably deliberate fertility regulation after marriage among many urban couples. Survival analysis shows that place of residence, level of education, age at first marriage and marriage cohort affect the first birth interval.

Ezra, M. and Gurum, E. (2002) studied breastfeeding, birth intervals and child survival in southern Ethiopia. The 1997 community and family survey data are used to primarily

address the question of whether or not short birth intervals are a problem in a populations that typically breastfeeds for more than two years. Anthropometry of children and recent morbidity of children are examined in addition to child survival data for children born in the six years before the survey. They tried to investigate the strength of birth interval on child survival in the context of communities that are characterized by high fertility, prolonged breastfeeding and poor living conditions. The results showed that birth intervals are not a crucial problems in populations that typically breastfeed for more than two years. Nonetheless it was clear from the analysis that short birth intervals are associated with increased mortality rates in the ages 1-12 months, and to a much lesser extent at ages 1-4 years.

Nath et al. (2003) studied socio-ecological and demographic correlates of the open birth interval. The study was carried out by population of a traditional Indian society with individuals still engaged in traditional occupations like agriculture, fishing, cloth washing, hair cutting, cane weaving, and pot making. The population was non-contraception and biased toward son preference. Using survival analysis they identified the following significant predictors of the duration of open birth interval: mother's education, per capita monthly household income, sub-caste, type of household, sex of the last child born, number of surviving male children, length of the last closed birth interval, number of children ever born, age difference between spouses, surviving status of the last child. Their findings are also compatible with an evolutionary analysis of reproductive decision making.

Davanjo et al. (2004) Used a large, high-quality longitudinal dataset on around 145,000 pregnancy outcomes gathered over a period of more than twenty years from an experimental setting in Matlab, Bangladesh, seek a better understanding of the effects of

the lengths of inter birth intervals on infant and child mortality and on maternal mortality and morbidity. They find that, compared with intervals of 3-5 years in duration, preceding inter birth intervals of less than 24 months in duration are associated with significantly higher risks of early neonatal mortality, and that inter birth intervals of less than 36 months are associated with significantly higher risks of late neonatal mortality, post-neonatal mortality, and child mortality. Effects of short intervals are stronger the younger the child. A short preceding interval also increases the risk that the index pregnancy will result in a non-live birth (particularly an induced abortion) or a premature live birth. A short subsequent inter pregnancy interval is also associated with a significantly higher risk of mortality for the index child. These effects persist when we control for potentially confounding factors (prematurity, breastfeeding, immunizations, and demographic and socioeconomic variables). Women with short interpregnancy intervals have a significantly higher risk of preeclampsia, high blood pressure, and premature rupture of membranes compared to those with an interval of 27-50 months. A preceding interpregnancy of less than six months duration is associated with a somewhat elevated risk of maternal mortality compared to intervals of 27-50 months, but the relative risk is not statistically significant. Women with very long interpregnancy intervals (75+ months) have a significantly higher risk of pre-eclampsia, proteinuria, high blood pressure, and edema compared to women with intervals of 27-50 months. Very long interpregnancy intervals are also associated with significantly higher risks of maternal mortality. However, long inter-outcome intervals do not significantly increase the risk of infant or child mortality.

Giashuddin and Kabir (2004) investigated the factors influencing the duration of breast feeding among children in Bangladesh. The study included 5068 mother child pairs,

selected on the basis of Bangladesh Demographic and Health Survey (BDHS) of 1999-2000. The risk of giving supplementary food at different ages was estimated by life table survival method. Independent effects of total duration of breast feeding of each of the study variables were estimated by using Cox's regression model. According to the study results, women with higher education, high economic level, lower birth interval and delivery assisted by health personnel had lower duration of breast feeding.

Syamala (2004) demonstrated the relationship between socio-demographic factors and child survival. The results found that demographic factors such as age of mother, birth order and birth interval and the socio-economic factors such as maternal education and standard of living affect significantly the probability of the survival of the child. It is also found that postponement of the female age at marriage to 20 years with the view to delay the onset of child bearing and proper spacing of births would have noticeable affect in bringing down the level of infant mortality and thereby improving the health of the women.

Bavel and Kok (2004) studied birth spacing in the Netherlands: the effects of family composition, occupation and religion on birth intervals. In this study, Dutch family reconstructions from the period 1820–1885 were analyzed. Cox regression on birth intervals discloses that couples deliberately increased birth intervals already before the onset of the fertility transition. Spacing was not related to a targeted family size or to the sex composition of the family. Rather, the (temporary) burden of young, dependent children induced the parents to delay the next conception. Catholics and orthodox Protestants had shorter birth intervals than liberal Protestants, either because they rejected breastfeeding or because they were reluctant to experiment with birth spacing. Relatively

long birth intervals were prevalent in the lowest social groups, whereas farmers and the self-employed middle class tended towards short intervals.

Guido and Jones (2005) examined the association between breastfeeding patterns and postpartum amenorrhoea in rural Guatemala. It was distinguished among women who experienced infant mortality before menses resumed. Women who weaned before menses resumed, and women who had return of menses while still breastfeeding. Weaning and infant mortality before menses resumes are significant risk factors for resumption of postpartum menstruation. Among those women whose menstruation resumed while still nursing or who remained amenorrhoeic and nursing at loss to follow-up or the end of the study, low number of nursing bouts per 24-hour day and the early introduction of supplements to the child were significant risk factors for the return of postpartum menstruation.

Satyajeet Nanda (2005) studied the causal relationship between the women's behavioural factors and fertility in a more or less non-industrial rural population in an eastern Indian state. It analyses the women's behavioural factors with regard to impact on fertility. The behavioural factors of women higher desired family size and longer perceived birth interval have been consistently associated with lower fertility. For scheduled caste population, the association of women's correct knowledge about probable days of conception within menstrual cycle, with lower fertility gives impression that this knowledge may provide chance to the women or couple to go for some kind of fertility control mechanism. The verbatim and incidents studied give impression that at one hand the child is at demand and in other hand there seem to have a need for access to controlled and intended fertility.

Zinab and Agha (2005) investigates the socio-demographic determinants of the timing of first birth and child spacing in Iran. The data are drawn from a DHS type survey conducted by the Ministry of Health and Medical Education and Statistical Center of Iran in 2000. The sample consists of 90,739 married women taken from all 28 provinces as well as Tehran Metropolitan Area. The paper applies the survival analysis approach including life table analysis, Cox, and Weibull regression techniques. The findings show significant but small differences in hazard ratios of different socio-demographic groups regarding the first child. They confirm the conjugal patterns hypothesis that married couples are under social pressure to prove their fertility by bearing a child within a short time interval after marriage. Only very young women married at ages that preclude the possibility of bearing a child have a long interval between marriage and first birth. The multivariate analysis reveals that labor force participation, age at marriage, current age and level of education are the main factors affecting postponing the first child. The analysis also showed that women with different socio-demographic characteristics have different hazard ratios of giving birth to the second child. According to the final multivariate model the variables age, level of education, survival of first child and age of mother at first delivery are the major factors affecting postponement of second child. The relationship is strong in the case of second child birth interval than the first child. The analysis also indicates that the model used fit better with weibull regression model than the exponential regression and distribution of survival data model.

Yadava and Sharma (2006) studied the distribution of consecutive closed birth intervals in females and tried to investigate the nature of the distribution of consecutive closed birth intervals. Data from the Uttar Pradesh National Family Health Survey 1998-99 (NFHS-2) were analyzed. It was found that, under certain assumptions; the postpartum

amenorrhea period and menstruating interval are negatively associated, indicating that socio-cultural factors were affecting the menstruating interval.

Islam, Yadava and Alam (2006) examined differentials and determinants of the duration of breastfeeding in Bangladesh. The differentials and determinants of the duration of breastfeeding were studied by a number of socio-economic and demographic characteristics of mother and child in Bangladesh. The data for this study were taken from the Bangladesh Demographic and Health Survey 1996-1997. Information of breastfeeding was taken from the mothers following the last birth and last but one birth. In this study about 98 percent mother in respect of last child and 92 percent mother last but one child breastfeed their children at least briefly. The mean duration of breastfeeding was found about 26.4 months for last child and 25.9 months for the last but one child cohort. Mothers belonging to the older birth cohort breastfeed for a longer duration than the younger mothers. Education as well as occupation of mothers and fathers was found inversely related with the duration of breastfeeding. A positive relationship of the mean duration of breastfeeding was found with post partum amenorrhoea, age of mother at the birth of the child, age of child and open birth interval.

Baschieri and Hinde (2007) examined the effect of the proximate determinants on the second birth interval and extended the analysis to the third birth interval to examine whether the effects of the proximate determinants change with birth order. Calendar data from the 2000 Egyptian Demographic and Health Survey (DHS) are used to assess the determinants of birth interval length among women who are in union. They used the well-known model of the proximate determinants of fertility, and take advantage of the fact the DHS calendar data provide month by month data on contraceptive use, breast feeding and post partum amenorrhoea, which are most important proximate determinants among women in union. The results suggested that births intervals are determined mainly by the

use of modern methods of contraception (the IUD being more effective than the pill). Breast feeding and post-partum amenorrhea both inhibit conception, and the effect of breast feeding remains even after the period of amenorrhea has ended.

Rasekh and Momtaz (2007) studied determinants of birth interval in Ahvaz Iran. A graphical modeling approach is used to study the effect of different socio economic factors on birth intervals of children in Iran. This approach provided an easily interpretable empirical description and illustrates explicitly the conditional independence structure between each pair of variables. The interpretation can be read directly from a mathematical graph. Besides examining the direct association of each determinant on birth interval, they also examined the effect of socio-economic determinants on intermediate determinants to understand the pathways through which the socio-economic determinants affect birth intervals.

Aryal (2007) investigated the patterns and determinants of breastfeeding in Nepal according to the characteristics of mother and her child. Cox proportional hazard model technique had been employed to investigate the determinants of breastfeeding. The data were utilized from a sample survey of Palpa and Rupaldehi districts of rural Nepal. The study revealed that the current age of mothers, their education and socio-economic status were found to be the main determinants of breastfeeding. The current age of mother showed statistically significant relation with the duration of breastfeeding. Younger mother are most likely to terminate breastfeeding early as compared to older counterparts. The decreased rate of terminating breastfeeding was found with increased duration of postpartum amenorrhoea, and a strong positive association was found to be statistically significant. The increased relative risk of terminating breastfeeding was found with increased the level of education of mothers, which indicates that the education is

inversely related to the duration of breastfeeding. Socio-economic status of the household exhibits a statistically significant effect on the duration of breastfeeding.

1.3 Rational of the Study

In the past few decades, considerable interest has been generated in the analysis of human reproduction. Because, during the past few decades, the world has witnesses a significant change in the way of population and reproductive health related issues that have been discussed and addressed. The unprecedentedly rapid rates of population growth in recent years have stimulated scientists in many fields to try to understand the dynamics of change in population composition and vital rates. Analysis of birth interval length has recently been proved to be a powerful tool for understanding family building dynamics. It is an important aspect of the fertility behavior of a human population. The major reasons have been studied for these dynamics:

- (i) Birth intervals may prove to be more sensitive indices for detecting current change in natality pattern of women who are still in reproductive ages.
- (ii) There is an increasing body of data on birth intervals, being made available, in developed as well as developing countries, from various retrospective surveys on maternity histories of currently married women. Of, special, significance is the series of surveys carried out, during the past decade, under the auspices of the World Fertility Survey (WFS) in a number of countries.
- (iii) The usefulness of reproductive process, specially of birth intervals in measuring and explaining the levels and changes in fertility in a population are being increasingly recognized by demographers on the basis of a number of analytical studies.
- (iv) Reproductive process can be expressed in terms of birth interval, family planning patterns etc. Birth interval is an important measure of the pace of

childbearing. In recent 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, it aspects can not be denied in the fertility behaviour of a human population.

- (v) Birth intervals are taken as indicators of reproductive performance to reflect differential patterns of reproduction.
- (vi) Data on birth intervals are often used for the estimation of fecundability, birth averted due to contraception and other quantities relevant to the study of natality.
- (vii) The unique advantage of the intervals can be had in a component analysis of the intervals. Details regarding the nature of parity specific fertility behaviour have been discernible and its analysis distills information regarding achieved fertility reduction or lack of it as well as the tempo of change at one period of time.
- (viii) Birth interval analysis views the process of family building of consisting of a series of stage where women move successfully from marriage to first birth and to other subsequent birth intervals.
- (ix) Breastfeeding pattern and its duration in a society have also important implications for infant and child health as well as fertility levels. Breastfeeding practice as a means of birth spacing and child mortality should be reconsidered in the context of differential socio-economic patterns prevalent in Bangladesh.

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 maternal age, birth spacing and parity groups.

1.4 Aims and Objectives of the Study

The present study attempt to examines the pattern of birth interval, breastfeeding and postpartum amenorrhea and also examine the birth interval influence on child survival in

Bangladesh. Generally, lower spacing between two births increase bad effect on maternal health of mother and her child and longer spacing decrease the effect. Thus it is very important to study the components of birth interval which increase or decrease the timing of birth interval and their contemporary effect on maternal health and child survival. Therefore, the specific objectives of the study are:

- (1) To investigate the over all pattern of birth interval and their differentials by selected socio-economic and demographic characteristics;
- (2) To study the quantum and tempo of fertility in Bangladesh;
- (3) To study the pattern of breastfeeding and postpartum amenorrhea and their determinants;
- (4) To study the influence of birth interval on child survival.

1.5 Organization of the study

This study is organized in eight chapters.

Chapter one is introductory one which contains background of the study, objectives, importance and literature review of the study.

Information about data and methodology are provided in chapter two. This Chapter also contains country profile, data source, selection of variables, concepts of terminology, selection of some technique of analysis and study limitations are presented in this chapter.

Chapter Three reflects the pattern, levels and differentials of birth intervals for some selected socio-economic and demographic factors.

The mean length of birth interval by parity recouring life table technique is presented in Chapter four. This chapter also presents the differential of selected set of covariates on birth intervals, as well as the quantum and tempo of fertility.

Chapter five examines mean length of breastfeeding by life table approach. The effects of selected socio-economic and demographic variables on the duration of breastfeeding using multivariate analysis are also postulated in this chapter..

In Chapter six mean lengths of postpartum amenorrhea and also their determinants that have significant influence on duration of postpartum amenorrhea are included.

Chapter seven focus on relation between birth spacing and child survival. This chapter examines the association between a short preceding birth interval and mortality of child. Influence of preceding birth interval on child survival and the determinants of neonatal and post-neonatal and less than five years of child mortality are also investigated here.

Finally in Chapter eight the summary of the study and major findings are included in addition to policy implications that seem to be helpful for formulating programmes for further fertility reduction.

CHAPTER TWO

Data and Methodology

Chapter Two

Data and Methodology

2.1 Sources of Data

2.1.1 Introduction

The data used for this work are extracted from the Bangladesh Demographic and Health Survey (BDHS) conducted in 2003-2004. This survey was conducted under the authority of the National Institute for Population Research and Training (NIPORT) of the Ministry of Health and Family Welfare. The survey was implemented by Mitra and Associates, a Bangladeshi research firm located in Dhaka. ORC Macro provided financial and technical assistance for the survey through the financial aid provided by U.S. Agency for International Development (USAID), Bangladesh.

This survey is the fourth in a series of national-level population and health surveys conducted as a part of the global Demographic and Health Surveys (DHS) program. It is designed to provide data to monitor the population and health situation in Bangladesh as a follow-up to the 1993-94, 1996-97, and 1999-2000 BDHS surveys. The survey utilized a multistage cluster sample based on the 2001 Bangladesh Census and was designed to produce separate estimates for key indicators for each of the six divisions of the country- Barisal, Chittagang, Dhaka, Khulna, Rajshahi and Sylhet. Data collection took over a five month period from 1 January to 25 May 2004.

The BDHS was part of the worldwide Demographic and Health Surveys (DHS) program, which was designed to provide information on basic national indicators of social progress including fertility levels, marriage, fertility preferences, awareness and use of family

planning methods, breastfeeding practices, nutritional status of women and children, childhood mortality and causes of death of children under five, maternal and child health, awareness and behavior regarding HIV/AIDS, and other sexually transmitted infections (STIs).

2.1.2 Selection of the sample size

The 2004 Bangladesh Demographic and Health Survey (BDHS) is a nationally representative survey of 11440 women age 10-49 and 4297 men age 15-54 from 10500 households covering 361 sample points (clusters) throughout Bangladesh, 122 in urban areas and 239 in rural areas.

2.1.3 Sample Design

The 2004 BDHS employed a nationally representative, two-stage sample that was selected from the Integrated Multi-Purpose Master Sample (IMPS) maintained by the Bangladesh Bureau of Statistics. Each division was stratified into three groups:

- (i) Statistical Metropolitan Areas (SMAs)
- (ii) municipalities (other urban areas), and
- (iii) rural areas

In the rural areas, the primary sampling unit was the Mauza, while in urban areas, it was the Mahalla. Because the primary sampling units in the IMPS were selected with probability proportional to size from the 1991 Census frame, the units for the BDHS were sub selected from the IMPS with equal probability so as to retain the overall probability proportional size. A total of 361 primary sampling units were utilized for the BDHS.

2.1.4 Questionnaire

The 2003-04 BDHS has four types of questionnaires: a Household Questionnaire, a Women's Questionnaire, a Men's Questionnaire and a Community Questionnaire. The

data we have used is mainly collected from Women's Questionnaire. This questionnaire was used to collect information from ever-married women age 10-49 years. These women were asked a number of questions from the following topics which are mentioned below background characteristics (age, education, religion, etc.), reproductive history, marriage, fertility preferences, knowledge and use of contraceptive methods, etc.

2.1.5 Study Area and the Population

Bangladesh is located in the northeastern part of south Asia and covers an area of 147,570 square kilometers. It is almost surrounded by India, except for a short southeastern frontier with Myanmar and a southern coastline on the Bay of Bengal. It lies between latitudes 88°01' and 92°41' east, and has a tropical country. For administrative purposes, the country is divided into 6 divisions, 64 districts and 496 upazilas (sub-districts) (BBS, 2001:19). Muslims constitute almost 90 percent of the population of Bangladesh; Hindus constitute about 9 percent, and others constitute about 1 percent. The national language of Bangladesh is Bangla, which is spoken and understood by all.

Agriculture is the overwhelmingly dominant sector of economy, occupying 80 percent of the total population and contributing 25 percent of gross domestic product (GDP). The average per capita income is as low as \$444 and more than one third of the populations live below the absolute poverty line (UNDP 2003). Bangladesh ranks 138th in the Human Development Index (HDI) as presented in the Human Development Report of 2004 with a HDI value of 0.519. With this HDI value, the country belongs to the category of medium human development countries. However Bangladesh ranks among the three last countries in the category, followed by Sudan and Cameroon. Within the region, the position of Bangladesh is better only than Pakistan, which ranks 144 in the HDI.

Bangladesh is most densely populated country in the world, excluding city-states such as Hong Kong and Singapore. The country has a population of about 140 million, with a corresponding population density of more than 900 per square kilometer (BDHS report 2004). During the first half of the last century the population increased by only 45 percent. This slow increase was due to a combination of high birth rates and high death rates. In the second half of the century, population growth was rapid, tripling during the period. The relatively young age structure of population indicates continued rapid population growth in the future.

Table 2.1: Total population, density and growth rate of population in Bangladesh

Census Year	Population (in million)	Density	Average Annual Growth rate (%)
1901	28.9	196	0.90
1911	31.6	214	0.94
1921	33.3	225	0.60
1931	35.6	241	0.74
1941	41.9	285	1.70
1951	41.2	299	0.50
1961	55.2	374	2.26
1974	76.3	518	2.48
1981	89.9	609	2.35
1991	111.5	755	2.17
2001	129.3	881	1.48
2007	158.67	928	1.7

Source: BBS 2005, Population Census 1991, Population census 2001, ESCAP 2007

According to the 2001 census, 39 percent of the population is under 15 years of age, 57 percent are between 15 and 64 years, and 4 percent are age 65 or over (BBS, 2003:51). This young age structure constitutes built-in “population momentum”, which will continue to generate population increases well into the future, even in the face of rapid fertility decline.

Bangladesh has undergone a remarkable demographic transition over the last two decades. The TFR has declined from about 6.3 in the early 1970s to 3.3 in 2004 (BDHS

2004). The crude death rate has also fallen dramatically from about 19 per thousand population in 1975 to 9 in 2004 (World Population Data Sheet of PRB, 2004). Although infant and under five mortality rates are declining, they are still high. The infant mortality rate was 150 deaths per thousand live birth in 1975 and fell to 66 in 2004 (World Population Data Sheet, 2004). Maternal mortality has declined 6.2 deaths per thousand live births to 4.4 in 1995. This small but important decline is mainly attributed to increased availability of family planning and immunization services, improved antenatal and delivery care, and a reduction in mortality. There is evidence of modest improvement in life expectancy during the past decades. Life expectancy at birth was 46 years for male and 47 years for females in 1974 (UN, 1981). It increased to 60 years both for males and females in 2004 (World Population Data Sheet, 2004). Striking change has also been observed in fertility preference of married Bangladeshi women were asked how many children they would ideally like to have; the response was an average of 4.1 children (Haque and Cleland, 1990). The mean ideal family size has dropped to 2.5 in 1993-94 (Mitra et al, 1994) and it has remained constant at 2.5 in 1999-2000 (Mitra et al. 2001).

In every society a verity of cultural, economic and health factors interfere with the process of human reproduction. The mean number of children ever born in Bangladesh has declined from 3.5 per ever married women age 15-49 years in 1991 to 3.0 in 1993-94, 2.8 in 1996-97, 2.6 in 2001, and 2.5 in 2004 (MOHPC, 1984; Mitra, et.al, 1993; Mitra and Associates, 1993-94, 1997, 2001, 2004).

The children ever born depend largely on the duration of exposure to childbearing as well as timing of births. The total fertility rate has decreased from about 6.3 in the mid-1970s (MOHPC, 1978:73) to 3.3 in 1999-2000 and then to 3.0 in 2004 (Mitra and Associates, 2004). At present total fertility in Bangladesh is 2.9 (UNESCAP, 2007). There has been

substantial decline in the crude birth rate in Bangladesh. It was 47.4 births per 1000 population in 1974, declined to 34.6 in 1981, to 31.6 in 1991, to 17.05 in 2001 and then to 7.6 in 2007 (BBS, 1994, 1997, 2001; UNESCAP, 2007). Young women desired even smaller families, 2.5 children on average, and a level close to replacement fertility (Mitra and Associates, 1993-94).

2.2 Definition of Variables

The aim of the study is to find the covariates influencing the birth interval. So the length of birth interval had been considered as the dependent variable and all other possible characteristics that may influence the birth interval were considered as independent variables. Another, important dependent variables are duration of breastfeeding, postpartum amenorrhea and child survival status of women.

Here we need to be sure that the quality of data of independent variables is satisfactory i.e.,

- (i) the data set is reliable
- (ii) the frequencies are not concentrated to any point or group
- (iii) the variables are well defined and do not contain a large number of missing observations

For the purpose, we observe the frequency distribution of the number of respondents for all the variables and select the data set.

2.2.1 Dependent Variables

The collected BDHS gives the scope to study birth intervals. The dependent variable used in this analysis is the length of subsequent birth interval which is measured in single months. From the column of the birth history data the birth intervals are computed by

subtracting the date of birth of a child from the date of first marriage or the date of birth of next child. The study considers first to fifth birth intervals as it covers most of the range of fertility experience in developing countries as well as Bangladeshi women. The first to fifth birth intervals are considered as dependent/response variables.

The analysis is restricted to ever-married women who had at least one live birth. Among the 11,440 ever married women, 10,145 women gave at least one child at interview date. This indicates that there are 10,145 marriages to first birth intervals. We have also restricted this study that the length of closed and open birth interval and excluding those intervals less than 9 months. With these restrictions, the sample yields 10,702 mothers for first birth interval to analysis. Similarly, subsequent birth intervals, 10,095 women for second birth interval, 8163 women for third birth interval, 5752 women for fourth birth interval and 3845 women for fifth birth interval are considered for univariate and multivariate analysis respectively.

Since data on breastfeeding and postpartum amenorrhoea were available only for the last child and as a considerable number of women were continuing to breastfeed their children at the time of the survey, it was necessary to have recourse to the life table technique for the analysis of lactation and amenorrhoea length and eligible mothers of 5455 children were included in the study and current breastfeeding status of their last and next to last child. Although breastfeeding rarely continues more than four years, but restricted only those mothers who breastfed their children up to 48 months and their last-born breastfed child were selected for this study. Incase of postpartum amenorrhoea the study restricted up to 30 months and yielding 5364sample.

2.2.2 Independent Variables

A great deal of independent variables is considered in this study. All the dependent and independent variables used in the analysis were not found directly from the BDHS data set. Again for the convenience, we computed some new explanatory variables and transformed some original and computed variables that are suitable for study. They were recoded into homogeneous sub-groups where necessary. Some other variables remain unchanged. Most of the variables are coded as categorical and some are in dummy. All independent variables, we can broadly classify into two groups. These are:

- (1) Demographic variables
- (2) Socio-economic variables

(1) Demographic variables

The explanatory variables that summarize the demographic behaviour of the respondents are treated as demographic variables. In this study the demographic variables that are used to analysis:

- (i) mother's age (ii) age at first marriage; (iii) spouses age differences; (iv) contraceptive use of respondent; (v) sex of previous child; and (vi) survival status of the index child.

(2) Socio-economic variables

The variables which reflect the social and economic status of any community are known as socio-economic variables. These variables are important in any demographic studies. The following socio-economic variables are examined in the analysis:

(1) place of residence; (ii) region of residence; (iii) religion of respondent; (iv) respondent educational level; (v) husband's educational level; (vi) respondent work status; (vii) wealth index; and (viii) mass media.

The selected socio-demographic variables and their percentage according to category are presented in Table 2.2.

Age of Mother

The age of mother is an important variable which influences other demographic characteristics. This variable is categorized into under 25 years, 25-34 years and 35 years or more. From the result, we observed that the majority proportion (36%) belongs to age group 35 years or more, and small proportion (28.1%) belongs to age group below 24 years.

Age at First Marriage

Age at marriage also needs to be considered. The Government of Bangladesh order in 1984, the legislative age at marriage was fixed at 18 years for female and 21 years for males. However, in the countryside, such requirements are hardly known and among those who do know about them, they have little impact on behavior (Islam and Ahmed, 1996). A large portion of marriages still take place before the legal age i.e., around 79% of Bangladeshi women marry before the age of 20 years (Mitra and Associates, 2005). Late married women may have their first birth sooner, but with most couples only having one or two children, age at marriage may be less of an influential factor than it once was (Zheng, 2000, Rahman, 2005a).

Table 2.2: List of selected socio-economic and demographic variables with percentage,
2003-04, BDHS, Bangladesh

Characteristics	Category	Frequency (N)	Percent
Respondent Age	1= <=24	2850	28.1
	2= 25-34	3643	35.9
	3= 35 years and more	3652	36.0
Age at First Marriage (years)	1= ≤14	5670	53.9
	2= 15-19	3885	38.3
	3= 20-24	499	4.9
	4= 25 and above	91	0.9
Couples Age Difference (years)	1= No difference	31	0.3
	2= 1-4	1099	11.8
	3= 5-9	4013	42.9
	4= 10 years and above	4203	45.0
Place of Residence	1= Urban	3446	34.0
	2= Rural	6699	66.0
Region	1= Barisal	1203	11.9
	2= Chittagong	1843	18.2
	3= Dhaka	2300	22.7
	4= Khulna	1511	14.9
	5= Rajshahi	2269	22.4
	6= Sylhet	1019	10.0
Religion	1= Muslim	9002	88.7
	2= Non-Muslim	1143	11.3
Respondent Education	1= No education	4187	41.3
	2= Primary	3044	30.0
	3= Secondary	2371	23.4
	4= Higher	543	5.4
Partner's Education	1= No education	3816	37.6
	2= Primary	2567	25.3
	3= Secondary and higher	3762	37.1
Contraceptive Use	1= Ever use	1682	16.6
	2= Never use	8463	83.4
Respondent Work Status	1= Working	7813	77.0
	2= Not-working	2332	23.0
Wealth Index	1= Poor	3702	36.5
	2= Middle	1889	18.6
	3= Rich	4554	44.9
Have TV	0= No	7210	71.2
	1= Yes	2923	28.8
Sex of Previous Child (last)	1= Male	5324	52.5
	2= Female	4821	47.5
Child Survival (last)	1= Death	520	5.1
	2= Survived	9625	94.9

Spousal age Difference

Women and their husband's age difference is another important covariate in birth interval analysis. In developing countries spousal age difference is also another important factor affecting fertility (Sembajwe, 1981; Levin et al., 1997). It was mainly continuous variable in original form of BDHS data. For my research convenience, it is categorized in four class such as have no age difference between spouses, (1-4) years, (5-9) years and lastly 10 years or more. As shown in Table 2.2, we observed that only 0.3 percent women and their husband have no age difference, and couples with 45 percent have age difference 10 years or more which is highest percent among category.

Place of Residence

Bangladesh is a predominantly rural country. There are a number of reasons to expect differences in birth intervals between rural and urban households. The employment situation of women differs substantially between rural and urban areas. Most urban women have a job while most rural women work not far from home, on the farm or household sideline industries, or as a housewife. Housing is a major concern for newly married couples in urban areas, but less so for those in rural areas. These employment and housing differences mean that the desire to plan or delay first birth will be different for rural and urban couples. Therefore place of residence should be an important factor affecting birth intervals and it has been coded in two categories: value one is urban areas and value two is rural areas. The result indicates that 34 percent living in urban areas and 66 percent are in rural areas.

Region of Residence

For administrative purpose, Bangladesh is divided into six divisions. Region of residence (Chittagong, Dhaka, Khulna, Rajshahi, Sylhet and Barisal) is considered as evidence suggesting that the Chittagong region is culturally different from other parts of

Bangladesh, because people adhere to traditional beliefs and values there more than those in other regions with regard to religion and preference for male children. So this variable is included into the analysis. Table 2.2 indicates that among the selected respondent almost (22.7%) were selected from Dhaka division, and lowest percent (10.0%) from Sylhet division. About 18 percent respondent lived in Chittagong division, 15 percent in Khulna and 22.4 percent in Rajshahi division.

Religion of Respondent

Religion is certainly a significant independent variable. Most studies indicate that Muslim often have higher fertility than non-Muslim. Islam is the dominant religion in Bangladesh. Majority (90%) persons of this category are Muslim and the remaining percent are Hindu, Christian, Baddish and others (BBS, 2004). So in the present study, religion is categorized into Muslim and Non-Muslim. In this study, we get from Table 2.1 about 89 percent were Muslim and around 11 percent were Non-Muslim respondent.

Mother's Educational Level

Level of education is another factor that should be related to birth interval as it affects knowledge and awareness of conception, and is linked to a women's age at marriage and occupation. Women who have graduated from high school are more likely to have a paid full-time job, even in rural areas. Thus average number of CEB decreased with the increased level of education (Rahman, et al., 2005). Four levels of education are considered: illiterate/no education, primary school, secondary school and higher education. The vast majority of Bangladeshi ever married women are illiterate. Table 2.2 shows that most (41.3%) of ever married women had no formal education, while another 30.0% said that they received primary education. It is also seen that 23.4 percent of women had completed secondary education and only 5.4 percent have higher education.

Partners Educational Level

Partner's education is very important factor in socio-economic analysis. It is mainly related to his occupation and income of family and family status. It is also categorized into no education, primary, and secondary and higher. Table 2.2 shows that around 38 percent of women reported, their husband have no education, 25.3 percent have primary education and about 37 percent have secondary and higher education.

Contraceptive Use

The length of subsequent birth interval will be long or short that depend on the use of regular contraception. In this study, we consider ever use of contraception method in her reproductive span. It is a dichotomous variable categorized into yes and no. As shown in Table 2.2, we see that out of 10145 women, about 83.4 percent use contraception ever and the remaining percent (16.6%) did not use contraception ever.

Woman's Work Status

Woman's work status may have a significant effect on the length of birth interval. The employment status of women has some influence on the duration of breastfeeding and, as such, an attempt has been made to investigate whether the women are involved in any activities for earning cash income. It has coded into two categorized such as working and not-working. Table 2.2 indicates that of the 10145 women, 23 percent were reported to be working and 77 percent were not working. Thus, the length of subsequent birth interval may vary from working mother to non-working mother.

Wealth Index

Wealth index is another important variable for birth interval analysis. It has been categorized into three classes: low class, medium class and high class. Table 2.2 shows

that out of total selected respondent 36.5 percent reported poor, and majorities (44.9%) are rich class.

Mass Media

Newspaper, radio and television are the main types of mass media in Bangladesh. Television is at present are of the most powerful media. It plays a very strong role for mass media; it shows some health awareness programs. According to Table 2.2 observed that only 28.8 percent women have TV in their house and majority (71.2%) women in their family have no television.

Sex of Children

The sex of the child both at the start and the end of the interval has been shown to affect birth interval length in a number of studies. Where the sex of the child is found to influence its length, the most common findings is for boys to be followed (Blanchard and Bongaert, 1997; Larsen et al., 1998; Mace and Sear, 1997; Swenson and Thang, 1993) and occasionally preceded (low, 1991; Nath et al., 2000) by longer intervals than girls. Sons are more energetically costly to rise than daughters. Male fetuses are larger than female, and male infants have higher energetic intakes than female while breastfeeding (Hoffmans et al., 1988). Women may take longer to recover from the birth of a son than a daughter. Some Gambian women consider the giving birth to a boy ‘cuts two muscles’ whereas giving birth to a girl cuts only one muscle because of the greater difficulty in expelling fetuses (Bledsoe et al., 1998). The sex of the index child and existing children may therefore be considered an indication of previous reproductive investment if giving birth to sons is more costly than giving birth to daughters. We have entered the sex of the index child into the model. We also created two categories for sex of the women’s previous children: one coded 1 women has male children’s and 2 coded women has

female. The reference category is therefore women who have daughters. The distribution relating to the sex of the last child indicates that boys constitute the higher proportion of the children ever born. The percentage of male children is 52.5 percent, whereas the percentage of female children is 47.5.

Child Survival Status

The death of the child born at the beginning of the interval may preclude its being breastfed and may therefore, lead to an earlier return of menses. A child death may also reduce contraceptive use if the couple chooses to 'replace' the child who has died. Both situations could lead to a shortened birth interval (Da Vanzo and Starbid, 1991). This variable is categorized into survived and death. Survival status of the index last child influences the length of birth interval strictly. From Table 2.2, it is evident that 5.1 percent of the index children died and the remaining 94.9 percent of the index children survived during the period of reference (2003-04).

2.3 Analytical Methods

There are different types of statistical and demographic techniques used to analysis the selected data according to perform the specified objectives.

The pattern and differentials of birth interval by some selected demographic and socio-economic variables are investigated through descriptive statistics (frequency distribution and χ^2 (Chi-square) test statistic).

Two summary measures, mean birth interval and the proportion of mothers continuing same parity by different birth order are calculated by life table technique (Srinivasan, 1979 and Rodriguez and Hobcraft, 1980). Life table techniques also estimate parity specific marital fertility rate from mean length of birth interval. Cox proportional hazards model analysis is used to measure the effect of each variable on the duration specific

probabilities of the length of the birth interval. To investigate the effects of multiple factors on the timing of the first to fifth birth, Cox proportional hazard model is used to determine the net effects of each variable (Cox, 1972) and it is also used to test significant differences between the survival functions for various groups.

In case of breastfeeding data were available only for the last child and as a considerable number of women were continuing to breastfeed their children at the time of the survey, it was necessary to have recourse to the life table technique for the analysis of lactation length.

Eligible mothers of 5455 children were included in the survey and information was collected on socio-demographic characteristics and current breastfeeding status of their last and next to last child. Although breastfeeding rarely continues more than four years, but restricted only those mothers who breastfed their children up to 48 months and their last-born breastfed child were selected for this study. The hazards coefficients and hazards model estimates of relative risk of termination of breastfeeding for each covariate Statistical Package for Social Science (SPSS for Windows 10.0), statistica, excel are used to analyze the data.

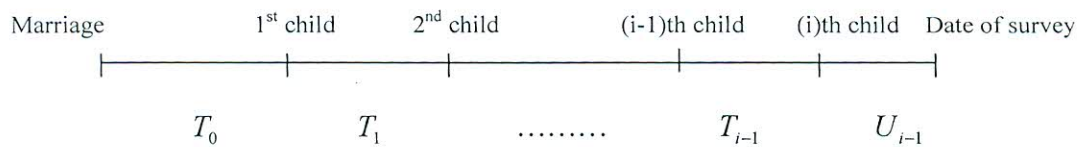
2.4 Concepts and Terminology

2.4.1 Parity

Parity refers to the number of live births a woman has born (Bogue et al., 1993). A women has had no children has zero parity, a women with only one children has one parity, and so on. The children are identified by their order at birth (i.e., first, second, and so forth).

2.4.2 Birth interval and Birth Spacing

Birth interval is defined as the lengths of interval between live births of successive orders; first and second, second and third etc. In general, time elapsed (months) between successive live births is called birth interval. There are mainly two types of birth interval are considered: closed birth interval and the open birth interval. For a woman of parity i at the time of the survey there will be i closed interval ($T_0, T_1, T_2, \dots, T_{i-1}$) and one open interval (U_i) as depicted below:



Birth Spacing refers to the time interval from one child's birth date until the next child's birth date. Alternative it refers to the amount of time between births and/or pregnancies. There are many factors to consider in determining what is an optimal time interval between pregnancies. However, researchers agree that 2 ½ years to 3 years between births is usually best for the well being of the mother and her children. When births are spaced 2 1/2 years to 3 years apart there is less risk of infant and child death. There is also lower risk of the baby being underweight. Short intervals between births can also be bad for mother's health. There is a greater risk of bleeding in pregnancy, premature rupture of the bag of waters and increased risk of maternal death.

2.4.3 Closed Birth Interval

The closed birth interval (CBI) defined as the duration of time between two consecutive live births of one woman or over a group of women in a community. If a female had only one live birth then marriage to first birth. There are some types of closed birth intervals seem to have been indicated (Srinivasan, 1979). These are as follow:

(i) **All closed birth intervals (ACBI)**

Here, all closed birth intervals obtained from a retrospective survey are included in the analysis which is made by birth order and current age of the women. A woman of parity- i will continue i -closed intervals.

(ii) Last Closed Interval (LCI)

Here, the interval between the last and last but one live birth of each woman is included in the analysis. Every woman who has given birth to at least one child will contribute to one closed interval under the scheme. The women can be classified by parity and age at the time of survey or at the beginning of the interval, and used in analysis. of child is the first closed birth interval.

2.4.4 Open Birth Interval

The open birth interval is extremely simple in its concept and it is easily measurable since the only point of time needed as information is the date of birth of the last child. The open birth interval (OBI) is the time interval from last birth interval to the survey date. If a female has had no previous birth, then the starting date of interval is the marriage. Srinivasan (1960) proposed that the mean open interval, computed by parity, can be considered as a sensitive index of fertility, especially for the measurement of fertility change in developing countries, if the distributions of open birth intervals by parity are obtained at successive points of time through independent sample survey of women in the reproductive ages in the population.

2.4.5 Breastfeeding

Breastfeeding is a way to the nature of food intake in newborns and can continue until the child is 6 to 9 months. Many mothers are uncomfortable feeding their babies in public, but to show, especially during the journey. Given that more and more mothers to realize the importance of breastfeeding their children, the fear that a parasite and inhibits breastfeeding is to breastfeed in public places. The child has received breast milk direct from the breast or expressed

The term "*exclusive breastfeeding*" meant that breastfeeding was the infant's only source of milk, but other foods might be given in addition to breast milk (Labbok, M. H., 2000). The infant has received only breast milk from the mother or a wet nurse, or expressed breast milk, and no other liquids or solids with the exception of drops or syrups consisting of vitamins, mineral supplements, or medicines (WHO, 1996).

2.4.6 Postpartum Amenorrhoea

Absence or cessation of menstruation. Thus, the absence of menstruation after a birth is called postpartum amenorrhoea or lactational amenorrhoea because it is now established that breastfeeding is the principal determinant of amenorrhoea (Bongarrts, 1983). The period of postpartum amenorrhoea is defined as the period between births to the return of the first ovulating menstrual period, but since ovulation itself is difficult to identify, the closest possible estimate of the end of amenorrhoea is the return of menstruation (Ferry, et al., 1983). Amenorrhea is conventionally divided into primary and secondary amenorrhea.

Primary amenorrhea -- menstruation never takes place. It fails to occur at puberty.

Secondary amenorrhea -- menstruation starts but then stops.

The absence of menstruation during pregnancy is a form of physiologic secondary amenorrhea, physiologic in the sense that it is completely normal and is not caused by anything medically harmful (pathologic). Amenorrhea during lactation is another type of physiologic secondary amenorrhea.

2.4.7 Child Survival

Mortality during the first year of life is frequently divided into neonatal mortality, namely that occurring in the first month of life, and post-neonatal mortality, that occurring during the remainder of the first year (United Nations, 1973). Infant mortality is the combination of neonatal and post-neonatal mortality.

(i) **Infant Mortality:** The baby dies before the first year of life. Thus, infant mortality rate is defined as the number of deaths of infants under 1 years of age registered in a given year per 1,000 live births registered in the same year (Pollard et al., 1975).

(ii) **Child Mortality:** The baby dies between the first and fifth birthday.

2.5 Limitations of the study

This study is based on data collected by Bangladesh Demographic and Health Survey (2004-2005). Though BDHS data is widely recognized and well accepted data, but may be affected by some non-sampling and sampling error. Non-sampling errors are made due to mistakes made in implementing data collection and data processing, such as failure to locate and interview the correct household, misunderstanding of the questions on the part of either the interview or the respondent and data entry errors. Although numerous efforts were made during the implementation of the BDHS to minimize this type of error.

The BDHS data collection process was very systematic, methodical and up-to-date. But even there were limitations because of illiteracy and ignorance of the people. Age is a very essential determinant in our study, but relevant result may not found as many respondent do not know the exact birth day of them or their children. It was based on respondent's personal reports or satisfaction and as a result birth interval may be subject to error. Duration of breastfeeding and amenorrhoea are another sensitive indices to

overview the situation of mother and her child which may very often affected by heaping problem.

As a human being limitation may contains in my study dissertation. May, I failed to receive appropriate results by make comparable study by up to date methods. The model may be fitted by other more variables.

CHAPTER THREE

Patterns and Differentials of Birth Interval

Chapter Three

Patterns and Differentials of Birth Interval

3.1 Introduction

This chapter focuses the patterns and differentials of birth intervals with respect to socio-demographic characteristics. Considering demographic characteristics are age at first marriage, sex of child, age at child death and socio-economic characteristics are place of residence, region, couples educational level, religion, respondent working status, contraceptive use and living standard. The spacing of births through a deliberately prolonged interval between births and a delay in child bearing following marriage could be logical alternative strategies for fertility control.

High fertility levels are of major concern to planners and policy makers in most countries in the developing world. Bangladesh is no exception. The analysis of birth intervals is of interest of this context since it can provide further insights into the mechanisms underlying fertility change (Njogu and Martin, 1991). Most of the relevant research on birth spacing patterns among married females in India as well as Bangladesh has been carried out from a socio-demographic perspective (Nath *et al.*, 1993, 1998; Nath & Land, 1994; Singh *et al.*, 1993; Chakraborty, *et al.*, 1996, Aireen, 1998).

The patterns and differentials of birth intervals from marriage to first birth, first to second, second to third, third to forth and forth to fifth birth are considered to our analysis. This chapter is also identifying of the factors affecting the birth intervals. Since the covariates

of birth intervals are time dependent, we may apply Cox proportional hazard regression model to estimate the relative risk of various covariates of the birth intervals.

3.2 Analytical Methodology

Bivariate and survival analysis like life table and Cox regression have been used to study the predictor variable birth interval in relation to the explanatory variables.

3.2.1. Bivariate Analysis

In order to investigate the differential of birth interval by selected socio-demographic characteristics life cross tabulation technique is used. The association of the length of birth interval to each variable included in the analysis was first checked by using Chi-square statistic in a two-way tabulation. The obtained data were analyzed using SPSS statistical software and results shown in the following Tables 3.2, 3.3, 3.45 and also using software Statistica.

3.2.2 Multivariate Analysis: Cox Proportional Hazard Model

Cox's proportional hazards regression model is applied for multivariate analysis. In survival analysis, the data are normally found to be incomplete because some individuals may leave the study before reaching the end-point (e.g. death or, in this case, the next birth).

Life table technique can handle such censored observations in the calculation of survival probabilities. In this analysis, the event of women who have had a birth within a specified duration is denoted as a "failure" event (uncensored); if it does not occur, then the event is termed as "censored". Since a considerable number of women were waiting for giving birth their next child or they had a desire for a future child at the time of survey, it is necessary to recourse to a regression technique that is appropriate for censored data.

Cox's proportional hazards model is most appropriate for the analysis of data with censored observations. This model is employed to allow for the inclusion of periods of observation of censored as well as non-censored cases.

In survival analysis several survival distributions are often considered for modeling the survival experience of a homogeneous population. One such model introduced by D.R. Cox in 1972 is termed as Cox's proportional hazard model which is based on the assumption of proportional hazard. A hazard function is defined as the failure rate during a very short interval $(t, t + \Delta t)$ conditional upon the individual surviving to the beginning of the interval y . For instance, for interval $(t, t + \Delta t)$, the hazard function can be expressed as

$$h(t) = \lim_{\Delta t \rightarrow 0} \frac{\text{pr}(\text{an individual fails to continue using during the interval } (t, t + \Delta t))}{\Delta t}$$

The proportional hazards model is non-parametric in the sense that it involves an unspecified function in the form of an arbitrary base-line hazard function. This model is comparatively more flexible and appropriate for the analysis of survival data with or without censoring and with or without tied failure time. This model assumes that the hazard of the study group is proportional to that of the underlying survival distribution. The Cox's proportional hazards model specifies that

$$h(t; z) = h_0(t)e^{z\beta} \dots \dots \dots (4.1)$$

Where $h_0(t)$ is an arbitrary unspecified base-line hazard function for continuous T and $\beta' = (\beta_1, \beta_2, \dots \dots \dots, \beta_p)'$ is a vector of p regression parameters. The estimation of β depends only on the rank ordering of the dependent variable vector z and is invariant with respect to the monotonic transformation of the dependent variable, i.e., survival time. The hazard function $h(t)$ is a product of an underlying age-dependent risk $h_0(t)$ (base line hazard function) and another factor $\exp(z, \beta)$ that depends on the covariates. The baseline

hazard function represents the hazard function for an individual whose covariate categories have the value zero. The hazard function allows us to estimate the risks of other groups in relation to the baseline group. Other specifications of the hazards relationship are possible, e.g.,

$$h(t; z) = h_0(t) + z \cdot \beta.$$

The problem with this relationship is the possibility of predicting negative hazard rates and one therefore needs to impose extra conditions on the estimation procedure to ensure positive hazard throughout. By assuming the relation $\exp(z \cdot \beta)$, given by Cox (1972), the model becomes partially parametric and positive values of hazard are ensured. The proportional hazards model derives its name from the relationship that exists between the hazard functions for two individuals and the proportionality factor depends on the explanatory variables introduced into the model.

In this model, the covariates are multiplicatively on the hazard function. If $h_0(t) = h$, equation (4.1) reduces to the exponential regression model

$$h(t; z) = h e^{z\beta} \dots \dots \dots (4.2)$$

However, another closely related function, the survival function,, allows us to estimate the probabilities of surviving at various ages for different characteristics of women. The survival function in Cox's model with covariate vector z is derived in terms of baseline survival function when $z=0$ and is given by

$$S(t; z) = [S_0(t)] e^{(\beta \cdot z)}$$

Where $S_0(t)$ is the baseline survivorship function representing the default category of the covariates.

The probability density function (PDF) in the proportional hazards model is given by

$$f(t; z) = h(t; z) S(t; z)$$

Where, $h(t; z)$ and $S(t; z)$ are the hazard function and the survivorship function, respectively. In terms of the hazard function, one can write the PDF as follows

$$f(t; z) = h_0(t) \cdot e^{z\beta} \exp\left[-e^{z\beta} \int_0^t h_0(u) du\right]$$

The vector of parameters β can be estimated by using the method of partial likelihood suggested by Cox (1975). The method involves arranging the data as requires for the product limit estimation method. Let $R(t_i)$ be the set of the individuals at risk to the event at time t_i . The conditional probability that an individual i experiences an event at time t_i given that set of individuals $R(t_i)$ are at risk and that exactly one failure occurs at t_i is given by

$$\frac{h(t_i; Z_i)}{\sum_{i \in R(t_i)} h(t_i; Z_i)} = \frac{\exp(Z_i \beta)}{\sum_{i \in R(t_i)} \exp(Z_i \beta)}$$

for $i = 1, 2, \dots, k$. Since $h_0(t)$ is completely unspecified under the proportional hazard model, no additional information about β is obtained from a surviving individual in $(t_{(i-1)} - t_{(i)})$ ($i = 1, 2, \dots, k$). If one had information as to the parametric form of the baseline hazard function, there would be a contribution to the inference about β from the surviving individuals.

The method of partial likelihood was proposed by Cox (1972, 1975) to derive estimates of β . It has been shown that the method of maximum likelihood gives essentially equivalent estimates to those given by the method of partial likelihood (Kalbfleisch and prentice, 1980). The partial likelihood is derived by taking the product over all failure time points t_i , giving

$$L(\beta) = \prod_{i=1} \frac{\exp(Z_i\beta)}{\sum_{i \in R(t_i)} \exp(Z_i\beta)}$$

The likelihood given above is not likelihood in the usual sense, meaning that the general construction does not give a result that is proportional to the conditional or marginal probability of any observed event. However, Cox, proportional has shown informally that the method used to construct this estimate of likelihood gives maximum partial likelihood estimates. Thus, the asymptotic results for β hold for estimation from partial likelihood as well as from the usual likelihood function. Maximizing L or its logarithm requires an iterative procedure such as the Newton-Raphson procedure.

3.3 Explanatory and Response Variables

To identify the significant factor affecting first to fifth birth intervals Cox proportional hazard model was fitted using thirteen independent variables. The category of the explanatory variables that is used in this analysis is mentioned in Table 3.1. The model assumes that all women with the same covariate have identical risk of termination of birth over the course of study, but these risks may vary among the groups with different covariate. The exponential of the coefficients or $\exp(\beta)$ are particularly intuitive as they allow us to express the birth transition rates of any defined group as a proportion of the rates of the reference category. They will be referred to as relative risks. Value greater than one indicates that the relative risk of termination of birth interval is greater for this group compared with the reference group, while the values less than unity indicates a decrease in the risk. The statistical significance of the individual coefficients will be determined from 'p' value.

Table 3.1: List of socio-economic and demographic variables used in Cox regression model

Characteristics	Category
Age at First Marriage (years)	1= ≤ 14 2= 15-19 3= 20-24 0= 25 and above
Spouses Age Difference (years)	1= No difference 2= 1-4 3= 5-9 0= 10 years and above
Place of Residence	1= Urban 0= Rural
Region	1= Barisal 2= Chittagong 3= Dhaka 4= Khulna 5= Rajshahi 0= Sylhet
Religion	1= Muslim 0= Non-Muslim
Respondent Education	0= No education 1= Primary 2= Secondary 3= Higher
Partner's Education	0= No education 1= Primary 2= Secondary and higher
Contraceptive Use	1= Ever use 0= Never use
Respondent Work Status	1= Working 2= Not-working
Wealth Index	1= Poor 2= Middle 0= Rich
Watch TV	1= No 0= Yes
Sex of Previous Child	1= Male 0= Female
Child Survival	1= Death 0= Alive

3.4 Distribution of Birth Interval

Table 3.2 and Figure 3.1 shows the distribution of the birth interval between marriage to first birth, first to second, second to third, third to forth and forth to fifth birth.

Table 3.2: Distribution of marriage to first birth and subsequent birth intervals, BDHS
2003-04, Bangladesh

Interval (months)	First birth	Second birth	Third birth	Forth birth	Fifth birth
<12	14.0	1.7	2.4	3.0	3.2
12-23	30.3	14.7	20.1	23.0	26.8
24-35	24.4	26.9	32.5	37.0	40.2
36-47	13.9	20.6	22.7	21.5	18.9
48-59	7.8	13.9	11.2	8.0	6.2
60-71	4.0	9.3	5.9	3.9	2.6
72-83	2.5	5.9	2.7	1.9	1.4
84-95	1.5	3.6	1.5	0.9	0.4
96-107	1.0	2.3	0.7	0.5	0.3
108-120	0.7	1.3	0.3	0.3	0.1
Total (%)	100.0	100.0	100.0	100.0	100.0
Total birth	9088	7817	5716	3829	2411
Mean	31.37	44.09	36.91	33.81	31.33
Median	26.0	38.00	34.00	30.00	28.00
Skewness	1.513	0.960	1.239	1.567	1.555
Kurtosis	2.429	0.452	1.868	3.546	3.818

Table 3.2 shows that about 45% percent women give first birth below 24 months of interval but in case of higher parity have experienced comparatively lower percent of that interval. The results also indicate that around 27 to 40 percent women gave their second to fifth birth within 24-35 months of their previous birth. Mean length is about 31 months for first birth, 44.09 months for second birth, 36.91 months for third birth, 33.81 months for forth birth and lastly 31.33 months for fifth birth. Second birth interval is

bit shorter than the median of the subsequent median intervals which is 26 months. The analyzing results indicated that median intervals remain shorter than those of corresponding mean values.

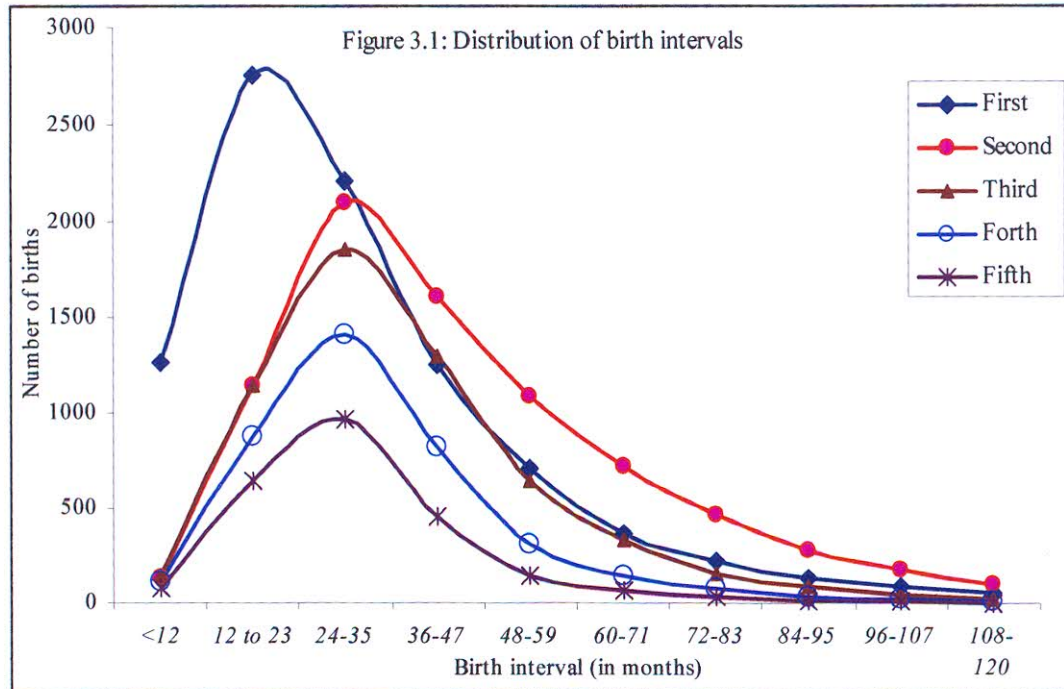


Figure 3.1 shows that the distributions of number of births corresponding with birth intervals are largely, positively skewed with unimodal peaks lying some where between 12 to 23 months for marriage to first birth and for subsequent birth intervals in the duration 24 to 35 months. Figure also shows that first birth interval distribution is highly positively skewed and tends to moderately skewed with increasing birth orders.

3.5 Differentials of Birth Interval

The study examines the mean birth interval by all the variables under study and thus can have preliminary idea of the differentials in birth interval lengths across the various groups of women according to their socio-demographic characteristics.

Table 3.3: Mean birth interval (months) of ever married reproductive women (15-49) by different Socio-demographic characteristics, Bangladesh

Characteristics	First birth		Second birth		Third birth		Forth birth		Fifth birth	
	Mean	P value	Mean	P value	Mean	P value	Mean	P value	Mean	P value
Respondent's age (in years)	24.68		36.35		31.10		24.41		21.83	
	32.07		46.43		37.31		31.71		28.29	
	36.22	0.000	45.07	0.000	37.45	0.000	35.22	0.000	32.42	0.000
Couple's age difference	27.89		44.10		36.65		29.23		31.36	
	33.67		45.08		37.83		34.51		32.42	
	31.20		44.65		37.00		33.75		31.65	
	30.50	0.004	43.66	0.042	36.85	0.218	33.78	0.956	30.96	0.303
Age at marriage (in years)	34.49		43.97		37.49		34.65		31.86	
	27.86		44.31		36.07		32.27		30.35	
	25.18		44.83		34.26		28.58		25.76	
	23.56	0.000	39.15	0.028	28.44	0.003	28.58	0.153	27.00	0.863
Residence	30.38		45.64		38.00		33.77		30.46	
	31.88	0.004	43.33	0.000	36.41	0.019	33.82	0.076	31.65	0.133
Region	33.15		44.76		37.00		33.13		32.28	
	28.55		41.18		35.13		32.80		29.67	
	31.46		44.20		38.18		34.09		32.22	
	31.88		47.70		39.45		35.58		31.13	
	33.05		46.49		37.87		34.85		31.90	
	29.68	0.000	38.64	0.000	33.87	0.000	32.42	0.007	31.21	0.549
Religion	31.50		44.07		36.93		33.87		31.34	
	30.33	0.209	24.28	0.152	36.73	0.957	33.19	0.699	31.11	0.483

Respondent's education	34.83		42.85		36.41		33.96			
Illiterate	31.39		43.99		36.85		34.08			31.55
Primary	26.71		46.09		38.60		32.15			31.44
Secondary	27.05	0.000	50.68		39.48	0.000	35.91	0.024	0.584	29.42
Higher										29.63
Partners education										
Illiterate	33.00		42.73		36.21		34.42			31.45
Primary	31.66		42.20		37.05		33.44			30.95
Secondary	29.88		46.67		37.48		33.58			31.95
Higher	28.98	0.000	48.49		38.47	0.000	32.06	0.008	0.484	30.15
Respondent's work status										
Working	30.95		44.20		36.83		33.37			31.34
Not working	32.78	0.002	43.77		37.17	0.472	35.25	0.422	0.057	31.28
Socio-economic status										
Low	32.88		41.35		36.32		33.68			31.46
Middle	31.63		44.54		36.84		34.21			32.16
High	30.07	0.000	46.33		37.51	0.000	33.73	0.148	0.207	30.37
Contraceptive use										
Yes	30.92		44.79		37.19		34.46			31.45
No	33.67	0.000	40.07		35.32	0.000	33.67	0.046	0.054	31.30
Sex of previous Child										
Male			43.79		36.40		33.45			30.87
Female			44.44		37.47	0.008	34.16	0.614	0.413	31.73
Child Survival										
Death in childhood			37.99		33.90		29.67			27.80
Not death			44.42		37.27	0.000	34.56	0.001	0.000	32.13
Watch TV										
Yes	29.76		47.45		37.70		34.05			30.44
No	32.03	0.000	42.83		36.66	0.000	33.73	0.012	0.307	31.54

To assess the effect of respondent's age on the timing of births, we grouped the women into three categories in their reproductive span; first group consists of young women whose starting age is below 24 years, middle aged women with starting age between 25 and 34 forms the second group and women with age 34 and above is the last reproductive group. Age of the respondents has a strong positive significant relationship with the birth interval. The mean length of the first birth interval is lowest (24.68 months) for the youngest cohort of the age below 25 years which increases rapidly to an average of 32.07 months and 36.22 months for those aged 25-34 years and 35 years and above respectively. The same pattern of results is observed for higher order of births. For the transition from first to second birth, the women aged below 25 too on average 36.35 months, while this figure is 46.43 months for women aged 25-34 years. Thus, the result indicates that the mean length of birth interval increases as the age of the respondents increases

Age at first marriage is a principal determinant of birth interval and found to have an inverse relationship with the birth intervals. The test statistics indicates that there are significant associations for first as well as subsequent birth intervals except forth and fifth birth with age at first marriage. The table values also suggest that first and overall subsequent birth intervals decrease with the increase of age at first marriage. The results in Table 3.2 indicate that for the age group of women whose age at first marriage is ≤ 14 years, the first, second, third, forth and fifth birth intervals are 34.49 months, 43.97 months, 37.49 months, 34.65 months and 38.16 months respectively. For those who married between ages 15 to 19 the first birth interval is 27.86 months. Again, the mean length of first, forth and fifth births are lower for women who marry 20 to 24 years and

later. The table suggests that for the younger cohort the mean birth interval is long but it decreases with the increase of age at marriage. Thus, the result indicates that the mean of birth interval decreases as the age at marriage increases.

Age difference between couples is another important factor to influence on different birth intervals. It has significant effect on marriage to first and first to second birth intervals but insignificant effect for later birth intervals. Table 3.3 shows that the mean length of birth intervals increases with increasing the age differences between spouses in case of marriage to first birth interval. But in case of second birth, the spouses have no age difference have an average birth interval which is around 44 months and when the age difference is (1-5) years have 46 months of birth interval from first to second birth which is higher than marriage to first birth.

The results suggest that rural women wait for a longer time before giving first birth than their counterparts and the difference is statistically significant (Table 3.3). The reason is that age at marriage in the rural area is lower than that in the urban areas. The progression to higher order births for urban women is slower than the rural women. This indicates that urban women will give birth to their first child very quickly and subsequent births order is comparatively longer duration. The difference in the time of fifth birth order between the rural and urban women is not statistically significant though.

There exist some regional variations on the mean birth intervals. As shown in Table 3.3, we see that regional effect is most significant form first forth birth interval but in fifth birth shows insignificant result. Comparing over the six divisions we observe that first order birth interval is minimum (28.55 months) in Chittagong division and maximum (33.15 months) in Barisal division. The table also shows that second to forth birth order have shorter birth interval in Sylhet division than the remaining counterpart divisions.

Table 3.3 indicates that there is no statistically significant association in the timing of first to fifth births among the women according to their religious affiliation. Non-Muslim women progress to higher order births faster than Muslim women. The Non-Muslim has the shortest mean first birth interval and also same case in their higher order births.

The study shows that the effect of education on child spacing by descriptive statistics separately for four broad educational categories: no education, primary, secondary and higher secondary level of education. The mean first birth interval decreases as the educational level of women increases but in higher order births shows positive relationship. The test statistic indicated that respondent education is significantly associated with birth order from first to third birth and then later birth order give insignificant results. Husband's education also shows similar pattern of relationship with the birth intervals that was found for respondent education. It has significant effect on birth interval from first to third birth order but insignificant effect on forth and fifth birth interval. Thus, it is observed that higher educated husbands have longer birth intervals in case of second to third birth but the remaining birth order shows reverse relationship.

Working status of respondent is often considered to be an important determinant of fertility aspiration and behaviour and hence some association with birth interval is expected. The test statistics suggests that work status of respondent is significantly associated with first and forth birth interval. The results indicates that respondent who did not have any work experience were more likely to have had shorter birth intervals than those who had some work experience for second and third birth intervals.

To study the socio-economic status on child spacing, the summary measures are obtained for women by their household socio-economic status. The table indicate that it is statistically and significantly associated for first and second birth but insignificantly

associated for the remaining births. The women from high socio-economic group have a shorter first birth interval than the women from low and medium status groups. The table also suggests that after first birth give different picture of birth intervals. From second to first birth the mean birth interval increases with improved the socio-economic status of family and their subsequent birth spacing is comparatively higher than first birth interval.

The sex composition of all women's previous births has also been shown to affect length of birth interval. The most common preference seems to be for a combination of sons and daughters, rather than a straightforward son preference, as often women with both sexes have the longest intervals and highest probability of stopping reproduction (Arnold, 1997; Rahman and DaVanzo, 1993; Yamaguchi and Ferguson, 1995). In developing countries like Bangladesh, the prevailing condition is that if the first, second or third is male one, a slightly longer mean birth interval is given for the succeeding birth which is reverse for the female one (Aireen, 1998). It is evident from Table 3.2 that the transition from first to fifth birth the women first birth was male took on average 43.79 months compared to 44.44 months for women whose first birth was female. If the second birth is a male or a female, the women take on average 36 months for second to third birth interval. Again the women whose third birth was male tend to space their third to fourth birth about 33.45 months compared to 34.16 months for those third birth was female. Women with no sons have been observed to have shorter birth intervals and a lower probability of stopping childbearing than those with at least one son (Bairagi and Langsten, 1986; Nath and Land, 1994). Thus, the results suggest that one after birth is male or female consequently reduce interval between two births.

The magnitude of the effect of the use of contraception during the interval is studied for those women who had used contraception ever and those who had not. The difference in the timing of births among these categories of women is more noticeable and it is larger at higher orders. The difference in the average birth interval among contraceptive user groups is around 31 months, 45 months, 37 months and 35 months for the first, second and forth births respectively. Which is lower duration for first birth but higher for non user counterparts. Though, it is an unexpected and peculiar result but it may occur due to the fact that those women who are ever users are young newly married and want to keep their family size small. Since at young age they are more fertile so birth interval may be shorter. Our study is consistent with Sathar (1988) in Pakistan, Aireen (1995) and Azad (2001) in Bangladesh. The test statistics indicates significant difference in the timing of births among these categories of women except fifth birth.

The survival status of the previous child is known to affect the spacing of the subsequent birth and information about the survival status is available only after the first birth. The results suggest that the survival status of the previous child has a significant role in determining the pattern of subsequent birth intervals. The study depict that for each of the birth orders studied, the death of the previous child increases the proportion of women who subsequently have another child and reduces the length of the following birth interval. The length of second birth interval is about 38 months for women whose previous child is died and is around 45 months for women whose child is alive. Similarly, child survival plays a significant role for variation of birth interval in higher parity.

Mass media is an important factor in determining the timing of birth interval and now a days T.V is an important media which is common both in rural and in urban areas. It increases awareness population by the health related programs that it shows. From Table

3.2 it is observed that the mean birth interval is significantly associated with watches T.V of the respondent for first to third birth but insignificant result for fourth and fifth birth. The results also indicate that for first birth the mean birth interval is lower for those who watch T.V and higher for those who do not watch but for second and third birth it gives reverse results.

3.6 Determinants of First to Fifth Birth Intervals

The foregoing analysis i.e., chi-square statistic approach on birth intervals assessed only the differentials among parities, without controlling for other variables. Therefore, to estimate the net effect of important socioeconomic and demographic variables and to analyze the moving and stopping behavior of women, the Cox's proportional hazard model was adopted. In a proportional hazard model the covariates are assumed to act multiplicatively on the base line hazard and the effect is constant over time (Akim, 1997). In our analysis to identify the significant factor affecting first to fifth birth intervals proportional hazard model was fitted using thirteen independent variables.

The category of the independent variables that is used in this analysis is mentioned in Table 3.1. The model assumes that all women with the same covariate have identical risk of termination of birth over the course of study, but their risks may vary among the group with different covariates. A comparison of 1st to 5th birth interval classified by specified covariates while controlling for other covariates is performed through Cox proportional hazard model and is presented in Table 3.4. This table provides the relative risk of the timing of the occurrence of the 1st to 5th birth and the net effects of the covariates of the hazard function of the thirteen socio-demographic variables.

The exponential of the coefficients of $\exp(\beta)$ are particularly intuitive as they allow us to express the birth transition rates of any defined group as a proportion of the rates of the

reference category. They will be referred to as relative risks. In the absence of covariates, the relative risk or $\exp(\beta)$ reduces to unity. Values greater than one indicates that the relative risk of termination of birth interval is greater for this group compared with the reference group. While the value less than unity indicates a decrease in the risk. The statistical significance of the individual co-efficient will be determined from “p” value.

The result indicates that age at marriage has been identified as a crucial determinant of fertility because it marks the beginning of exposure to the risk of child bearing in most societies. It shows a peculiar effect on the timing of birth interval from first to fifth birth.

Age at marriage shows significant effect on the first and forth birth but an insignificant effect on second, third, and fifth birth. Those who got married before 25 years had longer intervals than those who married at higher age (i.e. 25 years and above). From the table, we observe that for first birth interval the risk of termination of birth interval is 0.527, 0.699 and 0.878 times lower for age at marriage ≤ 14 , (15-19), (20-24) years respectively as compared with women whose age at marriage is 25 years and above.

The implication of the odds ratio is that women who marry at age ≤ 14 years are 0.527, 0.902, 0.726, 0.488 and 0.252 times lower risk to have first to fifth birth at a longer interval compared with those who married at ages 25 years and over. It is observed that the birth interval decrease with the increase age at marriage. This may due to in part, that late marrying women are attempting to catch up for the years lost in the single state and hence having shorter birth interval. Conversely adolescent sterility may be reason for usually longer first birth interval arising for a very low age at marriage. However another possible explanation is that, restricted by legal marriage age, women who marry less than 18 years old may not report earlier than the legal age (Zhen, 2000).

Table 3.4: Cox proportional hazard estimates of relative risk of birth intervals from first to fifth birth, Bangladesh

Characteristics	1st Birth Interval	2 nd Birth Interval	3 rd Birth Interval	4 th Birth Interval	5 th Birth Interval
Age at First Marriage (years)					
≤14	0.527*	0.902	0.726	0.488**	0.252
15-19	0.699*	0.883	0.793	0.546***	0.275
20-24	0.878	0.942	1.158	0.821	0.373
25 and above	1.000	1.000	1.000	1.000	1.000
Spouses Age Difference (years)					
No difference	0.898	0.825	1.093	1.159	1.047
1-4	0.770**	1.007	0.957	0.942	0.877
5-9	0.930**	1.005	1.023	0.994	0.955***
10 years and above	1.000	1.000	1.000	1.000	1.000
Place of Residence					
Urban	0.878	1.003	0.898*	1.010	1.050
Rural	1.000	1.000	1.000	1.000	1.000
Region					
Barisal	0.765*	0.835**	0.813*	0.956	0.946
Chittagong	0.998	0.928	0.855**	0.971	1.193**
Dhaka	0.875*	0.869**	0.789*	0.922	0.958
Khulna	0.857*	0.781*	0.774*	0.814*	0.974
Rajshahi	0.849*	0.770**	0.778*	0.860**	0.979
Sylhet	1.000	1.000	1.000	1.000	1.000
Religion					
Muslim	1.014	0.947	1.070	0.983	0.971
Non-Muslim	1.000	1.000	1.000	1.000	1.000
Respondent Education					
No education	1.000	1.000	1.000	1.000	1.000
Primary	1.208*	1.046	0.973	0.954	1.054
Secondary	1.534*	1.054	0.946	1.082	1.147
Higher	1.344*	0.962	0.804	0.813	1.154
Partner's Education					
No education	1.000	1.000	1.000	1.000	1.000
Primary	0.963	1.082***	0.973	1.084***	1.017
Secondary and higher	0.981*	0.860*	0.983	1.064	0.921
Contraceptive Use					
Ever use	11.158*	0.943	0.980	1.138**	1.058
Never use	1.000	1.000	1.000	1.000	1.000
Respondent Work Status					
Working	0.938**	1.064	0.989	0.880*	1.016
Not-working	1.000	1.000	1.000	1.000	1.000
Wealth Index					
Poor	1.025	1.094***	1.047	1.013	1.015
Middle	1.044	0.935	0.998	0.976	0.950
Rich	1.000	1.000	1.000	1.000	1.000
Watch TV					
No	1.043	1.069	1.027	1.097***	0.950
Yes	1.000	1.000	1.000	1.000	1.000
Sex of Previous Child					
Male		0.972	0.971	0.981	1.015
Female		1.000	1.000	1.000	1.000
Child Survival					
Death		1.257*	1.151**	1.366*	1.379*
Alive		1.000	1.000	1.000	1.000

Table 3.4 indicates that spousal age difference have significant impact on first birth interval and have insignificant impact for remaining intervals. The result depict that spousal age difference decrease the chance of shorter birth interval for first birth but increase the chance for second and third birth. In case of forth and fifth birth it gives miscellaneous results. The relative risk for first birth interval is 0.898, 0.770 & 0.930 respectively for the couples with no age difference, (1-4) & (5-9) years. That is the risk of terminating first birth is 0.898, 0.770 & 0.930 times lower risk than their counterparts. When age difference is greater than 10, they have shorter birth interval but when it is less than 10, the birth interval is longer. One of the explanations is that, those whose age difference is greater than 10, may wish to reach their desired fertility by quick succession. When, they get one child then they may delay to get another.

Table 3.4 indicates that place of residence gives significant results only for third birth, but insignificant result for remaining birth. The odds ratio shows that urban women are almost 0.878 times lower risk of terminating first birth to rural women. That is for urban women the birth interval is longer than rural women for first and third birth, but shorter for second, forth and fifth birth. Because rural women are less educated and are experienced by lower age at marriage. So they produce child early than urban women. The women in urban areas more educated and married at higher ages. Their desired family size is lower and has more access to health and family planning outlets to lengthen their birth interval between two successive births.

From Table 3.4, it is appeared that place of residence is an important predictor of birth interval. Region of residence has strong significant impact on first to fifth birth. The results indicate that women's of Barisal division are likely to have $(1-0.765)*100=23.5\%$ i.e. 24% less chance of terminating first birth interval compared to Sylhet division and

other four divisions, say Chittagong, Dhaka, Khulna, and Rajshahi are 2%, 13%, 14% and 15.1% less chance of terminating first birth compared to Sylhet division. Most of women of these divisions have longer birth interval than the women of Sylhet division. This is true for second to fifth birth interval. This may be due to the reason that the women of other division may be more educated and get other health facilities programmes and services than Sylhet division.

Another background variable shown in Table 3.4 is religion and has no significant effect on birth intervals. Though, the effect is insignificant for all birth intervals but also there is a tendency of shorter birth interval among the Muslim Bangladeshi women.

Contraception is seen to the most prominent determinant in lowering the total fertility rate among four intermediate fertility variables (Kabir et al., 2006). The use of contraception shows a significant effect on the first and forth births interval but an insignificant effect on second, third and fifth birth interval. The ever use of contraceptive tends to have a shorter first birth interval but longer second and third birth interval. The relative risk of termination of birth interval is 11.158 times higher among ever users for first birth interval, for second and third birth it is 0.943 and 0.980 times lower, and again it is 1.138 and 1.058 times higher compared with those of never users. One of the explanations may be that those who are ever user are very highly fertile group of women who have reached to their desired level of fertility by quick succession and now intend to terminate fertility. On the other hand, the vast majority of the never users might be adolescents (age below 20) and their birth interval is naturally higher due to adolescent sub fecundity.

The study examine the effect of respondent education on birth intervals by Cox proportional hazard models by birth order for four educational groupings: no education, primary, secondary, and higher. In Table 3.4, reveals that women education has

significant effect on first birth and have insignificant effect for later parity. The results indicate that women with primary, secondary, and higher education have 1.208, 1.534, and 1.344 times higher risk of terminating first birth than their no educational groups. After the birth of the second child, however, women with higher education begin to show a longer birth spacing than women with no education. Educated women are likely to have shorter first but longer subsequent birth interval than women have no education. For instance, the more educated women tend to marry later, and will therefore be relatively older than women with no education by the time they reach the second birth.

The study also find that husband education has significant effect on first to forth birth but insignificant impact on fifth birth interval. The women whose husband's are primary, secondary and higher educated a tendency to have 0.963 and 0.981 times longer first birth intervals than their counterparts whose husbands have no education. But in case of second and forth birth order whose husband completed primary education have 1.082 and 1.084 times higher risk of terminating giving birth than no educated husband. This implies that respondent's whose husband are higher educated are likely to take their child longer duration from parity one to fifth except forth child.

From Table 3.4 it is observed that working status of respondent has significant effect on first and forth birth interval and for remaining interval it shows insignificant result. The odds ratio for first birth interval is 0.938. This implies that the women who have working experience have 6 percent less chance of terminating first birth interval, that is working group of women have longer birth interval than their nonworking counterparts.

Though, mass media is considered to be an important factor of increasing awareness among women about their reproductive health, but from Table 3.4 it shows that it have

little impact on birth interval. Watches television shows significant impact only for forth birth interval. The odds ratios for first to forth birth order suggest that women who do not watch television have shorter birth intervals than women who watch television.

Birth interval variation could also result from parental sex preferences: if parents value sons over daughters they may breastfeed them for longer periods or deliberately shorten post-partum abstinence after girls in the hope of becoming pregnant again sooner with a preferred male child. This is not a universal pattern; however, some studies find no difference in the length of birth intervals by sex of child (Korpelainen, 2000; Strassmann and Warner, 1998; Zaldivar et al., 1991) and intervals after daughters have been observed to be longer than those after sons (Margulis et al., 1993). There is no difference in the probability of giving birth from first to forth child for sex of previous child. There is no significant impact in the length of birth interval of reproductive women. As shown in Table 3.4 the odds ratio for male first to forth birth order is approximately same, which is around 0.97. This implies that the risk of terminating birth is 0.97 times lower for child than their counterpart female child. The length of birth intervals depends on the sex of beginning and end of the birth interval (Low, 1991; Mace and Sear, 1997). In a study Nath et al., (2000) found that male child delayed the timing of the next birth while a female child hastened the timing of the next birth. Thus, we may say that in our society if the first, second and third child is male one; a slightly longer birth interval is given for the succeeding birth than the female child. So, women whose first child is male one tend to delay giving births than those whose first child is a daughter.

Finally, the survival status of the index child is likely to have a large impact on the probability of becoming pregnant again and it was entered as a time varying covariate. The death of the index child during infancy and early childhood has been found to be

strongly related to a shorter subsequent birth interval (Chakraborty, et al., 1996; Baschieri and Hindey, 2007). From Table 3.4 it shows that death of the index child had a highly significant effect on the subsequent birth interval. We see that the odds ratio for second to fifth birth is 1.257, 1.151, 1.366 and 1.379 respectively. This implies that the women whose previous child is dead during childhood have 25%, 15%, 37% and 38% more chance of terminating birth quickly than women whose previous child is alive. Thus, in the nutshell the study focuses those women who losses child have shorter birth interval than who have not losses any child. Women who experienced less child loss were to decline the fertility. Nanda (2005) and Rahman & Akter (2007) argued that women with lower child loss were found to have lower fertility.

3.7 Conclusion

This section provides some empirical evidence for association between some selected explanatory variables and subsequent birth interval. The main strength of this study is that it is bases on nationally representative data. From the distribution of birth interval, it is concluded that about 82% of the women take their first child with first 3 years of marriage and for subsequent child this percentage is lower (64%) for first to second child and the reaming percentage is longer for forth and fifth birth order. The results also suggest that very few percentage take subsequent child after 7 years of the previous child born. Among the explanatory variables that are examined, current age of the respondent, age at marriage, residence, region, couples education, child survival status and watches TV have significant effect on birth spacing. The survival status of the index child seems to have a very strong significant effect on birth spacing. The death of the index child during childhood has been found to be strongly related to a shorter subsequent birth interval. Prolonging the intervals between births reduces the number of children that

women can have during her childbearing period (assuming that the age at marriage and the age at which women cease childbearing do not change). Also, short birth intervals raise infant and child mortality (Hoberaft et al., 1983; Mturi and Curtis, 1995; Akim, 1997). In turn, this can raise the number of births for a woman since infant and child mortality is positively related to fertility in most societies (Preston, 1978). The results highlighted that age at first marriage, region and child survival status have most significant effect on birth interval.

CHAPTER FOUR

Life Table Analysis of Birth Interval

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4.1 Introduction

Reproduction is the most significant demographic characteristic of women, which plays a vital role in population changes and strategies of a country. Reproduction process can be handled very effectively through life table technique. Life table analysis of birth interval is not new. This technique enables us to study a wide range of varieties of human fertility. However, the method has rarely if ever been systematically used. The life table method calculates the probabilities that women who could give birth at the beginning of a month actually do so.

Birth interval is a demographic characteristic which is of great importance in population dynamics. Analysis of reproductive history by birth intervals has been preferred over the conventional measures of fertility due to the reason that it avoids the constraints produced on fertility analysis by arbitrary defining the appropriate denominator in determining fertility rates. It is possible to provide appropriate means to examine the patterns of reproduction for all those of age and marriage duration, by using the data on birth intervals (Pandey, 1994). Thus in human reproduction birth intervals offer an interesting, challenging and fruitful area of demographic inquiry. Analysis of birth interval length has been proved to be a powerful tool for interpreting family building pattern (Potter, 1963).

The total fertility rates did not reveal whether the decline was due to change in the timing of start of reproduction, in the spacing of births and / or in the proportion of women

reaching higher parities (Ni Bhrolchain, 1985; United Nations, 1997; Bongaarts and Feeney, 1998). Further, the timing of births or birth spacing may also be inversely related to completed or cumulative fertility. In this situation, examination of the family building patterns in determining the decline in fertility is more appropriate for a meaningful analysis. Family building process can be viewed as a series of stages through which women successively move, from marriage to first birth, first to second birth and so on, until they reach their completed family size (Rodriguez and Hobcraft, 1980; Poluru, 2007). Such stages can be better judged by parity progression ratios and birth intervals, where the former indicate the proportion of women who move from one stage to another and the latter indicate the timing of births. There are two aspects of interest to the demographer in the process of family building namely, the quantity or quantum of fertility and the timing or tempo of fertility. While quantum of fertility refers to the proportion of women at each parity who eventually move to the next higher parity, in fact it is nothing but the parity progression ratio. On the other hand tempo of fertility refers to the time it takes to make transition from one parity to the next for those women who continue to reproduce or the distribution of birth interval.

In this study an attempt has been made to utilize life table technique to understand family building dynamics which consists of series of stages where women move successively from marriage to first birth, from first to second birth and so on, until they reach their completed expected children. Another main aspect of the present analysis is to high light on the extent which has affected the women at different stages of their reproductive careers with respect to demographic and socio-economic characteristics of Bangladesh.

4.2 Life Table Methodology

In this chapter we discuss two techniques of life tables and then applying more subtle and reliable technique on the basis of comparative analysis. One of these techniques for birth interval analysis was proposed by Srinivasan (1972) and other one was proposed by Rodridguez and Hobcraft (1980). Infact, calculating procedures of both techniques are nearly same but one highlighted more accurate results and others provide bias results.

4.2.1 Life tables by birth order: Technique one

Women with slightly lower fecundity, including those who are sterile, are likely to remain in the open interval category and hence if a fertility analysis of a population is made just on the basis of closed intervals, it may not reflect the fertility conditions of population. Srinivasan (1979) and Ryder (1973, 1975) has repeatedly pointed out the need for combining the data from closed and open intervals into a common life table analysis.

The functions of life table are as follows

$$N_x = C_x + O_x$$

Where

C_x represents the number of closed intervals with ordinal month x ; and

O_x represent the number of open intervals with the same ordinal month x .

Then q_x , the probability of an interval getting closed between months x and $x + 1$ or during the month x is given by

$$q_x = \frac{C_x}{\sum_{y=x}^w N_y + \frac{O_x}{2}}$$

Where 'w' is the upper limit of the intervals for which data has been observed.

If P_x denotes $1 - q_x$, we have l_x the probability of a women continuing in the same parity (i) without giving birth to the next parity at month x after the birth of the i -th child, is given by

$$l_x = P_0 P_1 \dots P_{x-1} p_x$$

$$\text{Mean } (T_i) = 3(l_{i,0} + l_{i,120}) + 6(l_{i,6} + l_{i,12} + \dots + l_{i,114})$$

Results and Discussion

In order to keep the analysis simple, the life table probabilities have been worked out at intervals of 6 months, up to 120 months. These life tables are based on an analysis combining the last birth interval and the open birth interval As shown in Table 4.1 (See Appendix) increasing the birth interval of the women with decreasing the probability of continue to remain in the same parity for each parity and the same table indicated that the mean values of the birth intervals increases from 55.80 months for the interval between marriage and first child to 60.81 months between the first and second child (See Appendix). The results from the life table (Table 4.2 in appendix) analysis of birth intervals shows that the Bangladeshi women took on average 51 months for going from marriage to first birth, 61 months from first to second birth, 57 months from second to third birth, 55 months from third to forth birth and 60 months from forth to subsequent birth. In context of Bangladesh the mean duration of birth interval is below 35 months (Kabir and Sufian, 1983; Azad, 2000; Parveen, 1999) but our estimated mean birth interval found in the range 50 to 60 months which is unexpected result.

It might be noted here that we study both closed birth interval and open birth interval in combined in our analysis not in separately. So there is no way to leads biases from cross sectional data. But in our study it gives mislead results. So it needs further investigation.

The study used the procedures in the construction of another life tables by birth order provided by Rodridguez and Hobcraft (1980) and the approach adopted in the presentation of the results and in particular our choice of summary indications of the quantum and tempo of fertility are discussed below:

4.2.2 Life tables by birth order: Technique two

Now we are going to construct an abridge life table for the intervals from marriage to first birth for all ever married women. The same procedures may, of course, be applied for higher parities. The fundamental information required to construct a life table is cross tabulation of all married women by duration of exposure and termination status. By duration of exposure we mean the interval from marriage to either first birth or interview, from first birth to either second birth or interview and so forth. And by termination status we mean a variable indicating whether the exposure was terminated by interview or birth. Rodriguez and Hobcraft (1980) in their study had grouped duration exposure in three months interval. The choice of grouping is not crucial, however, to save labour and to reduce the volume of figures we may take 'four month' as the interval. Following standard life table notation we use the symbol x to refer the duration in exact month and n to refer to the width of the intervals of exposure.

As regards termination status, we have distinguished two categories namely i) censored cases, or women reaching the interview without a first birth, without a second birth and so on, and ii) events or women having the birth of any order in an interval of exposure prior to the interview. We denote by nCx the total number of women reaching interview in the interval x to $x + n$ that is category i) and by nEx the number of events in the interval x to $x + n$ to women reaching interview later, or category ii). In case of marriage to first birth interval the actual calculation of life table involves a series of steps which are illustrated by Table 4.3.

At first we calculate the number of women under observation at the beginning of each interval of exposure which we have denoted by N_x as shown in column 3. For the first interval of exposure this entry is simply the total number of ever married women in case

of first birth, the total number of women having first birth incase of second birth and so on. For the subsequent intervals, in order to calculate this figure we make use of the following equations

$$N_{x+n} = N_x - {}_nC_x - {}_nE_x \dots \dots \dots (1)$$

i.e. the number observed at duration $x + n$ as the number observed at duration x minus those censored.

Our second goal is to estimate the number of women exposed to the risk of having a first birth through each interval of exposure, denoted by N_x^* and shown in column 5. This number is simply the number of women under observation at the beginning of the interval less those who reach interview during the interval and are thus not fully exposed to risk, that is

$$N_x^* = N_x - {}_nC_x \dots \dots \dots (2)$$

Now we are interested in estimating the proportion of women having a birth of any specific order in the interval x to $x + n$ among women staying in the previous event at the beginning of the interval, denoted by ${}_nq_x$. This proportion is estimated simply as the ratio of the number of births in the interval of the number of women exposed through the interval, that is

$${}_nq_x = \frac{{}_nE_x}{N_x^*} \dots \dots \dots (3)$$

Then we estimate the proportion having a birth in the interval x to $x + n$ among all women, which we denoted by ${}_nB_x$, and shown in column 7 and cumulative proportion having a birth by duration x among all women, which we denote by B_x and shown in column 8 of Table 4.3. Since all women are in the previous event of duration zero, these

proportions are both equal to ${}_nq_0$ for the category of exposure starting at duration zero, that is

$${}_nb_0 = B_n = {}_nq_0 \dots \dots \dots (4)$$

For subsequent categories of duration we estimate the proportion having a birth in the interval x to $x + n$ among all women as the product of the proportion having a birth between x and $x + n$ among those staying in the previous event at x that is

$${}_nb_x = (1 - B_x) {}_nq_x \dots \dots \dots (5)$$

The cumulative proportion having a birth by duration $x + n$ among all women is then calculated simply as the sum of the proportion having a birth of same order by duration plus the proportion having a birth (same order) between duration x and $x + n$, i.e.

$$B_{x+n} = B_x + {}_nb_x \dots \dots \dots (6)$$

When any one deals with mortality analysis he or she might be interested in survival probabilities. It is then conventional to define a proportion surviving up to age x which is denoted by l_x . By defining $l_0 = 1$ and the proportion surviving up to age $x + n$ is estimated as the product of the proportion surviving to age x times the proportion of those alive at x who survive to $x + n$, or

$$l_{x+n} = l_x (1 - {}_nq_x) \dots \dots \dots (7)$$

In our case we are more interested in proportion having a first child (or second child or third child and so forth) than in proportions remaining childless (or remaining in the state of first child or second child or so on), which would be equivalent to 'survival' and consequently work with B_x rather than l_x . Of course these two proportions (i.e. B_x and l_x) are complementary, and it is possible to verify that expressions (5) and (6) follow from substituting $(1 - B_x)$ for l_x in the more familiar expression (7). For convenience we

shall refer to B_x as the function, which is analogous to the term survival function denoted by l_x .

Finally we introduce a minor correction in our estimate of B_x , to allow for the fact that where duration are calculated from dates given in calendar month and year (or equivalently from century month form), the actual width of the first category of duration is $n-1/2$ rather than n months (Smith, 1980). The correction is shown in Column 9 and is done by simple linear interpolation, calculating

$$B_x = 1/n [(n-1/2)B_{x-1/2} + B_{x+n-1/2}] \quad \dots \dots \dots (8)$$

Summary Indicators

In this study, we have considered only one type of event, namely a subsequent birth. These tables have been calculated separately for marriage to first birth, first to second, second to third, third to fourth and fourth to fifth births. From the statistics of BDHS it is observed that these birth intervals cover most of the range of reproductive period of Bangladeshi women. The assessment of differentials in the timing of birth among women is made by constructing 48 separate life tables with different background characteristics such as place of residence, education, age at marriage, and child survival status.

The first step in reducing the volume of figures was to present all results in terms of birth function B_x , that is, the cumulative proportion of women having the subsequent birth by four months of duration since the previous birth or marriage. This reduction entails no loss of information as all other life table functions can easily be derived from B_x . Our next aim is to search for two or three summary measures that would convey most of the information contained in the life table and could be meaningfully interpreted in terms of quantum and tempo of fertility. We considered the values of birth function at four, five and six years that is B_{48} , B_{60} , and B_{72} , as suitable candidates in order to understand the

process of progression to higher parities. As a handsome amount of women have birth intervals longer than four years, we observe that B_{48} was not sufficient. But there exist a small proportion of women who take their birth after a time span of 6 years of previous birth (or marriage). Thus we may settle B_{60} as the most convenient indicator of the quantum of fertility. Since this indicator is based on five years experience we will refer to it as the quintum of fertility and may denote it by Q .

Our next step is to search for some important companion measures which would reflect the distribution of birth intervals and could interpreted in terms of the tempo of fertility. The choice of these companion measures is not straight forward. At first we standardized the birth function distribution to make B_{60} unity; as a result, we obtain proportions of women having a subsequent birth among women who have another child within five years. We calculate the quartiles of the standardized distribution, denoted by q_1 , q_2 , q_3 and defined as the duration by which 25, 50 and 75 percent of the women who will have a subsequent birth within five years. Quartiles are quite informative indicators, particularly when the event of interest is not a sure event but is known to have prevalence in the study population. Other measures of location and dispersion can be calculated from the quartiles such as spread $S=q_3-q_1$. Another more sensitive measure of location is given by Tukey (1977), is called the trimean. The trimean (T) or the average birth interval can be calculated as,

$$T = \frac{(q_1 + 2 * q_2 + q_3)}{4}$$

The very nature of the trimean contains some information about the distribution, and so it is a good measure of tempo.

To illustrate the calculation of these measures we go to Table 4.3. As we can see from the last column of the same Table exhibits the quintum $B_{60} = 0.858082$. To calculate the

standardized quartiles we require the duration by which the cumulative proportion having a first birth are 0.2145205, 0.429041 and 0.6435615 (these values being 25, 50 and 75 percent of 0.858082). The first quartile is found by linear interpolation between duration 12 and 16 as $q_1 = 14.4977$. Similarly, q_2 from the duration 20-24, where $q_2 = 23.19999$ and q_3 from the duration 32-36, where as $q_3 = 30.6985$.

The trimean is thus

$$T = \frac{(q_1 + 2 * q_2 + q_3)}{4} = \frac{(14.4977 + 2 * 23.19999 + 30.6985)}{4} = 22.90 \text{ months}$$

and then median is $q_2 = 23.20$

The spread is calculated as

$$S = q_3 - q_1 = 30.6985 - 14.4977 = 16.20.$$

Thus 86 percent of Bangladeshi women have their first child within five years of marriage, with an average first birth interval of near two year (22.90 months) and a spread of just over one and half year (16.20 months).

4.3 Results and discussion

The 2004 BDHS provides detailed maternity histories and therefore brings to us an opportunity for studying nature of reproductive process, birth intervals and nature of parity specific fertility behavior. Employing life table technique we have made an attempt to study the quantum of fertility on the proportion of women at each parity who eventually move to the next parity, and also the time it takes to make the transition from one parity to the next or the distribution of birth intervals, which is related to the timing or tempo of fertility. We have also studied the effect of place of residence, education, age at marriage, and child survival status on duration of birth interval.

4.4 Quantum and Tempo of Fertility

Figure 4.1 and Table 4.3 presents life table by birth order for interval between marriage and first birth for the total sample. Alike the Table 4.3 we have constructed life table by birth order for parities one to five, which is given in details in appendix Table 4.4 to 4.7. In fact the results of first birth differ than all other births. With the help of these Tables we have formed another Table 4.8, represents the summary measures of the life table analysis.

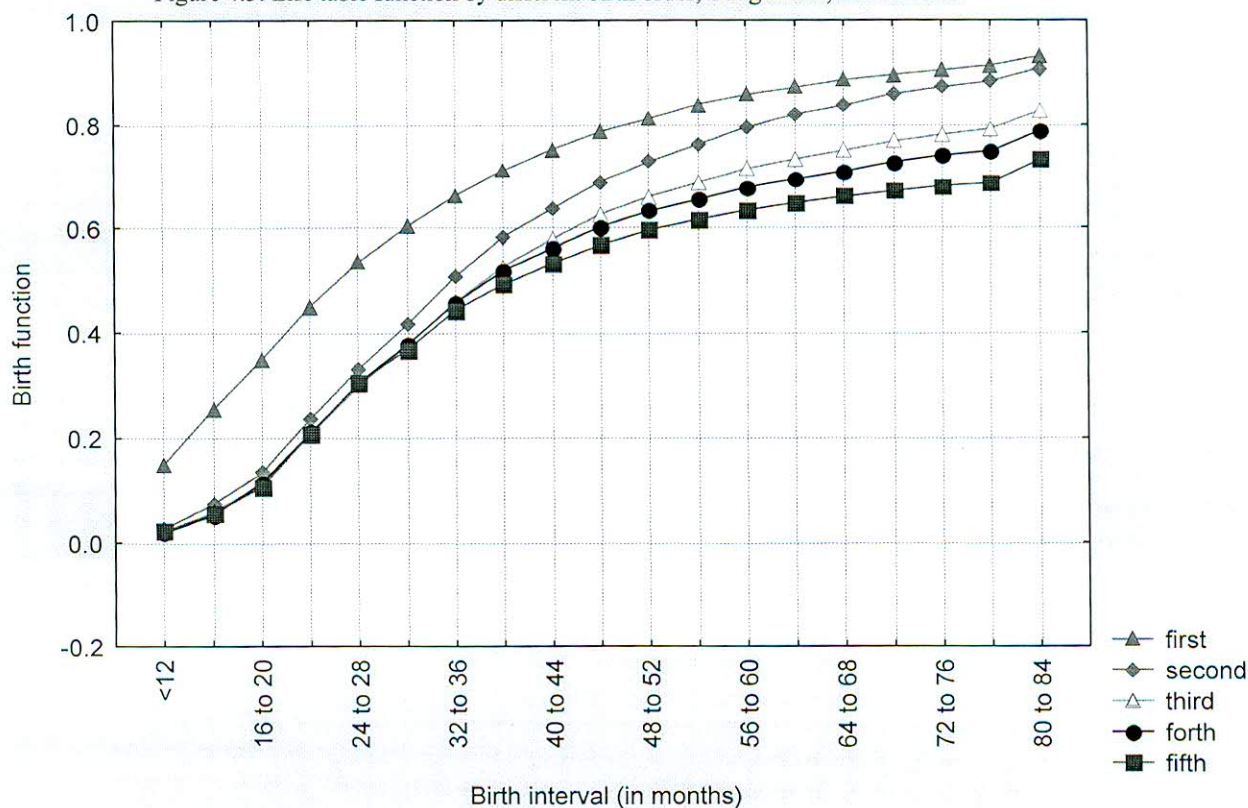
Table 4.3: Construction of abridged life table between marriage to first birth, BDHS 2004, Bangladesh

Duration of Exposure	Censored Cases	First Birth	Number observed start	Exposed through	Conditional probability of first birth	Unconditional probability of first birth	Cumulative probability of first birth	Interpolated cumulative probability
x, x+n	nC _x	nEx	N _x	N _x *	q _x	b _x	B _x	B _{x+n}
<12	517	1392	10702	10185	0.136672	0.136672	0.136672	0.149832
12 to 16	101	1060	8793	8692	0.121951	0.105284	0.241956	0.253428
16 to 20	58	917	7632	7574	0.121072	0.091778	0.333734	0.346868
20 to 24	69	1039	6657	6588	0.157711	0.105078	0.438811	0.449585
24 to 28	47	845	5549	5502	0.153581	0.086188	0.524999	0.5337
28 to 32	44	676	4657	4613	0.146542	0.069608	0.594607	0.602181
32 to 36	50	581	3937	3887	0.149473	0.060595	0.655202	0.661543
36 to 40	30	482	3306	3276	0.147131	0.05073	0.705932	0.711263
40 to 44	29	401	2794	2765	0.145027	0.042648	0.74858	0.752914
44 to 48	29	322	2364	2335	0.137901	0.034671	0.783251	0.786367
48 to 52	13	230	2013	2000	0.115	0.024926	0.808177	0.81172
52 to 56	24	258	1770	1746	0.147766	0.028345	0.836522	0.838995
56 to 60	17	178	1488	1471	0.121006	0.019782	0.856304	0.858082
60 to 64	10	127	1293	1283	0.098987	0.014224	0.870528	0.872434
64 to 68	18	134	1156	1138	0.11775	0.015245	0.885773	0.88704
68 to 72	12	88	1004	992	0.08871	0.010133	0.895906	0.896912
72 to 76	11	69	904	893	0.077268	0.008043	0.903949	0.905052
76 to 80	7	75	824	817	0.091799	0.008817	0.912767	0.913823
80 to 84	9	71	742	733	0.096862	0.00845	0.921216	0.931064
84+	199	463	662	463	1	0.078784	1	
Total	1294	9408						

Table 4.8: Summary measures for Birth Interval in Bangladesh BDHS 2004

Summary measures	Birth Order				
	First	Second	Third	Forth	Fifth
B_{16}	0.253428	0.073377	0.058184	0.052801	0.055484
B_{32}	0.602181	0.415288	0.374829	0.376919	0.366851
B_{60} or Quintum	0.858082	0.794404	0.714558	0.677249	0.632467
Trimean (T)	22.90	31.34	31.36	30.33	29.34
Spread (S)	16.20	18.05	17.64	16.94	16.47
Median (q_2)	23.20	31.14	31.07	29.90	28.45
No. of Cases	10702	10095	8163	5752	3845

Figure 4.3: Life table function by different birth order, Bangladesh, BDHS 2004



The Table 4.8 shows the life table cumulative probability of having a first birth or subsequent birth at various intervals of exposure i.e. 16, 32 and 60 months of marriage or of previous birth which have been denoted by B_{16} , B_{32} , and B_{60} . The results obtained from

the table indicate that 25 percent of the ever married women had or likely to have, first child within 16 months of marriage. This proportion rises to almost 60 percent for the women who were likely to have their first child within 32 months of their marriage. Similarly other indicators show the reproductive nature of Bangladeshi women. The results also revealed that for Bangladesh as a whole, the quantum of fertility in the first birth interval is 86, which indicates that about 86 percent of the Bangladeshi women have their first birth within five years of marriage. The trimean for the first birth interval is $T=22.90$ months which means that the average first birth interval is about 23 months. Finally we may comment that 86 percent of Bangladeshi ever married women have their first child within five years of marriage, with an average length of 23 months and a spread of about 16 months. The proportion of women having subsequent birth by each duration of exposure declines with parity. For 16 months of exposure the probability that a women having first birth will have a second birth is only 0.0733 and very naturally the probability is started to decline at a very slow rate with the increase of parity, which is 0.058184 for third birth, 0.052801 for forth birth and 0.05548 for fifth birth. For a 32 months exposure, the probability of having a subsequent birth after first birth is almost one third or one forth. However much variation is observed for the quantum which is 86 percent for first birth, then decline to 79 percent for second, 71 percent for third, 68 percent for forth and lastly fall to 63 percent for fifth birth.

The average birth interval (trimean) is about 23 months for first birth which is much lower than all other birth orders. Mean birth interval is comparatively higher for second and third birth order (31 months) and slight declining tendency for parity four and five which is 30 months and 29 months respectively. The lower mean first birth interval may due to absence of gestation period and post partum in fecund period. Results also demonstrate that the spread is 16 months for first birth and increase nearly one and half

years for second and third birth, again for fourth and fifth birth it is nearly 16 months. The median first birth interval is 23 months and that of the second and third birth interval is longer by 8 months, 7 months for forth birth and 5 months for fifth birth. The results show that the group differs widely in their birth intervals and highlights the differences in the distribution for first birth intervals as compared with later ones; first intervals are shorter and more homogeneous than other intervals. The results also indicate that after the birth of first child, family size affects the probability of having a subsequent birth, but not the timing of the next birth (for women who have another child within five years).

4.5 Differentials in Quantum and Tempo of Fertility

The study consider the effect of some socio-demographic variables on the quantum and tempo of fertility. We have selected four variables for analysis namely place of residence, level of education, age at marriage and child survival status. We have selected these variables because in chapter three we investigated by applying chi-square statistic that they have strong significant effect on birth interval. These variables are possible important determinants of fertility, and they all share the property of being temporally prior to the birth intervals of interest, a fact which leads to the possibility of causal inferences. We have constructed life tables for these variables and the quartiles of the corresponding distributions are considered as the demarcating points for defining the categories. The analytical table presents the cumulative proportion of women progressing, mean and median birth intervals, and also the spread, derived from life tables for different birth orders and their corresponding socio-demographic variables and their categories.

4.5.1 Effect of Place of Residence

To study the effect of place of residence on fertility, we have constructed life tables by birth order separately for women who live in rural areas and urban areas. Although the

concepts of rural and urban are admittedly ambiguous, this classification should provide a broad indication of the type of environment in which respondents are spending most of their times, and may therefore be expected to have an effect on her subsequent reproductive behaviour. The summary measures of the life table analysis of the birth intervals by current place of residence are presented in Table 4.9.

Table 4.9: Summary measures for birth intervals by place of residence

Birth Order	Summary measures	Rural	Urban
1	B ₁₆	0.244201	0.271058
	B ₃₂	0.594733	0.616444
	B ₆₀	0.856586	0.860958
	Trimean (T)	24.34	23.18
	Spread (S)	20.40	20.03
	Median (q ₂)	23.68	22.4
	No. of Cases	7024	3678
2	B ₁₆	0.071342	0.077328
	B ₃₂	0.426838	0.3928
	B ₆₀	0.80925	0.765306
	Trimean (T)	31.22	31.62
	Spread (S)	17.57	19.09
	Median (q ₂)	31.04	31.41
	N. of Cases	6671	3424
3	B ₁₆	0.058645	0.057288
	B ₃₂	0.483019	0.333752
	B ₆₀	0.747856	0.650001
	Trimean (T)	31.24	31.64
	Spread (S)	17.42	18.14
	Median (q ₂)	30.95	31.4
	No. of Cases	5418	2745
4	B ₁₆	0.058745	0.03977
	B ₃₂	0.401833	0.321993
	B ₆₀	0.710103	0.604925
	Trimean (T)	30.06	31.19
	Spread (S)	16.60	18.1
	Median (q ₂)	29.64	30.68
	No. of Cases	3954	1798
5	B ₁₆	0.055704	0.054968
	B ₃₂	0.37719	0.341826
	B ₆₀	0.66047	0.565046
	Trimean (T)	29.68	29.24
	Spread (S)	16.27	15.85
	Median (q ₂)	29.03	27.90
	N. of Cases	2746	1099

The Table 4.9 and figure 4.4 indicates that rural-urban differential in the transition from marriage to first birth is easily separable, where 24 percent women in rural area were likely to have their first birth within 16 months of marriage compared to 27 percent for urban area and within 32 months of marriage these figures ranges from 59 percent for rural to 62 percent for urban area. The quintum of fertility (B_{60}) is nearly same for both the areas which are 86 percent. The trimean also maintains a comparable level, nearly 24 months for rural women while it is 23 months for urban women. The results demonstrates that 86 percent of Bangladeshi rural women have their first birth within five years of marriage, with an average first birth interval of 24 months and also 86 percent of Bangladeshi urban women have their first issue within five years of marriage, with an average first birth interval of 23 months.

The result also reveals that the spread for urban and rural women is nearly same (for rural women $S=20.40$ and for urban women $S=20.03$). Like mean, median differs slightly in rural and urban area. In rural area it is nearly two months higher than in urban area, indicating that the first birth intervals are more homogeneous for urban women compared to rural women.

As we move on to higher parities we find an increasing effect of place of residence on fertility. We have observed that the quintum, trimean, and median for rural area are less than those of urban area. This discrepancy may due to adolescent sterility arising from a low age at marriage of women in rural area. But the scenario is totally reversed for the higher parities, as we expect. For birth order two the quintums are 81 percent and 77 percent for the rural and urban area respectively. The trimeans and medians are nearly equal for the two areas. However there is little difference in the tempo of fertility as measured by the trimean. Though for higher parities the summary measures B_{16} and B_{32} remain markedly between rural and urban, the quintum and trimean portrays the actual effects of place of residence. Thus we may conclude that place of residence have some

effect on the quantum of fertility and for the first birth interval the quantum is higher for urban women but for subsequent birth interval the quantum of rural women starting to increase from that of urban women. And last of all, the quantum of rural area is higher than the quantum of urban area in a greater context.

Figure 4.4: Life table function by place of residence for first birth interval

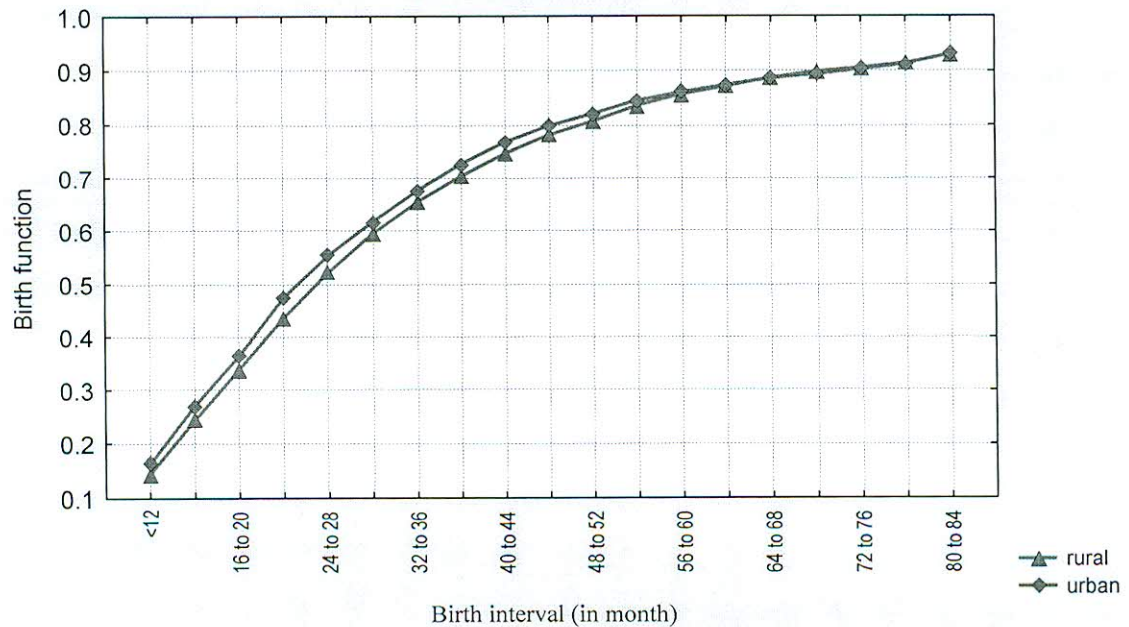


Figure 4.5: Life table function by place of residence for second birth interval

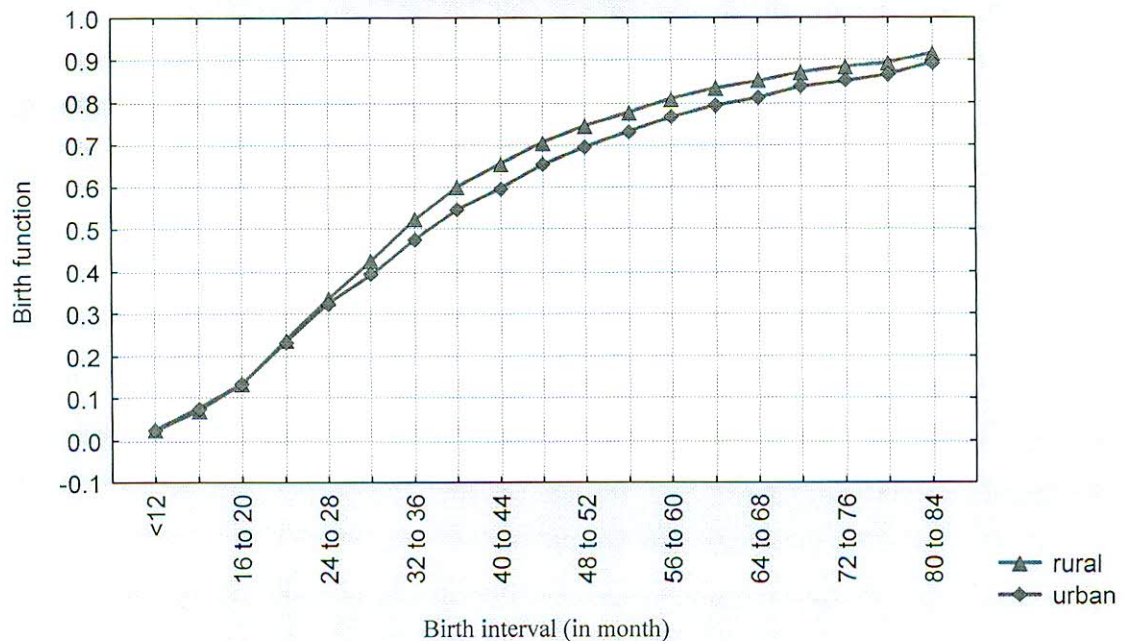


Figure 4.6: Life table function by place of residence for third birth interval

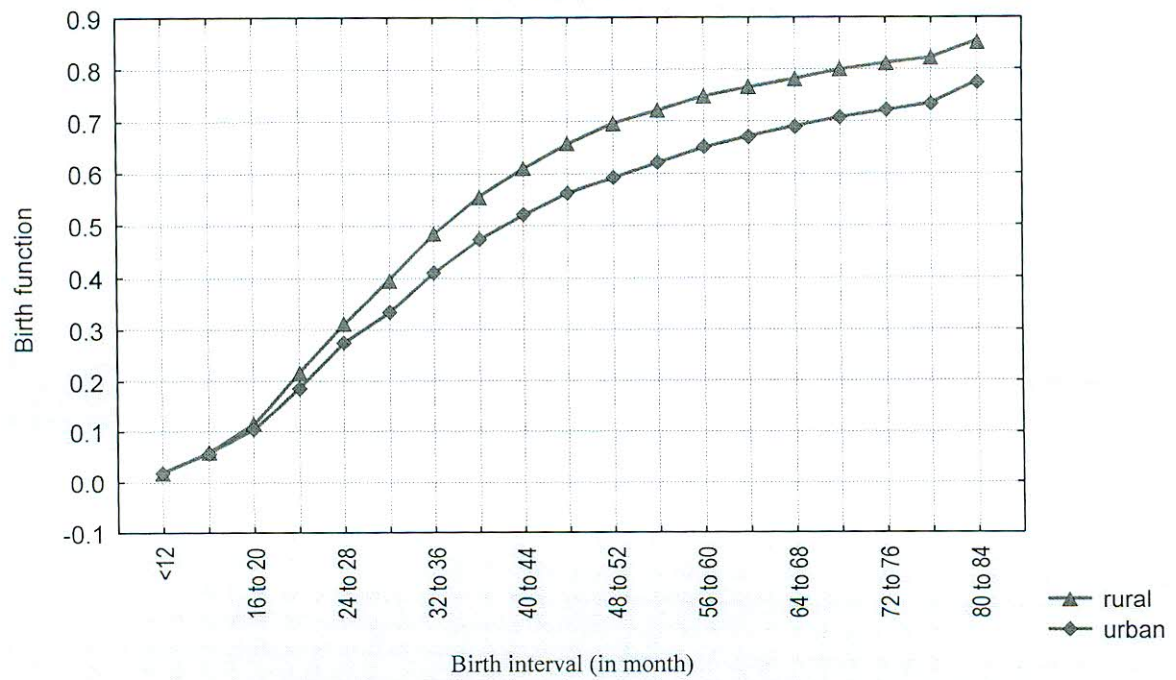
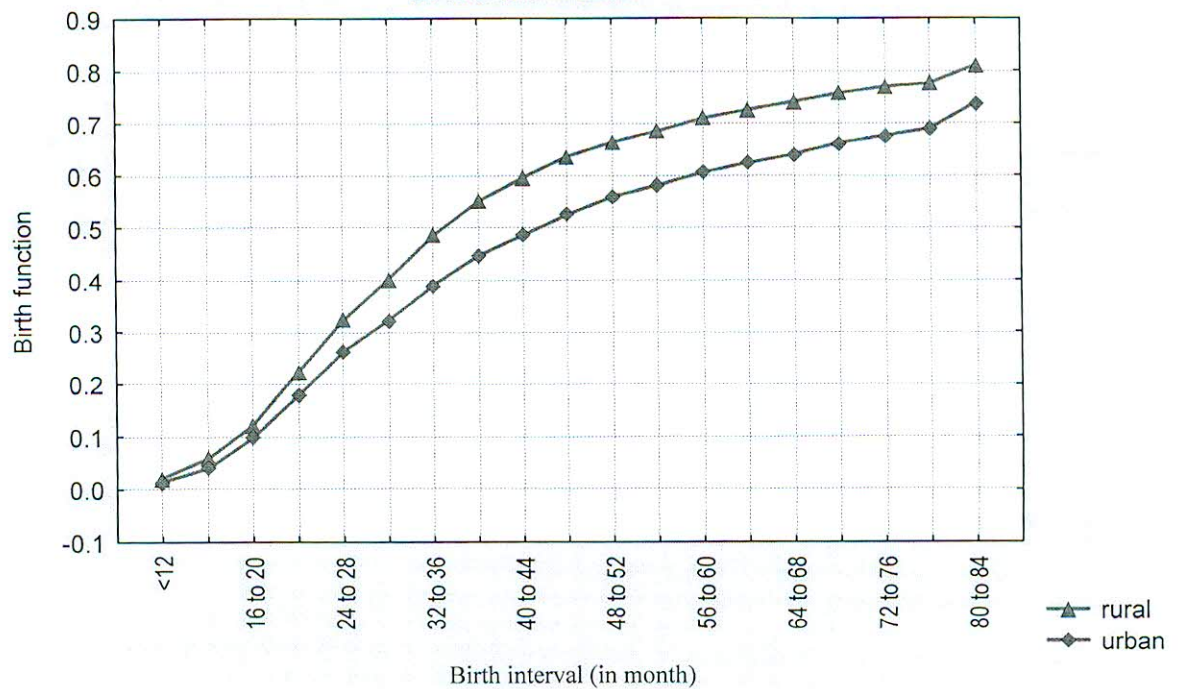
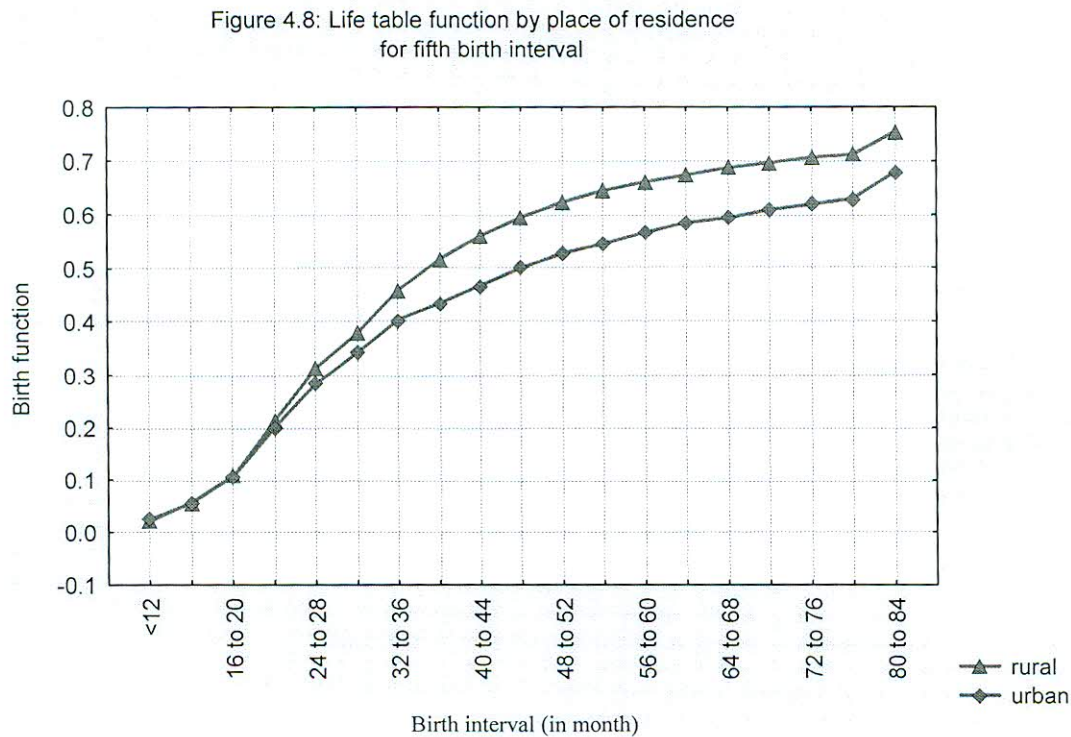


Figure 4.7: Life table function by place of residence for fourth birth interval





4.5.2 Effect of Respondent Education

Education is an important causal variable influencing the level and pattern of fertility. To investigate the effect of level of education on the quantum and tempo of fertility, life tables have been constructed for three broad educational categories of women, namely (1) no education (2) primary education and (3) secondary and higher education. Table 4.10 summarizes the results of the analysis on educational differentials and the Figures 4.9 to 4.13 also shows the patterns of that differential. It can be observed that the differentials in quintum, trimean and median interval of first order birth are substantial among the three educational categories. The first order quintum varied in the range of 82 percent for no educated group, 87 percent for primary educated group and 90 percent for secondary and higher educated group.

Table 4.10: Summary measures for birth intervals by respondent level of education

Birth order	Summary measures	No education	Primary	Secondary & higher
1	B ₁₆	0.212606	0.253493	0.304164
	B ₃₂	0.54169	0.608223	0.674796
	B ₆₀	0.820212	0.870188	0.897345
	Trimean (T)	25.49	24.14	21.74
	Spread (S)	21.16	20.35	18.59
	Median (q ₂)	24.74	23.44	20.87
	No. of Cases	4002	3165	3535
2	B ₁₆	0.082355	0.068446	0.064884
	B ₃₂	0.458309	0.428093	0.325488
	B ₆₀	0.834233	0.820428	0.686003
	Trimean (T)	30.32	31.45	33.55
	Spread (S)	16.99	17.84	21.78
	Median (q ₂)	30.12	31.21	33.03
	No. of Cases	4168	3027	2899
3	B ₁₆	0.061900	0.056033	0.047143
	B ₃₂	0.430356	0.354338	0.25833
	B ₆₀	0.773548	0.725884	0.531752
	Trimean (T)	30.37	32.48	32.83
	Spread (S)	16.86	17.72	19.85
	Median (q ₂)	29.97	32.47	32.6
	No. of Cases	3784	2487	1830
4	B ₁₆	0.056140	0.049167	0.04277
	B ₃₂	0.405890	0.375180	0.272121
	B ₆₀	0.715944	0.685674	0.516095
	Trimean (T)	29.97	30.67	31.93
	Spread (S)	16.20	16.89	20.95
	Median (q ₂)	29.58	30.36	30.88
	No. of Cases	3064	1760	928
5	B ₁₆	0.062923	0.045904	0.043444
	B ₃₂	0.395523	0.356454	0.249708
	B ₆₀	0.674390	0.619151	0.455939
	Trimean (T)	29.53	29.58	30.14
	Spread (S)	14.63	16.63	17.69
	Median (q ₂)	28.26	28.51	29.87
	No. of Cases	2220	1171	454

The proportion of women progressing from marriage to first birth within 16 months is lowest (21 percent) for women with no education and it is gradually increasing with the educational level, for the primary educated women it is 25 percent and this figure rises to 30 percent for secondary and higher educated women. In the transition from marriage to

first birth within 32 months the pattern is same and ranges 54 percent to 67 percent. There is marked differential in mean and median among educational categories. We observe that it is highest for no educated women ($T=25.49$, $q_2=24.74$) and comparatively higher for primary educated and secondary & higher educated women. Since the less educated groups tend to marry at a very young age, a longer waiting time to conception leading to first birth may be lowering their cumulative proportions compared to other two groups, who tend to marry at later age due to their prolonged stay at high school and other higher level institutions. However the scenes are different for the second order transition. Here the quintums are high for no educated and primary educated group (83% & 82%) as compared with secondary or higher educated group (69%). The B_{16} and B_{32} values decrease a greater extent in second birth order.

The mean rises to 30 months for no educated women, 31 months for primary educated women and 34 months for secondary or higher educated women which is much higher than previous group. In the case of secondary and higher educated group, there could be a considerable proportion of women among them using some temporarily methods of contraception. This is supported by the fact that the higher educated group have their median interval longer by 3 months and for primary educated group it is longer by 1 months than for no educated groups. For the illiterate group the low pace of their second order the fertility could be the effect of their possible deficient nutritional status combined with a host of reproductive health problems. At the third order however, significant differential among education groups were noted. The quintum for third order births declined considerably with rise in the level of education. For women with secondary and higher educated group the quintum declined to 53 percent at a third order for a high of 68 percent at the second order, registering decline by 16 percentage points. Similar decline observe for no educated and primary educated group. Mean value for third birth order is

near for second order. For fourth order the mean and median values are comparatively lower than second and third order for all groups, but substantial increases are seen for the primary and secondary & higher educated groups. The life table results for higher orders are not reliable due to reduced number of observations. but for the two less educated groups (no education and primary) substantial declines were noticed in their quintum, trimean and median values as the order of birth increased, which indicates the tendency to regulate fertility among these groups too, although after having 3-4 children. On the whole the data provide some evidences to conclude that fertility transition had begun to affect the less educated groups also, but at a higher parity.

Figure 4.9: Life table function by respondent education level for first birth interval

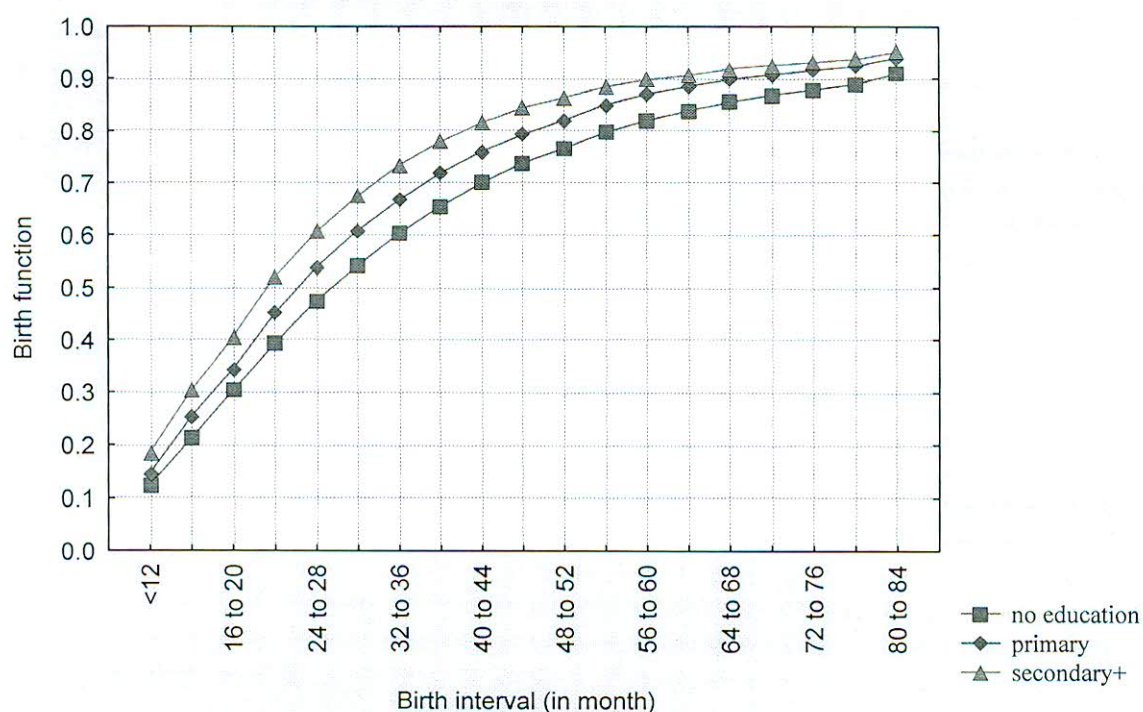


Figure 4.10: Life table function by respondent education level for second birth interval

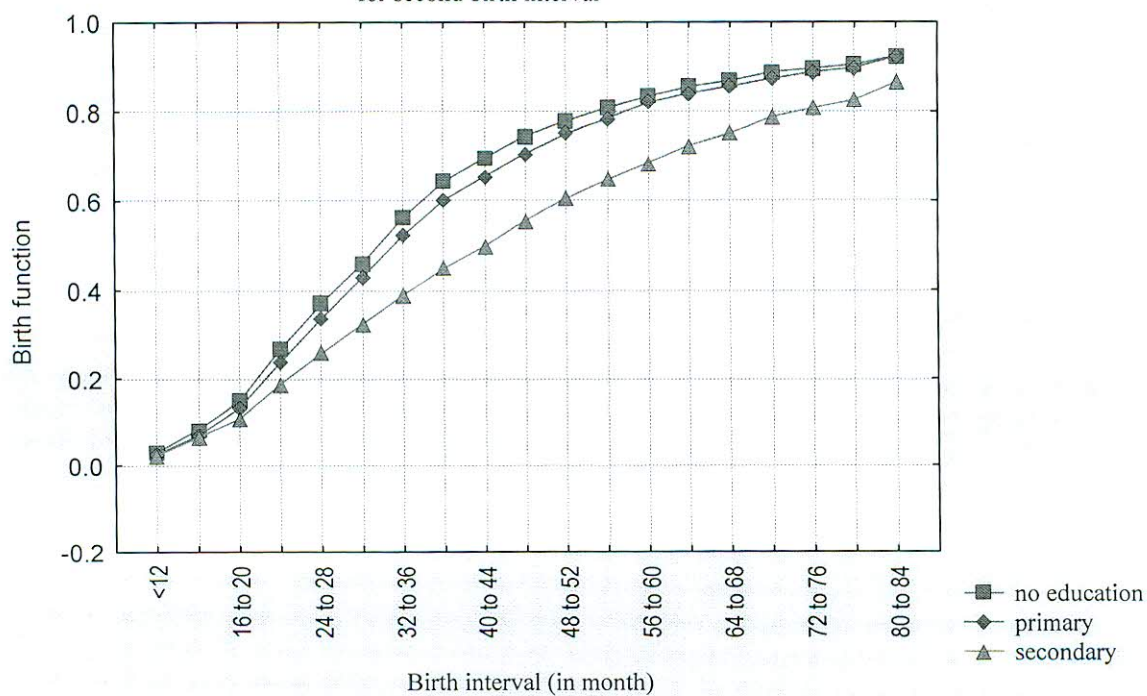


Figure 4.11: Life table function by respondent education level for third birth interval

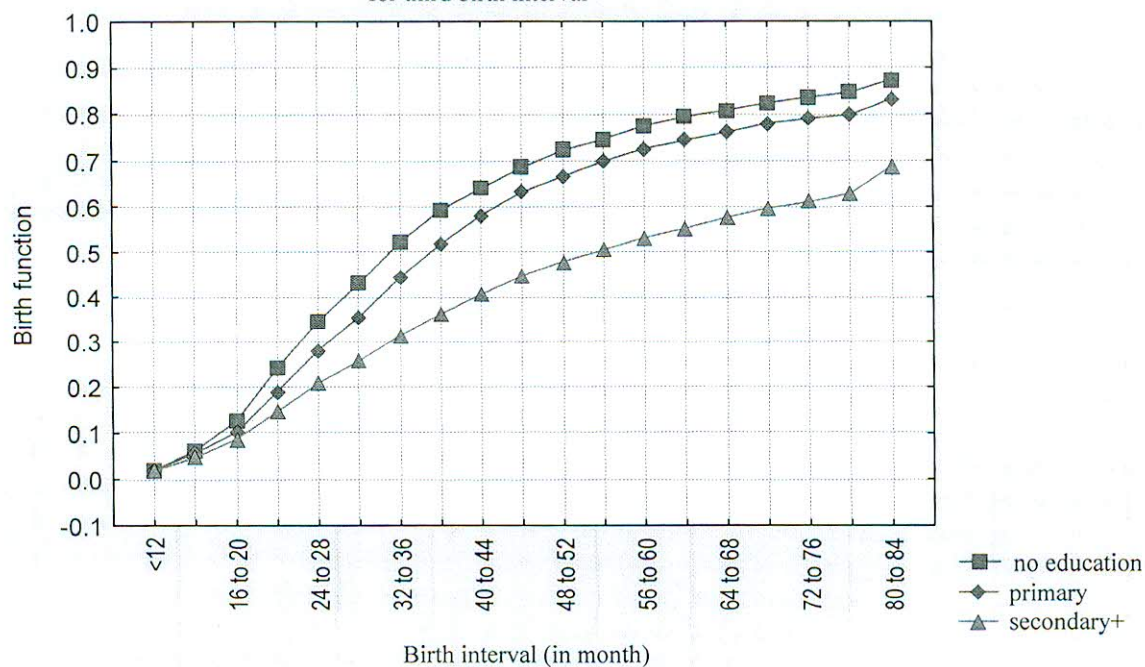


Figure 4.12: Life table function by respondent education level
for forth birth interval

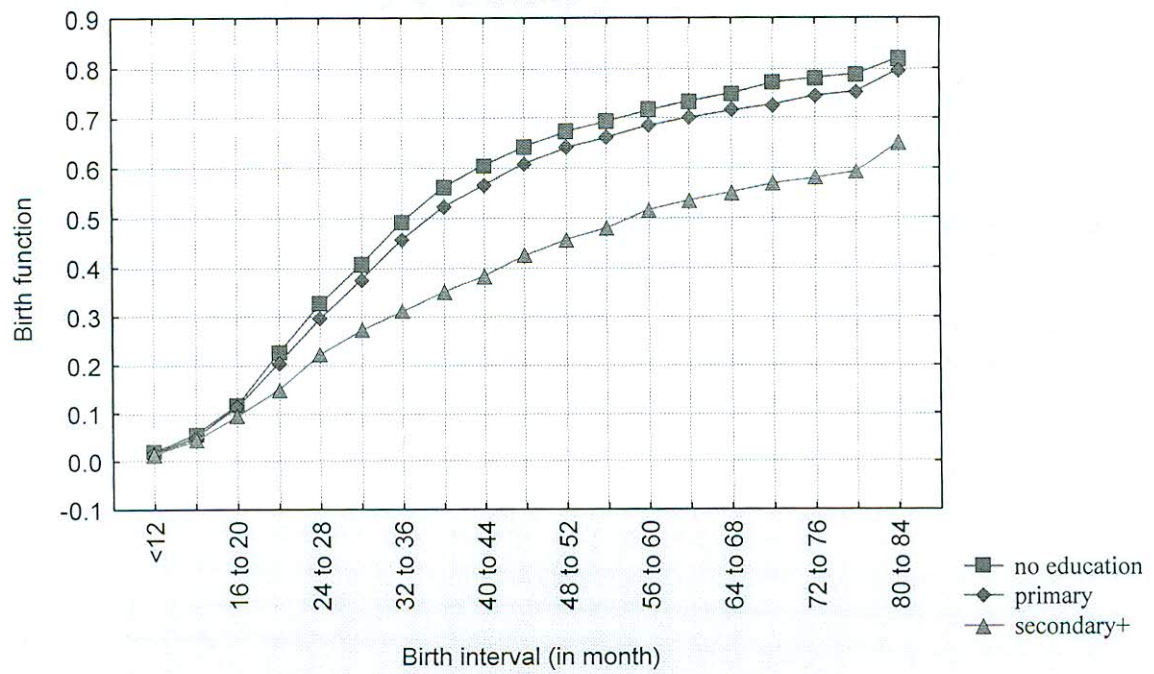
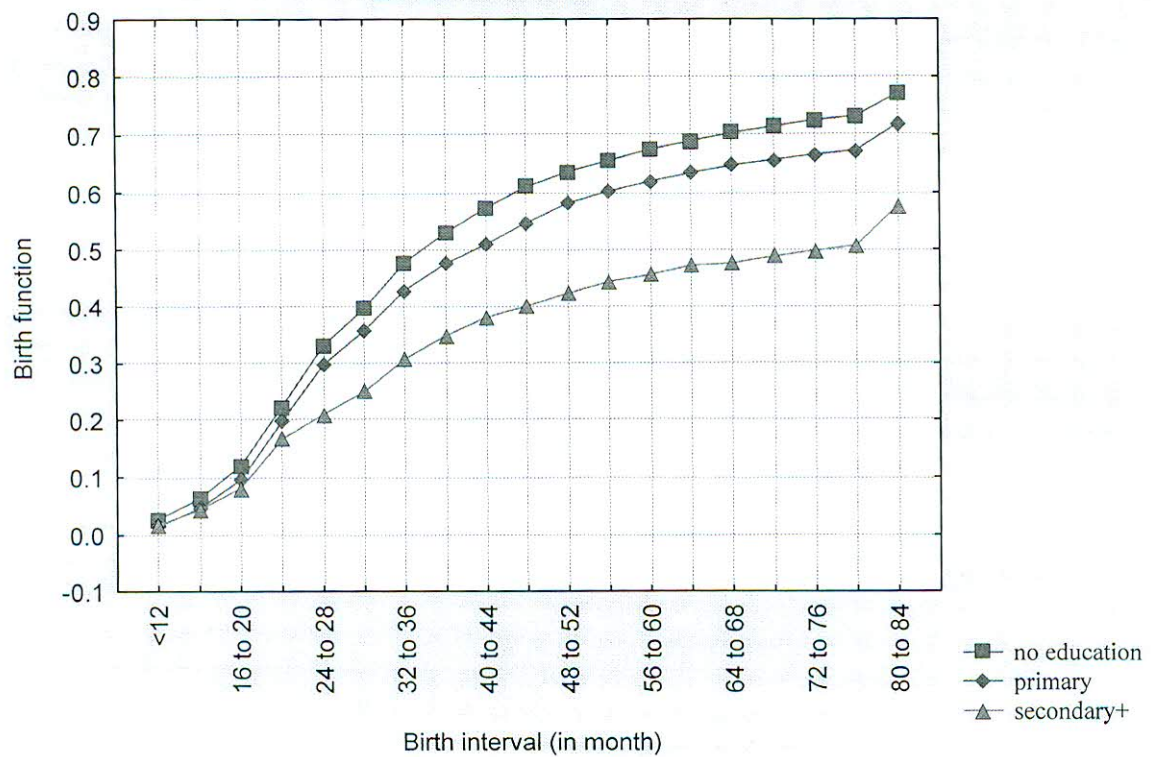


Figure 4.13: Life table function by respondent education level
for fifth birth interval



4.5.3 Effect of female age at first marriage

In many of the fertility related studies age at marriage has been introduced as a control factor (Ryder, 1973; Vaughan et al., 1977). The first birth interval is longer in Bangladesh than in many populations. In this section, an attempt has been made to examine this more incisively by controlling age at marriage, i.e., ≤ 15 and 15+ years. We consider this group as we see that 68% women married before 15 years of age. It is revealed from Table 4.11 that the women who had married under 15 years of age has a lesser chance of having their first birth immediately after marriage than those who had their marriage at 15 years and older age. This is indicative through the cumulative proportions shown in the table. Only 22 percent women with age at marriage less than or equal to 15 years, likely to have their first birth within 16 months of marriage whereas for women married late (15+ years) this percentage is 33. Within 32 months of marriage their percentage is 57 and 68. It is clear that ages below 15 years are tender stages for girls to initiate reproduction. Although with time, the cumulative proportion progressing to first parity had increased in the youngest age at marriage group (85% for youngest age at marriage and 88% for higher age at marriage).

The mean and median first birth interval is nearly same which were 25 months for youngest marriage group and much lower 21 months for older marriage group. It therefore indicates that among women who married at mature age the first births are accomplished faster, whereas among the very young adolescents the pace of attaining biological maturity is slow. The slower pace of child bearing experienced by women who married very young could be mainly due to adolescent sub fecundity. Since the girls in their early teens have many of their menstrual cycles likely to be anovulatory, marriage and thereby exposure to conception does not usually pose a high risk to them in terms of conception leading to live birth immediately after marriage.

Table 4.11: Summary measures for birth intervals by respondent age at first marriage

Birth order	Summary measures	≤ 15	> 15
1	B ₁₆	0.219236	0.327824
	B ₃₂	0.568001	0.677662
	B ₆₀	0.847461	0.881067
	Trimean (T)	25.29	21.08
	Spread (S)	20.62	18.45
	Median (q ₂)	24.59	20.46
	No. of Cases	7193	3509
2	B ₁₆	0.072076	0.076880
	B ₃₂	0.420582	0.401918
	B ₆₀	0.81107	0.749235
	Trimean (T)	31.43	31.19
	Spread (S)	17.90	19.06
	Median (q ₂)	31.29	30.67
	No. of Cases	7032	3062
3	B ₁₆	0.057048	0.057006
	B ₃₂	0.471778	0.335825
	B ₆₀	0.739017	0.629898
	Trimean (T)	31.47	31.27
	Spread (S)	17.71	18.03
	Median (q ₂)	31.22	30.8
	No. of Cases	5946	2149
4	B ₁₆	0.053878	0.050466
	B ₃₂	0.381984	0.358803
	B ₆₀	0.692331	0.621113
	Trimean (T)	30.53	29.66
	Spread (S)	17.09	15.8
	Median (q ₂)	30.13	28.48
	No. of Cases	4466	1285
5	B ₁₆	0.055814	0.054021
	B ₃₂	0.372286	0.343743
	B ₆₀	0.641693	0.591779
	Trimean (T)	29.32	29.49
	Spread (S)	16.50	16.97
	Median (q ₂)	28.40	28.48
	No. of Cases	3094	751

For the transition from first to second order, the younger age at marriage group (≤ 15 years) is seen more likely to progress to the next higher orders while in the oldest group (> 15 years) a dampening effect is noticed. The quantum or proportion of women progressing at 60 months is seen higher (81%) for younger age at marriage group than for

oldest marriage group at second order. Visibly this effect is reflected in the length of mean and median value, which is nearly same (31 months) for both ≤ 15 years and > 15 years of marriage. As we move to higher order births, the effect of age at first marriage is minimal, since there is no significant difference in the trimean and median (see Table 4.11). In fact, the trimean varies from 29.32 to 31.47 months and median varies from 28.40 to 31.29 months.

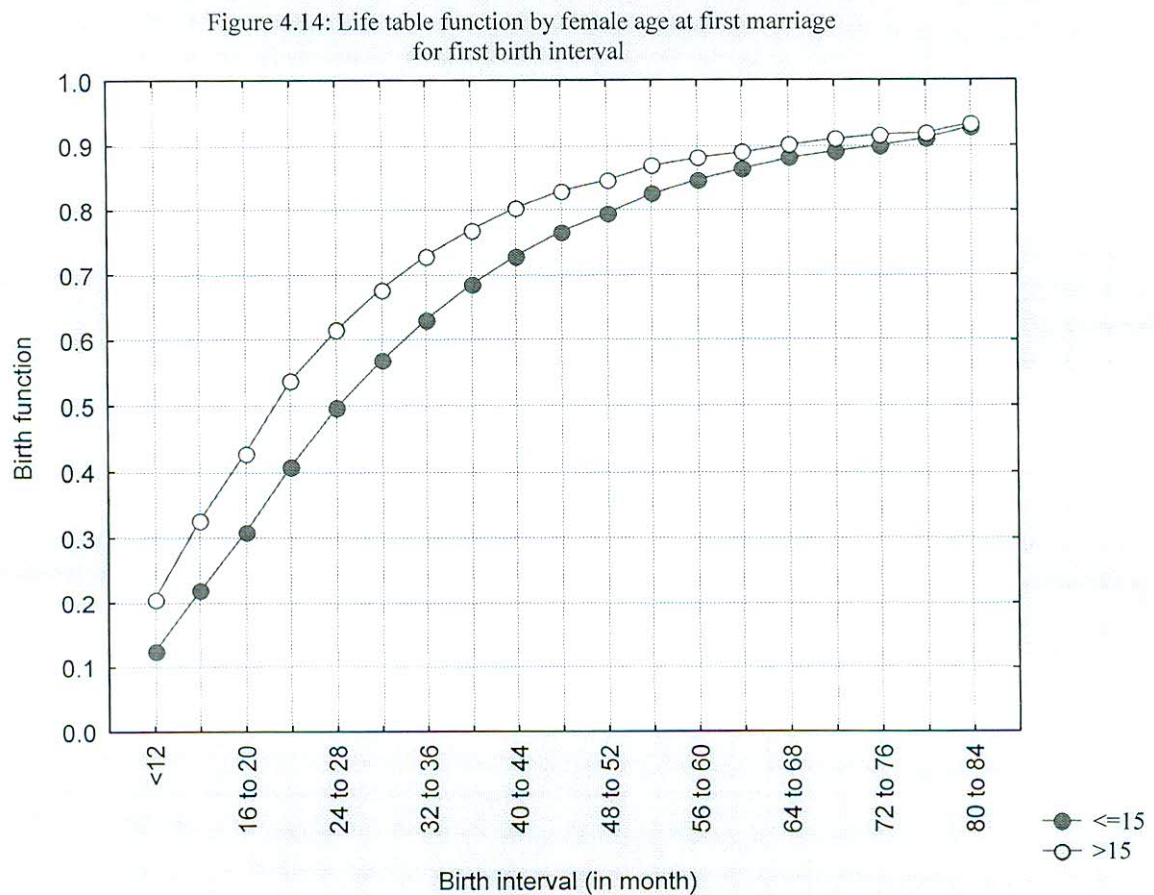


Figure 4.15: Life table function by female age at marriage for second birth interval

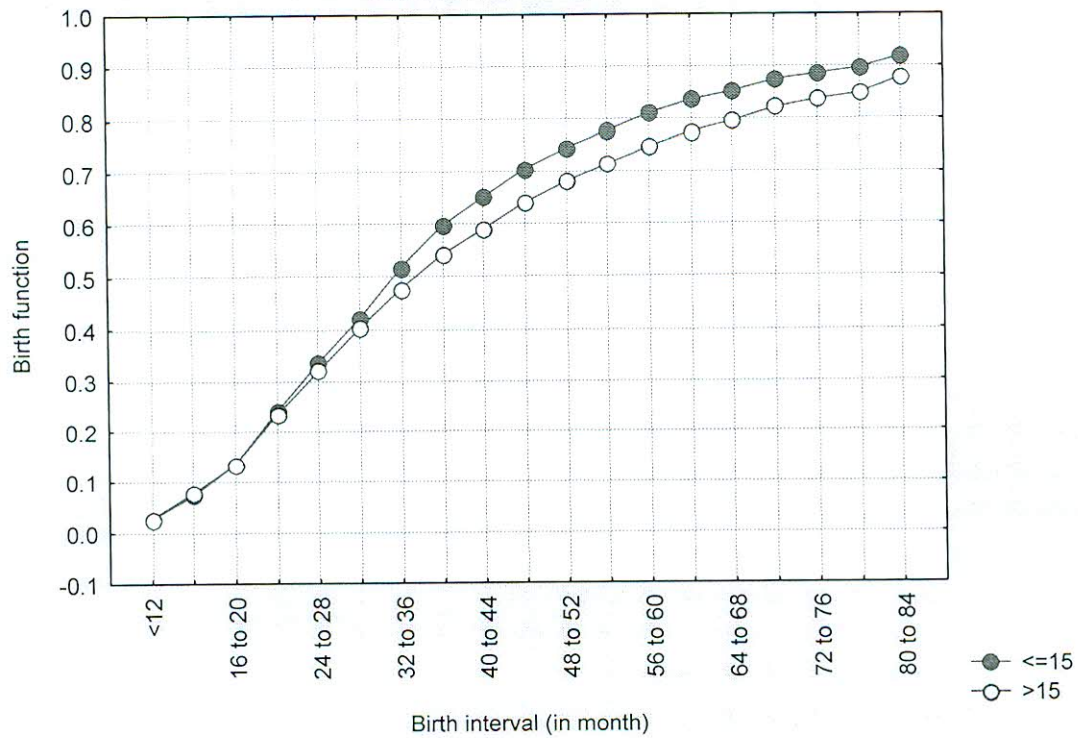


Figure 4.16: Life table function by female age at marriage for third birth interval

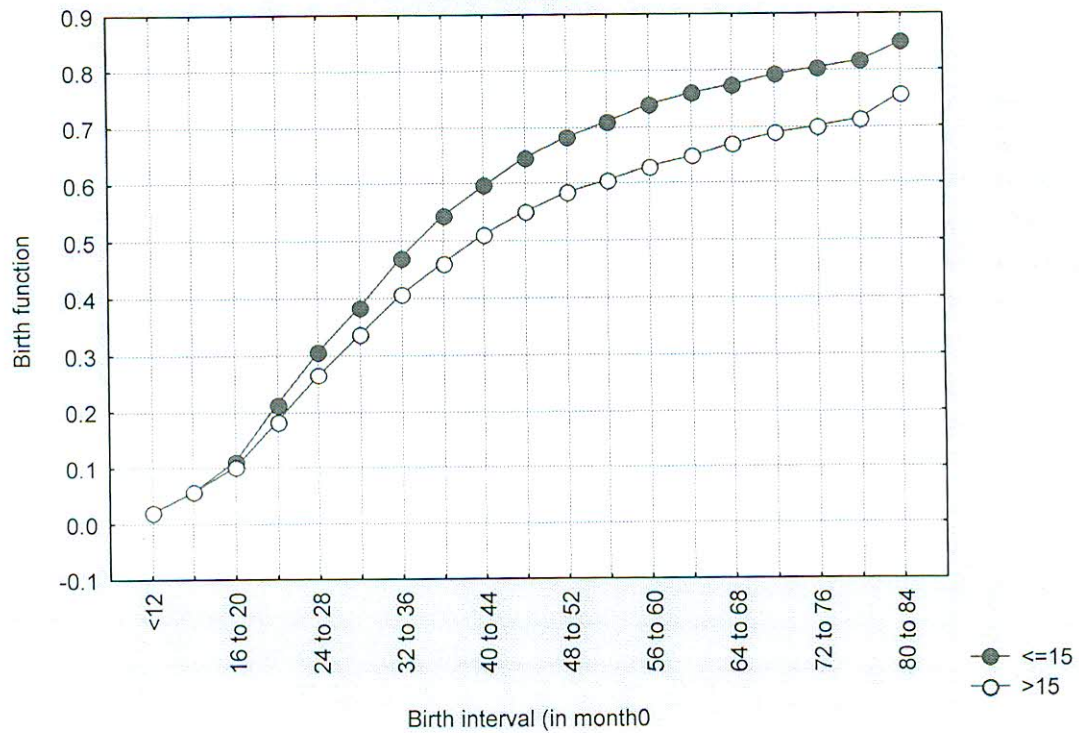


Figure 4.17: Life table function by female age at marriage for fourth birth interval

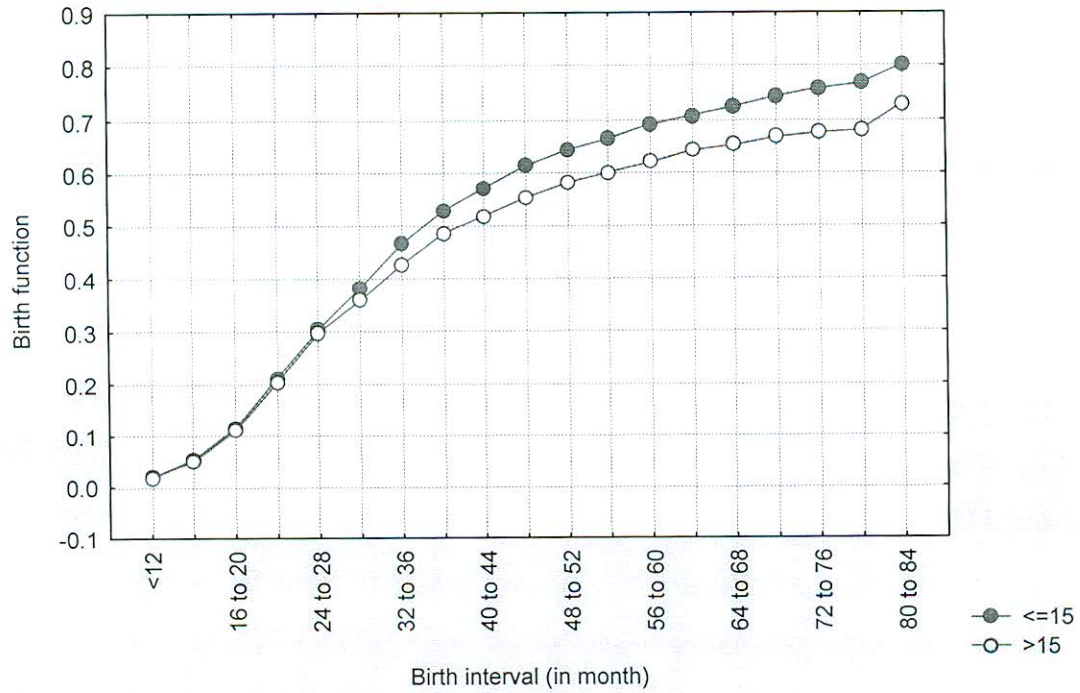
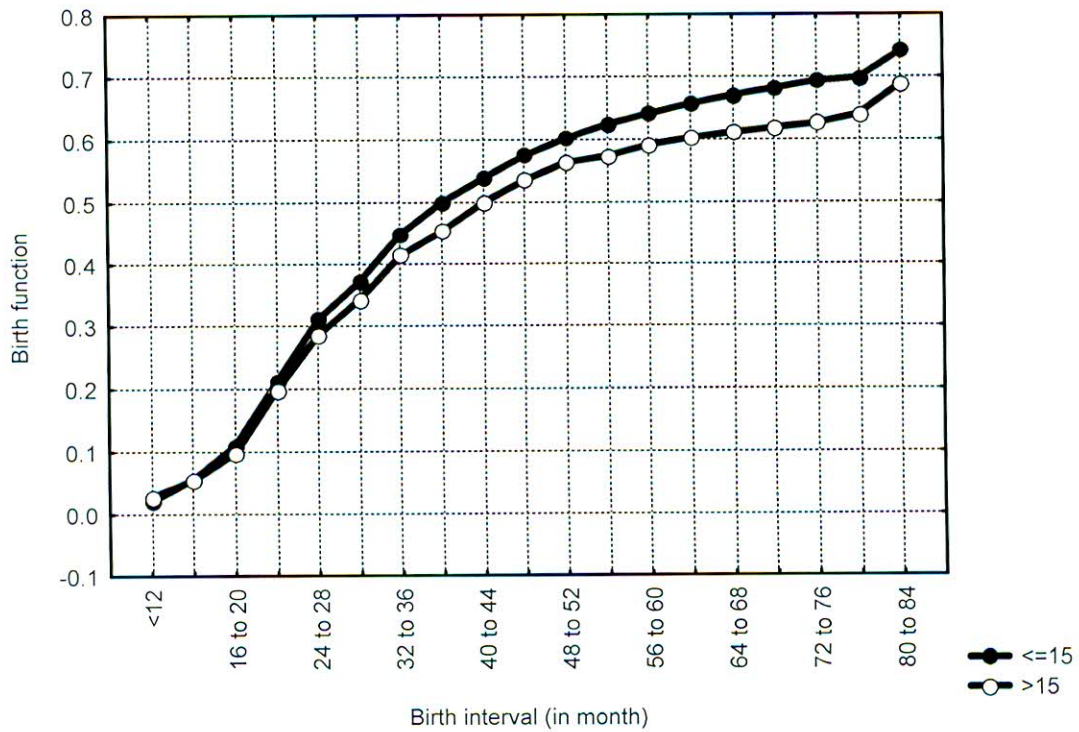


Figure 4.18: Life table function by female age at marriage for fifth birth interval



4.5.4 Effect of Child Survival

Among many factors that can be contribute to the wide variations in completed family size, child mortality is considered to be one of the important factors in the variation of natural fertility. It is often postulated that child mortality has a direct effect on fertility either because mothers tend to replace children who have died, or because women whose children die have reduced periods of breast feeding and amenorrhoea. To asses the magnitude of the effect of infant mortality on fertility we have constructed life tables by birth orders according to whether or not the previous child survived. The results are presented in summary form in Table 4.12, also the cumulative proportions of women to have births according to child survival status for various birth orders are presented in Figure 4.19 to Figure 4.22.

Table 4.12: Summary measures for birth intervals by child survival status

Birth order	Summary measures	Alive	Death
2	B ₁₆	0.066572	0.128720
	B ₃₂	0.389112	0.618967
	B ₆₀	0.780865	0.900138
	Trimean (T)	32.15	26.78
	Spread (S)	18.53	13.98
	Median (q ₂)	32.07	26.38
	No. of Cases	9008	1087
3	B ₁₆	0.051265	0.101800
	B ₃₂	0.350373	0.539101
	B ₆₀	0.696053	0.834761
	Trimean (T)	32.11	27.58
	Spread (S)	17.95	14.69
	Median (q ₂)	31.88	26.42
	No. of Cases	7192	910
4	B ₁₆	0.04946	0.076257
	B ₃₂	0.367933	0.434269
	B ₆₀	0.676429	0.680898
	Trimean (T)	30.80	27.77
	Spread (S)	17.24	15.27
	Median (q ₂)	30.38	27.12
	No. of Cases	4953	799
5	B ₁₆	0.049598	0.083164
	B ₃₂	0.360571	0.408056
	B ₆₀	0.644784	0.576059
	Trimean (T)	30.19	25.69
	Spread (S)	16.80	14.12
	Median (q ₂)	29.5	24.89
	No. of Cases	3215	670

The death of the forth child increases the quintum from 67 to 68 and reduces the average birth interval from 31 to 28 months. For fifth child the mean value decreases from 30 to 26 months. The results speculate that the child survival affects timing of birth not only for first two or three orders but also for higher orders but at a small pace. A study of Bangladesh (Kabir and Sufian, 1983) found the same pattern of birth interval for child survival status.

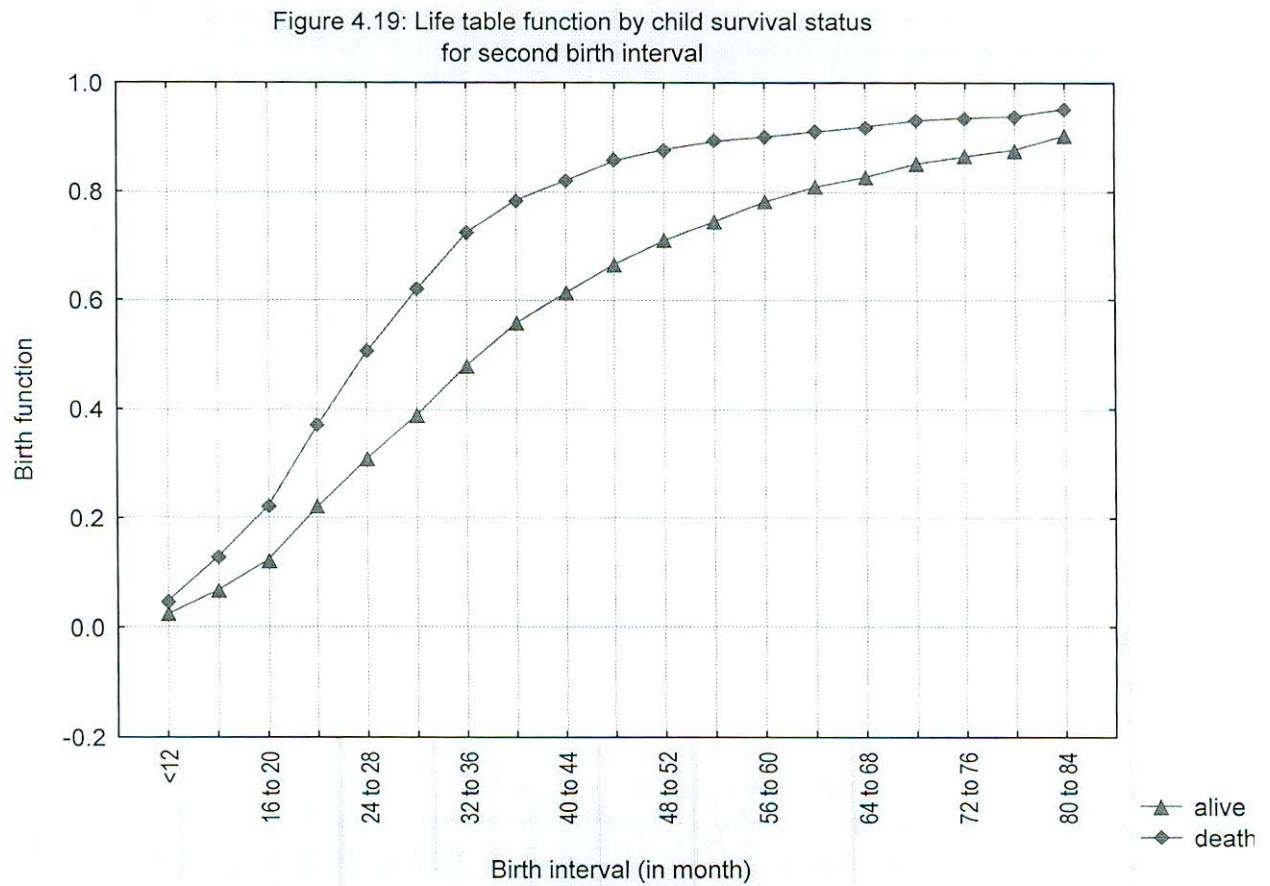


Figure 4.20: Life table function by child survival status for third birth interval

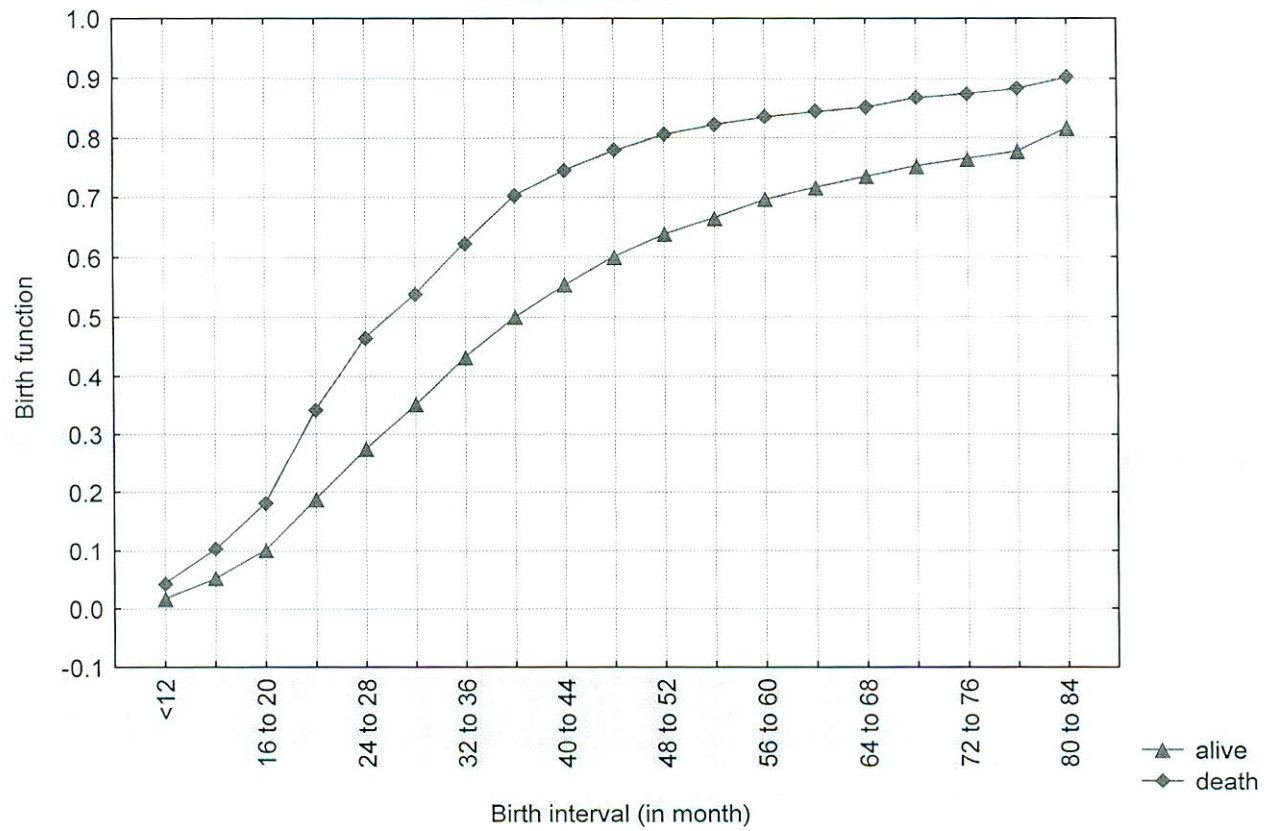


Figure 4.21: Life table function by child survival status
for forth birth interval

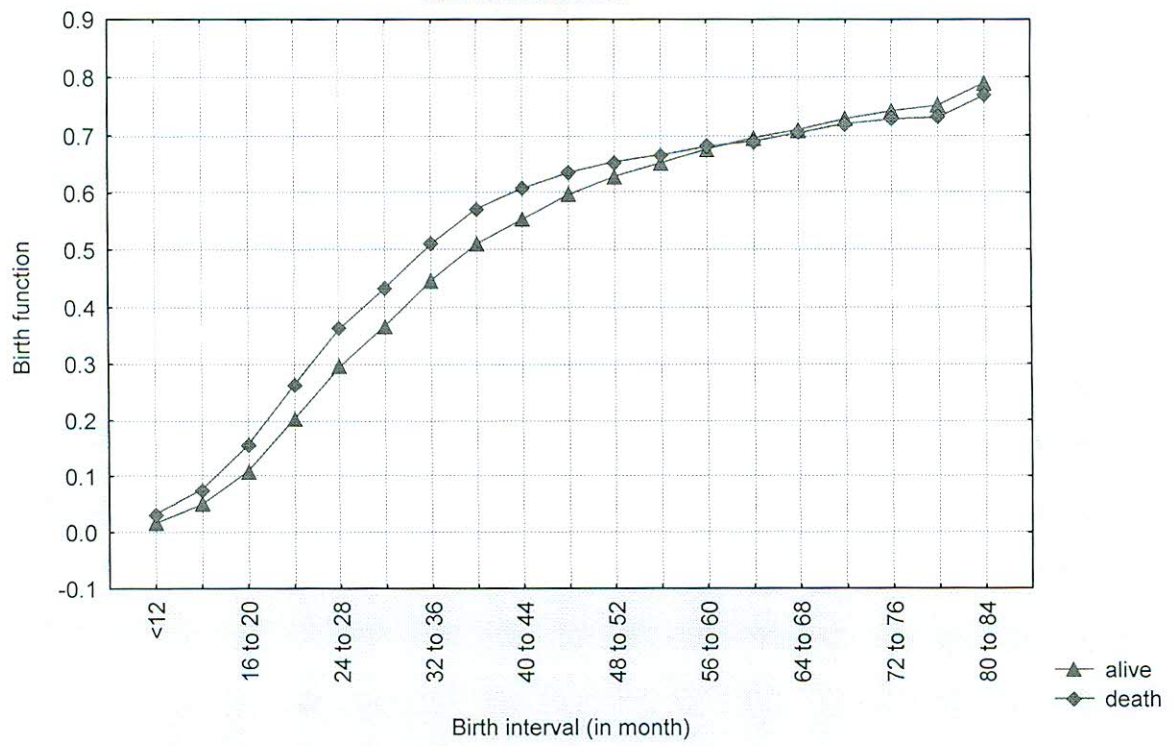
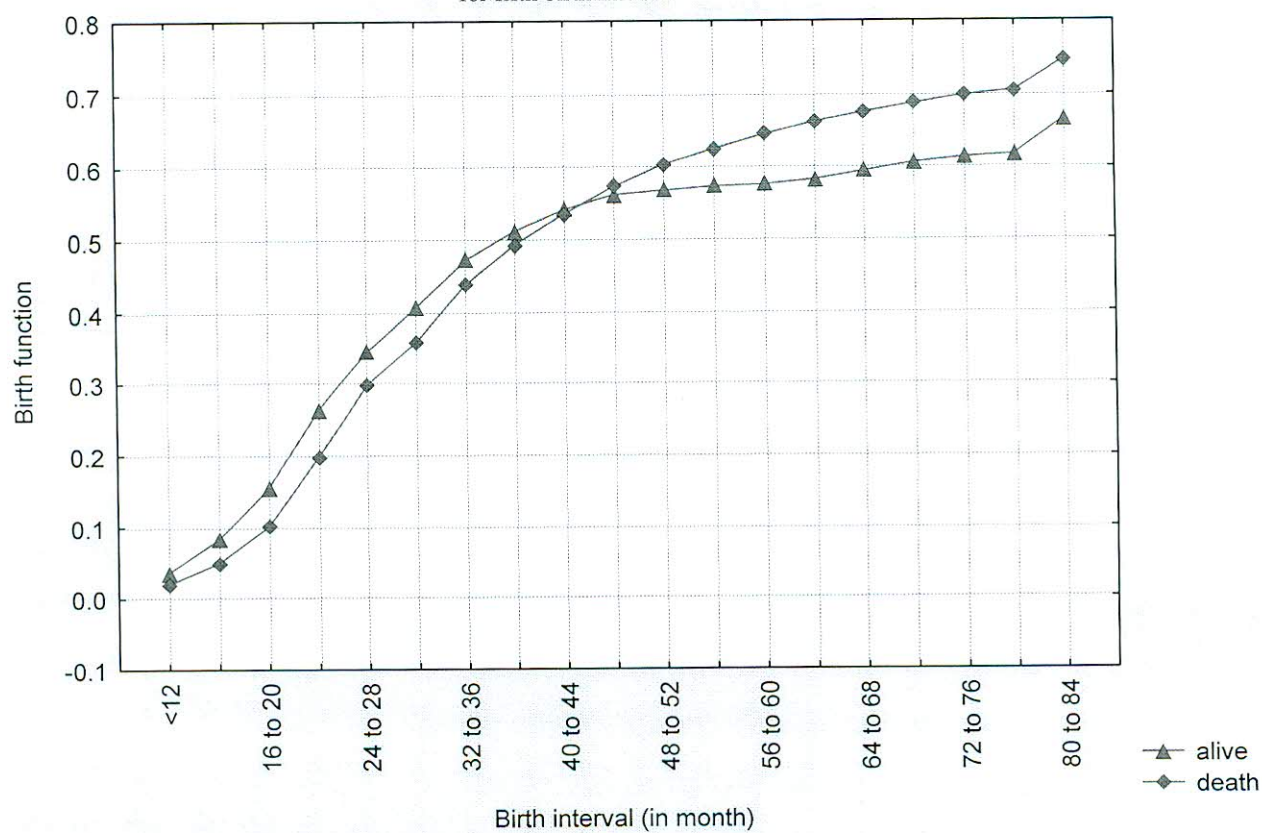


Figure 4.22: Life table function by child survival status for fifth birth interval



4.6 Conclusion

The results presented in this chapter reflect the pattern of family building process into a series of stages, including marriage and births of successive orders, and investigates the transition from one stage to another. Differential in quantum and tempo of fertility have been studied using life table techniques separately. Two life table techniques are applied and revealed that second one is more reliable in context of Bangladesh and applied it in more elaborate form. The results of life table techniques suggested that mean length of first birth interval is comparatively shorter than the length of subsequent birth interval for higher parity. Applying the technique it has found that the mean length of first birth interval is comparatively lower, which is 23 months and for subsequent birth it is higher and ranges between 29 to 30 months. Therefore, the study investigate the differential in quantum and tempo of fertility by using life table technique among four socio-demographic variables namely place of residence, education, age at first marriage and child survival status of respondent and found that they have substantial effect greater in first order and also in remaining order.

CHAPTER FIVE

Differentials and Determinants of Breastfeeding Pattern

Chapter Five

Differentials and Determinants of Breastfeeding Pattern

5.1 Introduction

Breastfeeding plays an important and influential role on duration of amenorrhoea, child survival and fertility, offering immunology protection to an infant against early morbidity and mortality. It has highly nutritious, provides all the elements needed for infant health during the first six months of life and many of those are needed for months there after (Buchanan, 1975). Breastfeed infants have a better pattern of growth and experience substantially lower mortality risk than infant who are not breastfeed particularly in the first year of life (James, 1984; Pallani and Millan, 1986; Rahman et al., 2005). In developing countries, increase in education of women leads to decrease in the duration of breastfeeding (Smith, 1985). In some countries, older women are more likely to breastfeed for longer durations (Akin et al., 1981; Jain and Bongaart, 1981)

Breastfeeding is the unique source of nutrition that plays an important role in the growth, development and survival of infants. The benefits of breastfeeding, especially exclusive breastfeeding, are well established (Victora et al., 1987, Huttly et al., 1997) particularly in poorer environments where the early introduction of other milk is of particular concern because of the risk of contamination and over dilution of milk leading to increased risks of morbidity and under nutrition. The duration of breastfeeding largely determines how much this form of feeding has a favorable influence on infectious diseases prevention, child development and child survival.

Several studies reveals that along with urban-rural residence, breast-feeding duration has been shown to be negatively correlated with maternal education and socio-economic status (Millman, 1981; Popkin, 1978; Mohiuddin, 1986; Mott, 1984; Othman, 1985). Rapidly intensify the levels of modernization and urbanization is also important contributors to the decline in breast-feeding duration, the impact being primarily upon younger women. Breast-feeding duration is positively correlated with maternal age and parity (Smith, 1985).

The importance of breast feeding in regulating individual and social fertility has been matter of general interest for many years, because it tends to increase the average birth interval and therefore to reduce women's fertility over her life span, especially in societies where the use of contraceptive methods is not widespread. There is substantial evidence that long-term breast feeding is associated with longer anovulatory periods, and thus with prolonged postpartum amenorrhoea, on the one hand, and with reduced fertility even after menses and ovulation has returned on the other hand. Prolonged lactation suppresses the production of certain types of hormones and thereby extends the postpartum anovulatory period. Moreover, there are different social norms, taboos, and other socio-economic factors, especially in traditional societies, that reinforce the effect of breast feeding. Therefore, the main purpose of this chapter is to asses the duration of breastfeeding in Bangladesh and the various socio-economic and demographic factors affecting it.

5.2 Analytical Methodology

The basic methodology applied for studying the pattern of breastfeeding is a current status analysis which uses the current status of a defined descriptive variable in each interviewed individual (breastfeeding status) at the moment of the survey. Bivariate and

multivariate statistical techniques have been used to study the predictor variable duration of breastfeeding in relation to the explanatory variables. The variable breastfeeding is coded as 0-12, 12-24, 24-36 and 36-48 months. The association of the duration of breastfeeding with all the independent variables in this study was first checked by the chi-square statistic. Chi-square statistic in a two-way tabulation has also been used to test the goodness of fit of the model as well as to test the significance of the independent variables. Both life table and Cox proportional hazard model analysis was used to study the duration of breastfeeding. Various summary measures based on this analysis were presented in different tables. Some important methods are described below:

5.2.1 Life-table technique

Many problems presented by linear regression models in the study of waiting times may be avoided through the use of life table; such is the case of censored observation. For instance when the survey is conducted many women still breastfeeding their child and it is unknown how long they could continue this.

Therefore the life table technique is an efficient tool through which the problem of right censoring can be handled. This technique treats a sample of women of different ages at any point in time as if they were representing a single cohort aging over time.

Breastfeeding Analysis

A life table can be constructed by pooling completed and censored cases of breastfeeding (Lee, 1993). The completed observations are those in which breastfeeding was stopped and the exact duration of breastfeeding is known. Censored observations are those in which the child was either still being breastfed at the time of survey or was breastfed until its death. First, probabilities of terminating breastfeeding are computed for each month and from these, life tables are constructed.

Let

N = Number of live births,

N_0 = Number of children ever breastfed,

d_i = Number of children for whom breastfeeding was stopped during the i th month since birth, for $i = 1, 2, \dots$,

c_i = Number of children who were being breastfed at the time of survey with child in the i th month at the time of survey, for $i = 1, 2, \dots$,

w_i = Number of children who were breastfed until death with child in the i th month at the time of death, for $i = 1, 2, \dots$,

Then, N_i = Number of children being breastfed at the end of the i th month since birth,

$$= N_{i-1} - d_i - c_i - w_i \text{ for } i = 1, 2, \dots$$

q_i = Probability of discontinuing breastfeeding during the i th month

$$q_i = \frac{d_i}{[N_{i-1} - 0.5(c_i + w_i)]}, \text{ for } i = 1, 2, \dots, \text{ and}$$

P_i = Proportion continuing breastfeeding at least up to the end of the i th month

$$= (1 - q_i) * P_{i-1}, \text{ for } i = 1, 2, \dots, \text{ where}$$

P_0 = Proportion ever breastfed = N_0/N .

A small adjusted is required if it is reported that a few babies died immediately after birth before breastfeeding could be initiated. If the number of such death is n , then P_0 will be given by $N_0/(N-n)$ instead of N_0/N

From the computed values of P_i , the mean length of breastfeeding can be obtained by a standard life table formula

$$\text{Mean length} = \left[\frac{1}{2}(P_{i,0} + P_{i,48}) + (P_{i,1} + P_{i,2} + \dots + P_{i,47}) \right]$$

5.2.2 Cox's Proportional Hazard Model

The regression models (logistic or multiple linear regression) that are usually used for identifying the covariates of any time dependent variables such as breastfeeding duration

or post-partum amenorrhoea consider only the terminated cases without considering the censored events. Ordinary regression models are, therefore, not suitable for analyzing time dependent censored data. The duration of breastfeeding involved censored cases as a considerable number of women were still continuing to breastfeed their child at the time of survey. In this regards Cox's proportional hazards models is more appropriate for censored observations. This model is employed to allow for the inclusion of periods of observation of censored as well as non-censored cases.

The factors affecting duration of breastfeeding were investigated in a regression using Cox's proportional hazard model (Lawless 1982). Cox (1972) model permits joint estimation of the effects of predicted variables on the "hazard" and can be used to analyze data that contain censored observations. Survival time is treated as the dependent variables and the associated variables as explanatory variables. In brief the Cox proportional hazard model technique is given below:

$$h(t;x) = h_0(t,x) \exp(\beta' X),$$

Where $h_0(t;x)$ represent the base line hazard, t is the survival time, $X = (x_1, x_2, \dots, x_p)$ is a vector of covariate values, $\beta' = (\beta_1, \beta_2, \dots, \beta_p)'$ is a vector of regression parameters. The hazard function allows estimation of the relative risks of women grouped by variable categories, with one group chosen as the reference group, by the exponent of the regression coefficient $\exp(\beta)$. Each exponentiated coefficient, $\exp(\beta)$, represents the effect of the covariate on the hazard function for a certain group. A relative risk of 1.000 was considered to indicate baseline category or reference for each variable. $\exp(\beta)$ becomes unity when there is no covariate present, with values greater (or less) for this

group than that of the reference group. A relative risk greater than 1.000 was taken to indicate higher risks of occurrence of the event than the reference category or vice-versa.

This model permits joint estimation of effects of independent variables on the hazard (the risk of terminating breastfeeding), rather than the duration itself and can be used to analyses data that contain censored observations. The degree of statistical significance of the variables included in the model was calculated by using Wald's test. Moreover, confidence interval (95%) of relative risk showed the level of significance.

5.2.3 Definition of Response and Explanatory Variable

The duration of breastfeeding was defined as the child's age (in months) at the time of complete weaning, regardless of when consumption of other food began. For the children who had died or still being breastfed at the time of the survey, duration of total breastfeeding was considered equal to child's age at death or at the time of the survey., Full or exclusive breast-feeding is defined as baby takes breast milk and plain water only NIPORT (1997).

The dependent variable in this study was the duration of breastfeeding. The dependent variable contained some censored cases and it was measured in completed months. The independent variables, all measured at the survey date, were grouped into two broad categories: demographic and socio-economic variables. Demographic variables included here were age of the respondent, female age at marriage, sex of child, parity of mother, contraceptive use, and delivery status. Socio-economic variables included were place of residence, administrative division (region), education of mother, education of father, working status of mother, and religion. Dependent and all other explanatory variables

used for breastfeeding multivariate analysis are grouped into categories as shown in Table 5.1

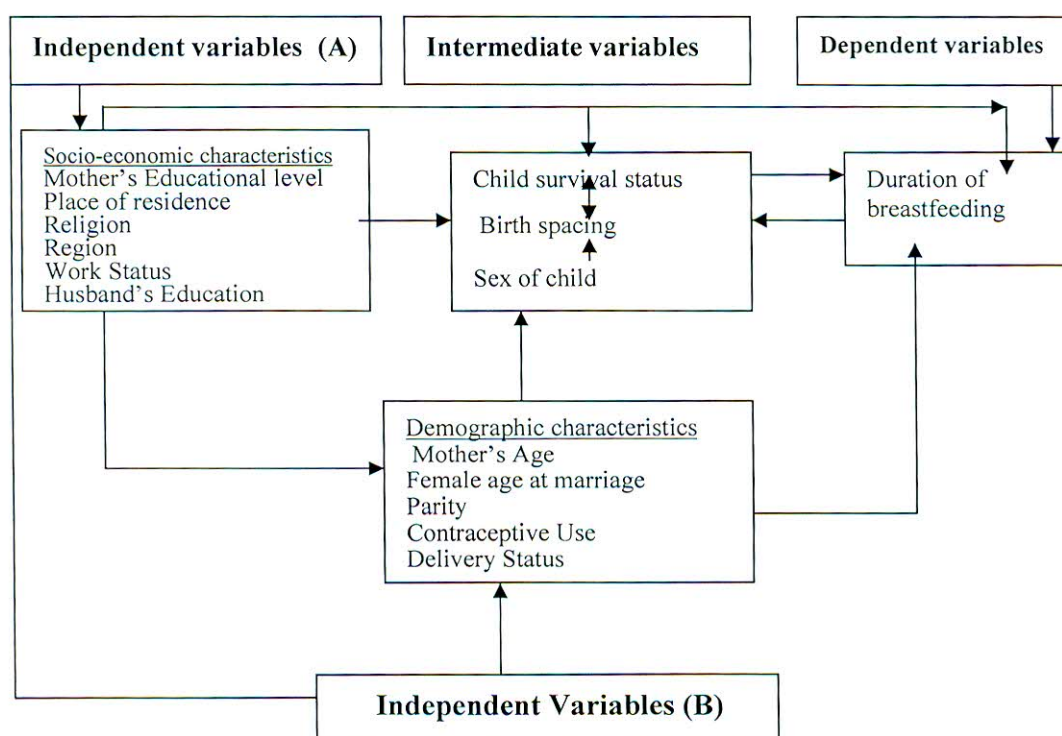
Table 5.1: List of dependent and explanatory variables with their category levels used in Cox proportional hazard model

Characteristics	Level
Dependent variable	Duration of breastfeeding in months
Independent variables	
Place of Residence	1= Urban 0= Rural
Division	1= Barisal 2= Chittagong 3= Dhaka 4= Khulna 5= Rajshahi 0= Sylhet
Mothers Education	1= No education 2= Primary 3= Secondary 0= Higher
Respondent Work Status	1= Working 0= Not-working
Husband Education	1= No education 2= Primary 0= Secondary and Higher
Religion	1= Muslims 0= Non-Muslims
Age of mother (years)	1= <=24 2= 25-34 0= 35 and above
Female age at marriage (years)	1= <=14 2= 15-19 3= 20-24 0= 25 and above
Sex of Previous Child	1= Male 0= Female
Parity	1= 1 2= 2 3= 3-5 0= 6 and above
Contraceptive Use	1= Never used 0= Ever Used
Delivery Status	1= Normal 0 = caesarean

5.2.4 Conceptual Framework

However, our reading of numerous studies and the realization of the methodological issues guided the formulation on the interrelationship of some factors and duration of breastfeeding. Shah and Khanna (1990) present a frame work and show the interrelationship among a number of factors that need to be considered in examining the infant health and survival status. Here we modified the framework and showing the relationship between socio-demographic factors and duration of breast feeding. The framework presented in figure shows the interrelationships among a number of factors that need to be considered in examining the duration of breastfeeding.

A framework for the interrelationship among socio-demographic factors and duration of breastfeeding



Socio-demographic factors are common causes that influence a mother's decision to breastfeed her new born baby as well as the duration of breast-feeding. These factors are

mother's age, age at marriage, parity, contraceptive use, delivery status, education, place of residence, religion, region, work status and husband's education. There are two sets of factors have been termed as "independent" variables owing to their direct influence on other "intermediate" and "dependent" variables listed in framework.

There are three main intermediate variables: namely, child survival status, birth spacing and sex of child. The independent variables mentioned above (column A & B) affect the child survival status which in turn affects the birth interval and sex of child. If the women would likely to decide fully breast-feed her newborn child, she have delayed next child and, consequently, the duration of breast-feeding lengthened. Therefore, all of three factors can influence and elongated the duration of breastfeeding individually as well as in coalition.

5.3 Pattern of Breastfeeding

The differential patterns of breastfeeding durations by selected socio-demographic characteristics are displayed in Table 5.2. The durations increase up to 48 months as a whole for all cases.

Table 5.2 shows that little portion of mother weaning their child (0-12) month and a mere (36-48) month. The highest portions of mothers (42.3%) are in the age group 25 years and above who breastfeed their child (24-36) month. More than half of the mothers of the age group below 24 year and (25-34) year breastfeed their child (0-12) months and (12-24) months respectively. For women whose current age was less than 24 years maximum (36.8%) of them breastfeed in the duration (12-24) months, and for women of age group (24-34) years highest portion (38.8%) feed them in the duration (24-36) months.

Table 5.2: Percentage distribution of breastfeeding (in months) by different socio-demographic characteristics, Bangladesh

Characteristics	Duration of breastfeeding			
	0-12	12-24	24-36	36-48
Current age				
<=24	21.5	36.8	34.1	7.7
25-34	19.4	34.1	38.8	7.7
35 and above	20.5	33.5	42.3	3.8
Age at marriage				
<=14	19.0	33.8	39.2	8.0
15-19	19.7	36.8	36.9	6.6
20-24	29.7	36.0	28.8	5.4
25 and above	47.4	10.5	42.1	0.0
Residence				
Urban	25.0	35.8	34.0	5.1
Rural	17.7	34.5	39.5	8.3
Region				
Barisal	14.9	33.3	45.1	6.7
Chittagong	15.3	52.0	30.2	2.4
Dhaka	30.1	27.7	33.8	8.4
Khulna	19.1	24.5	46.6	9.8
Rajshahi	15.5	28.6	44.0	11.9
Sylhet	28.6	36.6	31.1	3.7
Religion				
Muslim	20.3	35.5	37.5	6.7
Non-Muslim	21.2	28.0	38.1	12.7
Educational level				
Illiterate	21.5	34.4	36.2	7.9
Primary	15.9	35.1	41.1	7.9
Secondary	20.6	37.7	36.2	5.5
Higher	31.4	26.3	34.7	7.6
Parity				
1	25.5	31.6	34.1	8.8
2	15.8	36.5	40.3	7.3
3-5	19.8	35.6	37.1	7.4
6 and above	20.8	37.0	40.1	2.1
Women work status				
Not working	20.2	36.2	36.8	6.8
Working	20.8	30.6	40.3	8.3
Contraceptive use				
Never used	35.2	35.2	25.1	4.5
Used	18.4	35.0	39.2	7.5
Delivery Status				
Normal	19.2	35.4	38.2	7.3
Caesarean	42.5	27.5	25.0	5.0

If we consider age at marriage of the mothers, we see that the mothers whose age at marriage was less than 14 years, the highest portion (39.2%) of mothers breastfeed their children (24-36) months. For mother whose age at marriage is 25 years and over,

maximum (47.4%) of them breastfeed their children (0-12) months. So from Table 5.2 we see that for lower age at marriage the duration of breastfeeding is higher, and for upper age at marriage it is lower.

Among urban mothers nearly one third (34.0%) of mothers breastfeed their babies within the intervals (24-36) months, but incase of rural mothers about 39.5 percent carry this period. So, rural mothers breast-feed their babies more durations than urban mother. If differential pattern of breast-feeding is seen by region wise we see from Table 5.2 that in every region more than one third mother breastfeed their children up to 36 months. In Khulna division it is highest percentage (46.6%) and lowest in Chittagong division (30.2%) in the interval 24-36 months. Incase of religion Muslim mother breastfeed their children (35.5%) with in interval (12-24) months, than non-Muslim mothers (28.0%). But incase of duration (24-36) months the percentage is 37.5 for Muslim and 38.1 for non-Muslim . So, Non-Muslim mother breast-feed more duration than Muslim mother.

More than one-third mother continues breastfeeding up to 36 months, in all education level. For higher educated mothers the duration of breastfeeding is higher for about one year, but less among other category. In average, higher educated mother breast feed their children less time period as compared with illiterate mother and other educational category. If we consider parity of women we see that for all parity highest portions are breastfeed with in the duration 24-36 months, the second highest portion lying between duration 12 to 24 months and third portion lying between durations 0 to12 months. A few parity breast feed (36-48) months by their mother. Finally we can say that maximum parity breast feed (12-36) months by their mother.

From Table 5.2 it is found that working mother breastfeed highest portion (40.3%) during the interval (24-36) months. For non-working mother it is found that 36.2%women breastfeed during 12-24 months and 36.8% for 24-36 months and lowest percent of

mother breastfeed in the duration 0-12 and 36-48 months. About one-third (35.2%) of the contraceptive non-user mothers terminated breastfeeding within 12 months as compared with only 18.4% doing so among women who use contraceptive. Among contraceptive using women 39.2% breastfeed up to the interval 24-36 months. The same table indicate that the duration of breastfeeding is higher among normal delivery type women as compared with caesarean women. For caesarean women the highest portion (42.5%) shows duration of breast feeding to be (0-12) months whereas for normal delivery type women the highest portion (38.2%) shows breastfeeding duration to be (24-36) months.

5.4 Distribution of Breastfeeding

Figure 5.1 provides information on distribution of the breastfeeding duration for the mother of the last child

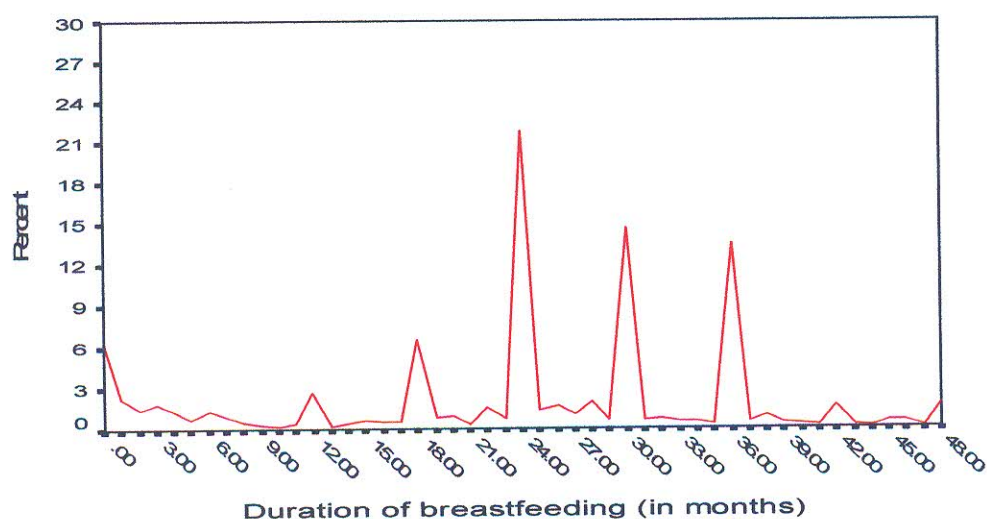


Figure 5.1: Percentage distribution of women by reported duration of breastfeeding

The Figure 5.1 provides the information of breastfeeding distribution of the reproductive women for last child in Bangladesh. The figure depict that heaping occurs in every multiple of 6 months and in crown heaping happened in 24 months and the months 30 and 36 exhibits the same heaping pattern but at lower extent.

5.5 Mean Duration of Breastfeeding

Table 5.3 presents a life table analysis of the duration of breastfeeding for each parity of women in Bangladesh. Since data on breastfeeding were available only for the last child and a considerable number of women were continuing to breastfeed their children at the

time of the survey, it was necessary to have recourse to the life table technique for the analysis of the lactation length.

Table 5.3: Life table estimate for probability of continuing breastfeeding at different months (0 up to 48 months) by parity, Bangladesh

Months	parity 1	parity 2	parity 3	Parity 4	Parity 5	Parity 6+	Overall
0	0.974975	0.985999	0.983531	0.98546	0.980309	0.968531	0.980128
1	0.964265	0.981458	0.974089	0.980521	0.974517	0.9631	0.972705
2	0.961514	0.976812	0.967652	0.975432	0.968539	0.957539	0.968018
3	0.954399	0.970467	0.965439	0.968439	0.962379	0.948058	0.961785
4	0.950011	0.963124	0.96315	0.964872	0.959209	0.944185	0.957238
5	0.948505	0.962282	0.958423	0.963047	0.946001	0.94222	0.954473
6	0.944604	0.958814	0.951153	0.957415	0.935792	0.940221	0.949654
7	0.93895	0.957037	0.948681	0.951624	0.935792	0.938182	0.946282
8	0.936447	0.956127	0.946151	0.951624	0.928743	0.936108	0.944207
9	0.935588	0.954275	0.944864	0.951624	0.92515	0.933995	0.942794
10	0.93471	0.954275	0.943558	0.951624	0.921493	0.933995	0.942073
11	0.931115	0.954275	0.942222	0.951624	0.914077	0.933995	0.940349
12	0.919107	0.941264	0.933975	0.93198	0.910300	0.924916	0.928704
13	0.919107	0.940229	0.932568	0.929721	0.910300	0.922560	0.927659
14	0.917125	0.937015	0.932568	0.929721	0.906316	0.920113	0.925768
15	0.916096	0.933698	0.931081	0.922391	0.906316	0.915036	0.922968
16	0.915033	0.929126	0.929533	0.922391	0.906316	0.909755	0.920647
17	0.913929	0.926755	0.927921	0.919778	0.893085	0.907027	0.917937
18	0.887388	0.888551	0.896211	0.885019	0.851003	0.862166	0.883209
19	0.882594	0.883484	0.88761	0.885019	0.851003	0.859278	0.878687
20	0.878878	0.878276	0.882295	0.879391	0.846026	0.850480	0.87338
21	0.877597	0.875600	0.882295	0.873662	0.846026	0.850480	0.871678
22	0.872302	0.867410	0.867357	0.859076	0.840851	0.844383	0.862605
23	0.866777	0.860410	0.861568	0.856072	0.840851	0.844383	0.857928
24	0.732979	0.717609	0.705465	0.726076	0.748629	0.709795	0.719745
25	0.722257	0.711560	0.699157	0.708911	0.737067	0.703083	0.710655
26	0.707811	0.700404	0.690179	0.694104	0.724731	0.696087	0.69895
27	0.694329	0.688675	0.687762	0.694104	0.711494	0.696087	0.690995
28	0.674568	0.667403	0.674978	0.681709	0.704519	0.692251	0.67554
29	0.670691	0.659977	0.672305	0.677325	0.690141	0.688215	0.670097
30	0.550999	0.537369	0.55185	0.534972	0.600122	0.523550	0.54194
31	0.544387	0.529363	0.548915	0.530174	0.592067	0.519094	0.535913
32	0.544387	0.516709	0.533539	0.530174	0.583424	0.514460	0.528397
33	0.541901	0.516709	0.520406	0.530174	0.574014	0.504798	0.523535
34	0.536728	0.512116	0.509998	0.525002	0.563854	0.504798	0.517807
35	0.534003	0.512116	0.506355	0.514287	0.553315	0.499399	0.513801
36	0.403405	0.333002	0.346658	0.349275	0.402899	0.338878	0.352442
37	0.39395	0.330272	0.342431	0.34355	0.380823	0.338878	0.346306
38	0.380307	0.318317	0.337803	0.325468	0.346719	0.338878	0.333789
39	0.365749	0.315085	0.332646	0.325468	0.334553	0.338878	0.327396
40	0.358208	0.30816	0.332646	0.311162	0.334553	0.338878	0.321416
41	0.350378	0.30816	0.325857	0.311162	0.319346	0.338878	0.317065
42	0.321524	0.276554	0.27627	0.285587	0.30297	0.315097	0.284605
43	0.317058	0.276554	0.261337	0.285587	0.30297	0.315097	0.280794
44	0.31229	0.276554	0.261337	0.275566	0.30297	0.315097	0.278
45	0.302297	0.276554	0.241613	0.255154	0.282075	0.298513	0.265913
46	0.291873	0.259448	0.241613	0.232474	0.282075	0.280421	0.252533
47	0.291873	0.246475	0.241613	0.232474	0.282075	0.280421	0.248792
48	0.232909	0.161969	0.170551	0.201477	0.255211	0.280421	0.186071
Mean	32.42	32.04	32.05	32.09	32.29	31.82	31.99

Figure 5.2: Survival functions of continuing breastfeeding by different parities of mother

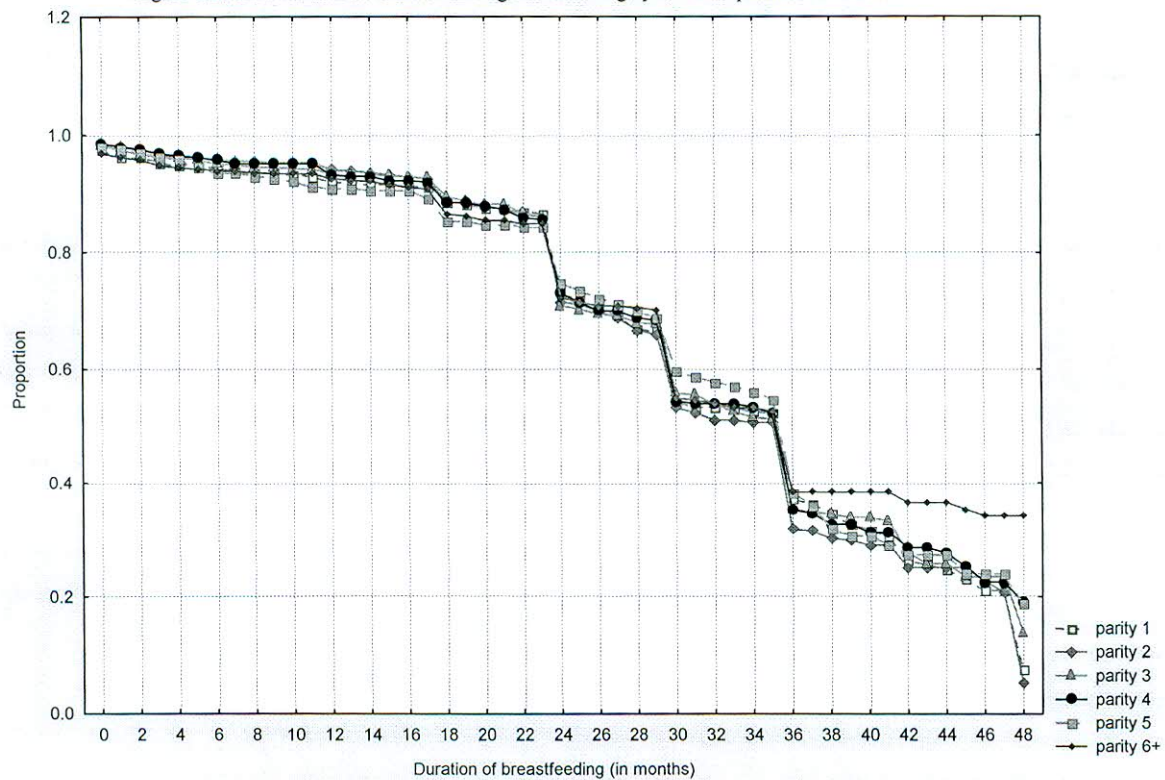
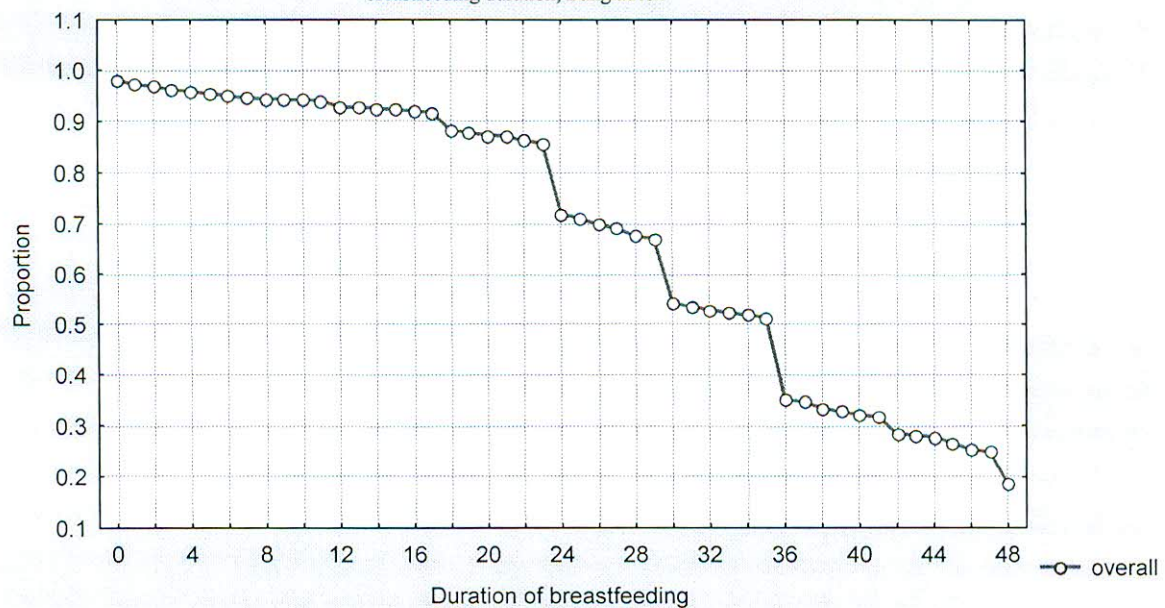


Figure 5.3: Survival function for women who were continuing breastfeeding at different months of breastfeeding duration, Bangladesh



Studies on a few characteristics of breastfeeding differentials using World Fertility Survey (WFS) and 1976 BFS data were performed by Ferry and Smith (1983) and Ahmed (1986), respectively; and 1989 BFS data were performed by Mannan H.R (1995); and 1999-2000 BDHS data by Giashuddin M S & M Kabir (2004). Two other studies of limited scope were carried out using data from rural areas of Bangladesh by Huffman and others (1980) and Nessa and others (1987). The results of the present study are compared with those from previous studies. This comparison are made to indicate any change in breast feeding patterns in Bangladesh, although the values of the means may vary owing to differences in the source of data used and techniques employed (ferry and Smith 1983). Table 5.3 provides the values, which indicates probability of a mother of parity i continuing to breast feed the child at x months after the birth of the child. The life tables mean values have also been calculated by standard procedure which has been described in analytical methods. From Table 5.3 it is observed that the mean duration of breast-feeding is about 31.99 months for all parity in Bangladesh. Giashuddin and Kabir (2004) obtained average duration of breastfeeding for surviving children as 31.3 months which is very close to this study. As compared to South Asian countries (India, Pakistan and Srilanka) where average duration of breastfeeding was 18.4 months, 21.8 months and 23.2 months respectively. Breastfeeding duration is relatively longer in Bangladesh (Rajaretnam 1994, Page et al. 1982 and Mahler 1996). Table 5.3 also shows that the mean length of breastfeeding is comparatively higher for parity one and is lowest for parity two and it increases there after as compared with parity two. The duration of breastfeeding are decreasing from the following parity two due to short birth spacing and lack of breastfeeding practice. For parity one the mean length of breastfeeding is 32.42 months and it decrease a little bit in parity two which is 32.04, and afterwards it is increasing. For

parity three the mean length is 32.05 months, for parity four it is 32.29 months, for parity five it is 32.29 months, and for parity six and above it is 31.82 months respectively.

From the Table 5.3 it is observed that the probability of a mother of each parity continue to breast feed their child is highest for 0 months and it is about 98% and gradually decrease the percentage as time duration (months) increases (shown in Table 5.3 and Figure 5.2). A sudden decrease is observed after 23 months that is 73% for parity 1, and lowest for parity 3 and parity 6 and above which is 71%. This sudden decrease may due to because most of the respondents are Muslim in our study area and in a Muslim community there is a tendency to breastfeed their children up to 2 years and maximum up to 2 and $\frac{1}{2}$ years. So we observe that at 36 months the probability of continuing breast-feeds is only 34.63% for combined parity.

Figure 5.3 illustrates the patterns for continuation of breastfeeding for all women in the study. As we can see, the survival function decreased steadily up to 23 months; after that point the function decreased substantially with fluctuations. The survival curve indicated that about 68 percent women weaning their child within 36 months.

5.6 Differentials of Breastfeeding: Life Table Analysis

So far the results of breastfeeding differentials have been discussed only on the basis of the differences in the mean values of certain characteristics. A complimentary but statistically more powerful method of comparison is the use of the chi-square test for the survival distributions for the different subgroups of a broad category (Lee and Desu, 1972). The differences in the survival distributions for the different subgroups of a variable based on the chi-square test are given in Table 5.4. The results show that the differences between survival distributions are highly significant ($p < 0.001$) for the following variables: place of residence,

administrative division, contraceptive use and type of delivery. The differences in the variables age at marriage, mother's education, husband's education, parity ($p < 0.01$) and religion ($p < 0.05$) are also significant.

Table 5.4: Mean duration of breastfeeding by different socio-demographic characteristics based on life table technique, Bangladesh

Characteristics	Level	Number	Mean	Cal. χ^2	p value
Mother's Age (years)	≤ 24 25-34 35 and above	2659 2217 579	32.69 31.42 31.63	$\chi^2 = 9.93$ d.f=6	0.128
Age at marriage (years)	≤ 14 15-19 20-24 25+	2745 2337 323 50	32.70 31.49 30.53 28.85	$\chi^2 = 22.70$ d.f=9	0.007
Sex of Previous Child	Male Female	2774 2681	32.00 31.99	$\chi^2 = 0.674$ d.f= 3	0.879
Parity	1 2 3-5 6 and above	1529 1375 1967 584	32.42 32.04 32.13 31.82	$\chi^2 = 23.66$ d.f=9	0.005
Place of Residence	Urban Rural	1707 3749	30.51 32.71	$\chi^2 = 18.82$ d.f= 3	0.000
Division	Barisal Chittagong Dhaka Khulna Rajshahi Sylhet	619 1129 1224 725 1101 657	32.83 27.78 32.25 33.79 33.72 32.16	$\chi^2 = 135.91$ d.f= 15	0.000
Mothers Education	No education Primary Secondary Higher	1924 1675 1524 338	32.60 32.96 30.71 29.90	$\chi^2 = 20.91$ d.f= 3	0.013
Respondent Work Status	Working Not-working	998 4457	32.25 31.90	$\chi^2 = 4.44$ d.f= 3	0.218
Husband Education	No education Primary Secondary & Higher	2035 1466 1954	33.01 32.35 30.65	$\chi^2 = 18.99$ d.f= 6	0.004
Religion	Muslims Non-Muslims	4962 493	31.53 36.13	$\chi^2 = 7.33$ d.f= 3	0.062
Contraceptive Use	Not use Currently use	917 4538	31.47 32.13	$\chi^2 = 35.87$ d.f= 3	0.000
Delivery status	Normal caesarian	5189 266	32.13 30.12	$\chi^2 = 29.38$ d.f=6	0.000
Bangladesh	Bangladesh	5455	31.99	-	-

The average duration of breast-feeding in Bangladesh for surviving children is 31.99 months. While Mannan and Islam (1995) found to the mean duration of breastfeeding is 28.2 months, Ferry and Smith (1983) found duration to be 28.9 months, Ahamed (1986) using the prevalence/incidence method found it to be 27.3 months and Nessa and others (1987) found it to be 26.4 months for all children. Huffman and others (1980) found the median duration to be 32.0 months for surviving children. Most recently Giashuddin & Kabir (2004) found the mean duration of breastfeeding to be 31.3 months and Sabina et al (2006) found 26.4 months. The mean duration of breast feeding found by other Bangladesh studies was between 22 to 34 months (Nessa et al, 1987; Mannan and Islam, 1995).

Mother's age showed a insignificant association with duration of breastfeeding. It reveals that mean duration of breast feeding is comparatively higher among younger (<25 years) than women aged after 25 years. The mean duration of breastfeeding is 32.69 months for younger age group women, 31.42 months for middle aged women and 31.63 months for older (35 and above) women. In Figure 5.4 the effect of current age of mother on the duration of breastfeeding are shown. Women who were older (35 years and over) have the faster termination of breastfeeding during the first 30 months than less 34 years of mother. The survival curves decreased tediously up to 24 months; after that point the rate of decreases of the survival function tends to slow down dramatically. The survival curve for women with age ≤ 24 years have to terminating breastfeeding comparatively lower than other functions.

From Table 5.4 it is observed that age at marriage also shows significant association with duration of breast feeding. The mean duration of breast feeding is highest (32.70 months) for mother whose age at marriage is less than 14 years. For women with age at marriage

15-19, 20-24 and 25+ the mean age at marriage is 31.49, 30.53 and 28.85 months respectively. Thus we see that when age at marriage increases the mean duration of breastfeeding decreases. Figure 5.5 also divulge a decreasing trend of breastfeeding and it is observed clearly from the figure that it is higher for age at marriage group ≤ 14 years and the line graph shows a comparatively lower than each other trend for different higher age at marriage group women.

The analyzing data provide no evidence in a marked differential in breast feeding duration by sex of the previous child as they show insignificant result. From Table 5.4 it is found that the average duration of breast feeding is 32.00 months for male children and 31.99 months for female children, but the difference is marginal. Mannan and Islam (1995) found the average duration of breastfeeding to be 28.3 and 28.1 months for male and female children respectively. Giashuddin and kabir (2004) found the average duration to be 30.50 and 30.25 months and Sabina Islam and others (2006) found the duration to be 30.6 and 30.8 months respectively or male and female children. Thus it is well recognized that for all the study the difference is quite marginal. The quite lack of variability in breastfeeding pattern can be justified by observing at Figure 5.6. The survival functions have completely the same shape and most points of intersection; that is, they are not clearly differentiated.

Parity demonstrates a significant variation with duration of breast feeding at 5% level of significance. From the table we observe that women with parity one have an average duration of 32.42 months, women with parity two have 32.04 months, women with parity 3-5 have 32.13 months average duration of breastfeeding, which decrease to 31.82 months for those who were reported to have 6 and above children.

Place of residence showed strong significant variation for the duration of breastfeeding. As may be expected, urban women were found to breast-feed for a relatively shorter duration, i.e. 30.51 months, compared with rural women who breast-feed for 32.71 months on average. Ferry and Smith (1983) found these durations to be 26.0 and 29.2 months for urban and rural women, respectively; Ahamed (1986) found that the average durations were 24.0 and 27.6 months, Mannan and Islam (1995) found 27.1 months and 28.6 months, Giashuddin & Kabir (2004) was found 33.3 and 29.7 months, respectively. In Figure 5.8 the survival functions for breastfeeding are shown for women who live in rural and in urban areas. As we expected, the functions decrease minimally up to 24 months but later 24 months the functions decrease dramatically and mother who live in urban areas terminate breastfeeding faster than those their rural counterparts. According to the same figure exhibit that about 70 percent urban mothers terminate breastfeeding after 36 months while among rural mother about 60 percent do so.

Administrative divisions have also showed strong significant variation on the mean duration of breastfeeding. Among the six administrative divisions of Bangladesh, the average duration of breast-feeding has been lowest in Chittagong division (27.78 months) and highest in Rajshahi division (33.72 months), while it is 32.25 and 32.16 months, in Dhaka and Khulna divisions respectively. Mannan and Islam (1995) found the same pattern of breast feeding durations for the four administrative divisions. According to his study the average duration of breastfeeding in Chittagong division is 27.4 months in Dhaka division it is 28.0 months, in Khulna division it is 28.8 months and in Rajshahi division it is 28.9 months respectively.

It is observed that education of respondents showed significant association with duration of breastfeeding. The respondent having no education breast feed on the average for

32.60 months which is nearly same for secondary educated mother i.e. 32.96 months. For secondary and higher educated mother the duration of breast feeding is comparatively lower. For secondary educated mother it is 30.71 months and for higher educated mothers it is 29.90 months. Thus the duration of breastfeeding is found to be shorter among secondary and higher educated mother than among those have primary or no educated mothers. Grummer-Strawn (1996) in his study was found to be shorter duration of breastfeeding for higher educated mother in the developing countries but Vestermark et al. (1991) found reverse results in case of industrial countries. In Figure 5.10 the effect of mother's education on the duration of breastfeeding. The survival functions indicated that there is markedly difference in the duration of breastfeeding for higher educated mother than no and primary educated mothers. The of most proportion e.g. about 70 percent of secondary and higher educated mother terminating breastfeeding in 24 months while in the no educated or primary educated mother showed lowest proportion amounting of 20 percent stop breastfeed their child after delivery.

Though the work status of the respondent shows insignificant results it reveals from Table 5.4 that working women breast feed for slightly longer duration (32.25 months) as compared with non-working women. The survival functions showed that basically there little difference among working and non-working women on the duration of breastfeeding (Figure 5.11).

Education of husband also showed significant results on duration of breast feeding pattern. The study demonstrates inverse relationship and shows a decrease in the month of breast feeding. For women having husband with no education the duration to be 33.01 months, with primary education the duration to be 32.35 months and with secondary and higher education the duration to 30.65 months respectively. Ahmed (1986), Huffman and

others (1980), Nessa and others (1987), and Mannan and Islam (1995) also found similar association.

Religion of respondents shows significant variation on duration of breast feeding. The differential in breast feeding duration by religion shows that the duration is higher among non-Muslim mother (36.13 months) than Muslim mother (31.53 months). In various studies of Bangladesh Sabina Islam and others (2006), Manna and Islam (1995) also found that Non-Muslim women have longer duration of breast feeding than Muslim women. Figure 5.13 divulged that the Muslim mothers have lower proportion with regard to different interval for continuing breastfeeding. According to the same figure, we see that about 49 percent Muslim mother terminating breastfeeding in 30 months while Non-Muslim mother have 29 percent breastfeeding. The survival functions decreased steadily up to 12 months and in subsequent duration mother who Muslim terminate breastfeeding faster than those of non-Muslim mother. The most people residence in Bangladesh is Muslim and the remaining parts are Hindu, Christian, Baddish and others. Mother would be breastfeed their child up to 24 months for male and 30 months for female according to Muslim religion (Holly Quarn). The proportion of terminating breastfeeding is decline unprecedently after 24 months due to religious restriction.

Contraceptive use showed a strong association with duration of breastfeeding at 1% level of significance. As we expected, there is significant variation of the mean duration of breastfeeding among contraceptive user and non user women. The results indicated that the average duration of breastfeeding is 31.47 months for mothers who do not using contraception whereas those using contraception the average duration for breastfeeding is 32.13 months. Mannan and Islam (1995) found that those who were using contraception breastfeed on average for 28.3 months whereas those not currently using contraception

breastfeed for 28.1 months. Figure 5.14 showed the proportion of women continuing breastfeeding for user or non-user group decreased tediously and there is quite difference of their survival functions of breastfeeding.

Delivery status of mother shows a strong significant variation on the mean duration of breast feeding. From the table we observe that the mean duration of breast feeding is comparatively lower among caesarean delivery type women (30.12 months) as compared with women with normal delivery type (32.13). In Figure 5.15, shows that the breastfeeding survival functions for groups of women are quite different from each other, and it is clear that women who delivered their child in normal cases, in fact faster continuing of breastfeeding up to 36 months; after that point lower trend of continuing breastfeeding as compared to the caesarean women.

5.7 Determinants of Breastfeeding: Proportional Hazard Estimates

The simultaneous and independent effects that the covariates considered in the analysis have the termination of breastfeeding can be assessed through the proportional hazard model. The coefficients associated with the covariates describe the relationship between them and the risk of terminating breastfeeding at every time t . If their interpretation as a value is rather sophisticated, but their signs give us sufficient information about the direction in which the risk is changing. A positive coefficient indicates an increase in the risk of terminating breastfeeding, and a negative coefficient means a decrease in the risk.

Hazard regression models were fitted under three different specifications. The results for these models-formed by excluding and including some of the variables in each cases- are presented in Tables 5.5, 5.6, and 5.7. The Model 1 (Table 5.5) estimates the effects of demographic variables including age of mother, female's age at marriage, sex of last child, parity of women, contraception and type of delivery status on the duration of breastfeeding. The Model 2 (Table 5.6) estimates the effects of socio-economic variables namely place of residence, administrative division, mother's education, mother's working status, father's education and religion on the duration of breastfeeding. Finally, the Model

3 (Table 5.7) is estimated the effects both demographic and socio-economic variables simultaneously on the duration of breastfeeding in the study.

5.7.1 Model 1: The effect of demographic variables on breastfeeding

Model 1 estimates the effect of age of mother, mother's age at marriage, sex of child, parity, contraceptives use, and delivery type of mother on duration of breast feeding. In the same **Model** indicate that all these covariates have significant effects on the risk of duration of breastfeeding except sex of the last child.

Table 5.5: Cox proportional hazard model estimates of relative risk of demographic characteristics on breastfeeding. **Model 1**

Explanatory variables	Coefficient (β)	S.E	Wald χ^2	P value	Odds ratio	95% CI
Mother's age* (Years)						
<=24	0.783	0.067	135.33	0.000	2.188	1.918-2.497
25-34	0.336	0.057	34.46	0.000	1.399	1.251-1.565
(35+)	...	...	...	...	1.000	
Age at marriage* (Yrs)						
<=14	-0.633	0.152	17.44	0.000	0.531	0.394-0.715
15-19	-0.513	0.151	11.63	0.001	0.599	0.446-0.804
20-24	-0.377	0.158	5.67	0.017	0.686	0.503-0.936
(25+)	...	...	...	...	1.000	
Sex of Child						
Male	-0.030	0.028	1.14	0.286	0.971	0.919-1.025
Female	...	...	...	...	1.000	
Parity*						
1	-0.480	0.072	44.39	0.000	0.619	0.537-0.713
2	-0.401	0.067	36.08	0.000	0.670	0.587-0.763
3-5	-0.132	0.058	5.20	0.023	0.877	0.783-0.982
(6+)	...	...	...	...	1.000	
Contraceptives use*						
Never used	0.356	0.039	83.33	0.000	1.427	1.322-1.541
(Used)	...	...	...	...	1.000	
Delivery status*						
Normal	-0.302	0.068	19.52	0.000	0.739	0.648-0.844
(Caesarean)	...	...	...	...	1.000	
Log-likelihood	: 77301.554					
Model Chi-square	: 294.909					
Degrees of freedom (d.f)	: 11					
P	: 0.000					
*at 1% level of significant						

Note: Reference category is in the parenthesis (...), $p < 0.01$, $p < 0.05$, $p < 0.10$ and $p < 0.20$

From Table 5.5, we observed that age of mother is strongly associated with the termination of breastfeeding. The relative risk of termination of breastfeeding is 2.188 times and 1.399 times higher for current age group less than 20 years and (25-34) years respectively as compared with mothers age group 35 and above. Mother's in the age group (25-34) years have a significantly lower hazard of termination of breastfeeding than those of mother aged ≤ 20 years. This means that older women are likely to have longer duration of breastfeeding than their younger counterparts. These findings support the results of Mannan and Islam (1995) where they showed that the relative risk of weaning for older women is lower than their younger counterparts.

Female age at marriage has a negative and significant effect on the risk of termination of breastfeeding. Women with age at marriage ≤ 14 years, (15-19) years and (20-24) years are 0.531, 0.599, 0.686 times less likely weaning than women whose age at marriage 25 years and above. Thus, we see that increasing age at marriage with decreasing the duration of breastfeeding practice.

Table 5.5 shows that parity has also a negative and significant effect on the termination of breastfeeding. The results reveals that women with parity 1, 2 and (3-5) are 0.619, 0.670, and 0.877 times less likely to terminate the breastfeeding than 6 and above parity of women. Thus we may conclude that increase in parity is associated with a decrease in probability of weaning, which means that women with higher parity associated with extended duration of breastfeeding. Use of contraception shows a positive and highly significant effect on the risk of termination of breastfeeding. The relative risk of termination of breastfeeding is 1.427 times higher for women with not using contraception than women with using contraception. This means that Women who are not currently using any contraception tend to breastfeed their children shorter than their user counterparts. The type of delivery status of mother shows a negative significant effect on duration of breast feeding. Mother who delivery their child in normal way is 0.739 times

less likely to terminate breastfeeding than the mothers who delivery their child in caesarean section.

5.7.2 Model 2: The effect of socio-economic variables on breastfeeding

Table 5.6 shows the hazards coefficients and hazards model estimates of relative risk of termination of breastfeeding for each socio-economic covariate. Among the included variables all are statistically significant except place of residence and husband's education.

Table 5.6: Cox proportional hazard model estimates of relative risk of socio-economic characteristics on breastfeeding. **Model 2**

Explanatory variables	Coefficient (β)	S.E	Wald	P value	Odds ratio	95% CI
Residence						
Urban	-0.002	0.031	0.005	0.946	0.998	0.939-1.060
(Rural)	...	...	...	...	1.000	
Region*						
Barisal	-0.250	0.059	18.03	0.000	0.779	0.694-0.874
Chittagong	0.054	0.052	1.11	0.293	1.056	0.954-1.168
Dhaka	-0.197	0.051	14.75	0.000	0.822	0.743-0.908
Khulna	-0.213	0.056	14.30	0.000	0.808	0.723-0.902
Rajshahi	-0.266	0.052	25.98	0.000	0.766	0.692-0.849
(Sylhet)	...	...	...	...	1.000	
Religion*						
Muslim	0.282	0.050	32.18	0.000	1.325	1.202-1.461
(Non-Muslim)	...	...	...	...	1.000	
Educational level*						
Illiterate	-0.267	0.069	14.91	0.000	0.766	0.669-0.877
Primary	-0.208	0.066	9.86	0.002	0.812	0.713-0.925
Secondary	-0.093	0.063	2.18	0.140	0.911	0.806-1.031
(Higher)	...	...	...	...	1.000	
Work Status*						
Not work	0.167	0.037	20.14	0.000	1.781	1.098-1.271
(Work)	...	...	...	...	1.000	
Husband education						
Illiterate	0.020	0.040	0.243	0.622	1.020	0.943-1.104
Primary	0.003	0.040	0.004	.950	1.003	0.928-1.084
(Secondary & Higher)	...	...	...	...	1.000	
Log-likelihood	: 77427.23					
Model Chi-square	: 161.773					
Degrees of freedom (d.f)	: 13					
P	: 0.000					
*at 1% level of significant						

Note: Reference category is in the parenthesis (...), $p < 0.01$, $p < 0.05$, $p < .10$ and $p < .20$

From Table 5.6, we observed that administrative division has a significant effect on the risk of termination of breastfeeding except Chittagong division. The result shows that women of Chittagong are 1.056 times more likely to terminate breastfeeding than women of sylhet division. But women of Barisal, Dhaka, Khulna and Rajshahi divisions are 0.779, 1.056, 0.822, 0.808 and 0.766 times less likely to terminate breastfeeding than women of Sylhet division. This means that women of Barisal, Dhaka, Khulna and Rajshahi divisions have longer duration of breast feeding than Sylhet division.

As shown in Table 5.6, religion has a significant effect on the risk of termination of breastfeeding at 1% level. The probabilities of weaning of Muslim mothers are 1.325 times higher than the Non-Muslim mothers. Thus non-Muslim mother breast feed longer time than Muslim mother.

The education of mother is found to have negative and significant effect on termination of breastfeeding. The risk of termination of breastfeeding with illiterate, primary and secondary educated mothers are 0.766, 0.812 and 0.911 times lower than mother with higher education. Thus, we say that increasing the level of education of mother with decreasing duration of breastfeeding. Mannan and Islam (1995) and Tu ping (1990) are found that education had a negative impact on the duration of breastfeeding.

The mother's occupation is strongly associated with the duration of breastfeeding when all the other demographic covariates included in the study are controlled. Working status of mothers has highly significant and positive effect on the probability of weaning. The result indicates that women who do not work aside from home are 1.781 times more likely to terminate breastfeeding than their working counterparts. Children born to a mother who has a non-agricultural occupation are breastfeed for a significantly shorter period of time than children born to a mother who is an agricultural worker or has never

worked outside the home (Tu Ping, 1990). Currently working women were breastfeed for a slightly longer duration as compared with their non-working counterparts (Mannan and Islam 1995; Ahamad 1986; Sivakami, 2003). Education of husband shows no significant effect on duration of breastfeeding.

5.7.3 Model 3: The effect of socio-demographic variables on breastfeeding

Finally, in Model 3 all twelve covariates are considered together to observe the simultaneous effect of all the factors. It can be seen that sex of child, place of residence and husband's education does not have significant net effects on the length of breastfeeding in this full model. Model 3 is obtained by adding model 2 and model 1.

Both demographic and socio-economic variables are taken into account in the third model (Table 5.7). The improvement of the fit is considerable, in the first model the value of model chi-square is 294.91 and in the second model it is 161.773, but when combining these variables the model chi-square value increases to 405.96 which are highly significant. The model 1 is comparatively the best fitted model among the three models. So, demographic covariates influence remarkable on breastfeeding duration than socio-economic covariates. We can see that in the first model sex of child and in the second model education of husband and place of residence shows insignificant effect. These variables also show insignificant effect in the third model.

In the third model age of respondents still show one of the most important determinants in the duration of breast feeding. In the first model the relative risk is 2.188 for age group less than 24 years, the changes goes from 2.114 in the third model. And for age group 25-34 the relative risk is 1.386 where the difference is marginal for model 1(1.399). Women with more than 35 years of age had lower risk of stopping breastfeeding than younger

ages. Thus it is clear that age of respondent is directly related with duration of breastfeeding.

Table 5.7: Cox proportional hazard model estimates of relative risk of socio-demographic characteristics on breastfeeding. **Model 3**

Explanatory variables	Coefficient (β)	S.E	Wald χ^2	P value	Odds ratio	95% CI
Mother's age* (in years)						
≤ 24	0.748	0.068	121.73	0.000	2.114	1.851-2.414
25-34	0.327	0.057	32.32	0.000	1.386	1.239-1.551
(35+)	...	...	...	...	1.000	
Age at marriage* (years)						
≤ 14	-0.523	0.153	11.63	0.001	0.593	0.439-0.801
15-19	-0.455	0.151	9.04	0.003	0.634	0.471-0.853
20-24	-0.358	0.158	5.09	0.024	0.699	0.513-0.954
(25+)	...	...	...	...	1.000	
Sex of Child						
Male	-0.030	0.028	1.103	0.294	0.971	0.919-1.026
Female	...	...	...	...	1.000	
Parity*						
1	-0.459	0.075	36.99	0.000	0.632	0.545-0.733
2	-0.370	0.069	28.87	0.000	0.691	0.603-0.790
3-5	-0.093	0.059	2.50	0.114	0.991	0.813-1.022
(6+)	...	...	...	...	1.000	
Contraceptives use*						
No used	0.327	0.042	59.40	0.000	1.387	1.276-1.507
(Used)	0.000	...	...	...	1.000	
Delivery status*						
Normal	-0.265	0.070	14.20	0.000	0.767	0.669-0.881
Caesarean	...	...	...	...	1.000	
Residence						
Urban	0.007	0.032	0.052	0.819	1.007	0.947-1.072
(Rural)	...	...	...	...	1.000	
Region*						
Barisal	-0.135	0.061	4.90	0.027	0.874	0.776-0.985
Chittagong	0.124	0.053	5.57	0.018	1.133	1.021-1.256
Dhaka	-0.102	0.054	3.61	0.057	0.903	0.813-1.003
Khulna	-0.074	0.060	1.51	0.219	0.929	0.825-1.045
Rajshahi	-0.150	0.056	7.17	0.007	0.861	0.771-0.961
(Sylhet)	...	...	...	...	1.000	
Religion*						
Muslim	0.254	0.050	25.81	0.000	1.289	1.169-1.422
(Non-Muslim)	...	...	...	...	1.000	
Educational level*						
Illiterate	-0.236	0.076	9.60	0.002	0.790	0.680-0.917
Primary	-0.199	0.072	7.68	0.006	0.820	0.712-0.943
Secondary	-0.116	0.067	2.10	0.083	0.891	0.782-1.015
(Higher)	...	...	...	...	1.000	
Work Status*						
Not work	0.149	0.037	15.98	0.000	1.161	1.079-1.249
(Work)	...	...	...	...	...	
Husband education						
No education	-0.003	0.041	0.007	0.931	0.997	0.920-1.079
Primary	0.002	0.040	0.003	0.956	1.002	0.927-1.083
(Secondary & Higher)	...	...	...	...	1.000	
Log-likelihood	: 77191.721					
Model Chi-square	: 405.96					
Degrees of freedom (d.f)	: 24					
P	: 0.000 *at 1% level of significant					

Table 5.7 shows that age at marriage has negative significant effect on duration of breastfeeding. When age at marriage increased the risk of termination of breast feeding decreased. The relative risk for termination of breastfeeding is 0.593, 0.634 and 0.699 for age at marriage group less than 14, 15-19, and 20-24 years respectively as compared with age at marriage group 25 years and above. The observed reduction in the coefficient values and relative risk estimates of model 1 and model 3 after adjusting for other variables, means that some demographic and socio-economic variables are actually confounding variables.

Both model 1 and model 3 shows insignificant effect for the variable sex of the child. From table 5.5 we see that the relative risk for the termination of breastfeeding is 0.971 for male child as compared with female child which value is same in model 1. So we observe that for both model 1 and model 3 coefficient and relative risk is remain steady for sex of child but chi-square value changes a little bit.

Parity is another most important factor influence on the duration of breastfeeding. It showed still significant results while combine with demographic and socio-economic characteristics. The estimates of relative risk value increased slightly and Wald chi-square minimally decreased when combined with model 1 and model 2. The relative risk of termination breastfeeding in the first model was 0.619, 0.670, and 0.877 for parity 1, 2 and 3-5 respectively, while in the additive model was 0.632, 0.691 and 0.991 in the same parity groups. Thus it is clear that the risk of waning in Model 1 is comparatively lower than in Model 3.

Contraceptive use is the second most important factor influencing the duration of breastfeeding. The relative risk for termination of breastfeeding is 1.387 times higher for

those who never used contraceptives as compared with those who used contraception. We observe from Table 5.7 that the risk and other coefficient factor decrease its impact when socio-economic factors added with demographic factors. From model 1 we see that the relative risk is 1.427 and it decreases to 1.387 in model 3. A decrease is also observed in its chi-square value.

Delivery status of mother is another important factor that has strong significant impact on duration of breastfeeding that depicted in model 1 and 3. We observe from Table 5.7 that the risk of termination of breastfeeding is 0.767 times lower for mother with normal delivery type as compared with caesarean type delivery mother. For model 1 the relative risk of terminating breastfeeding was minimally lower from the third model constituting 0.739. In demographic and socio-demographic model revealed that normal delivery type mother is more likely continue breastfeeding than their counterpart caesarean delivered mother.

An insignificant association was found in both model 2 & 3 between place of residence and duration of breastfeeding. In Model 3 urban children were more likely to be weaned at any time as compared with rural children but in case of Model 2 women in urban areas breastfeed less than rural areas.

There are also geographic variations in the duration of breastfeeding and divulge significant effect on it. As expected, breastfeeding is shorter in the Chittagong area than all other administrative region like Barisal, Dhaka, Khulna, Rajshahi and sylhet. Without controlling demographic covariates (Model 2) the relative risk of terminating breastfeeding is comparatively lower than the combined Model 3. The duration of breastfeeding is longest in Rajshahi division, while in the second model exhibits the same result.

Model 2 & 3 showed that religions have a positive significant effect on the duration of breastfeeding. However, in both model there is little variation of coefficient and other values for including religion. Muslim mothers were 1.289 times more likely to terminate breastfeed their babies as compared to Non-Muslim (Christian/Buddhist/Hindu) mothers. This might be related to Islam's favourable stance towards breastfeeding—for example, the Quran (Chapter 2, Verse 233) decrees that 'mothers shall give suck to their offspring for two whole years' (Counsilman and Viegas, 1985).

Mother's education showed still strong negative effect on the duration of breastfeeding. The effect of maternal education status probably influence through via covariates such as women's employment status, and socio-demographic factors. The study found that the risk of terminating breastfeeding lower among mothers having no education, primary or secondary education than among those with higher educated mothers (In Model 2 & 3). Basically there is minimal variation of the estimated values for Model 2 and Model 3 in case of women education. There are abundant factors that could affect the relationship women employment and the prevalence of breastfeeding: place of work, type of work. The place and type of work influence lactation by affecting the access to the infant as well as the time available with him.

Working status had a strong significant effect on breastfeeding duration. As mother's educational level was a potential confounder on the effect of working status on breastfeeding status, stratification was done for both groups according to this factor. Non-working mothers were 1.161 times more likely terminate breastfeeding than working mothers to breastfeed (Odds ratio= 1.161, 95% CI 1.079–1.249, P value = 0.000), after adjusting for potential socio-demographic variables using Cox proportional hazards

model 3. Moreover, the husband's education was not showed significant effect on the duration of breastfeeding according to the second and third model.

5. 8 Conclusion

The chapter revealed that breastfeeding is virtually universal (98.3 percent) and homogeneously prolonged in Bangladesh. The average duration of breastfeeding in Bangladesh for surviving children was found to be 31.99 months. Breastfeeding duration tends to increases with parity of mothers. The mean lengths of breast feeding is highest for parity one and is lowest for parity 6 and above. After parity one the durations are decreasing and gradually increasing before parity six and above. The proportional hazard analysis has identified that administrative division, religion, maternal education; work status, current age, age at marriage; parity, contraceptive use and delivery status have significant effect on the duration of breast feeding. In conclusion, the results obtained indicated that breastfeeding promotion programme in Bangladesh should address the mothers with higher education, giving birth with higher parity and caesarean delivery status, Muslim mothers and those living in urban and Chittagong region areas since these mothers tend to breastfeed their children for a relatively shorter period of time.

Figure 5.4: Proportion of women continuing breastfeeding by age of mother

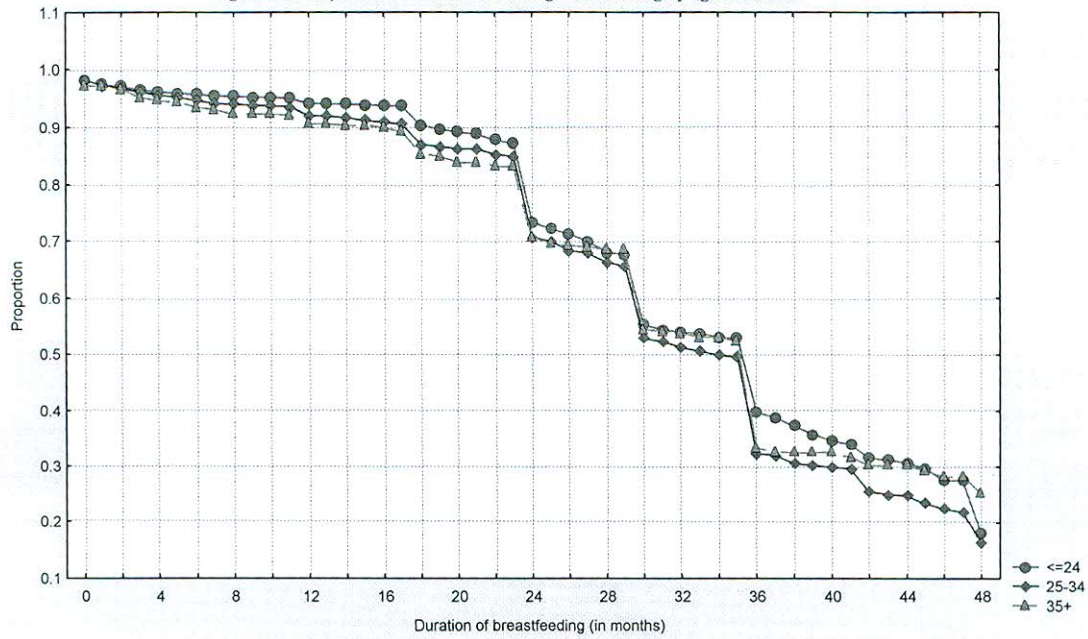


Figure 5.5: Proportion of women continuing breastfeeding by age at marriage

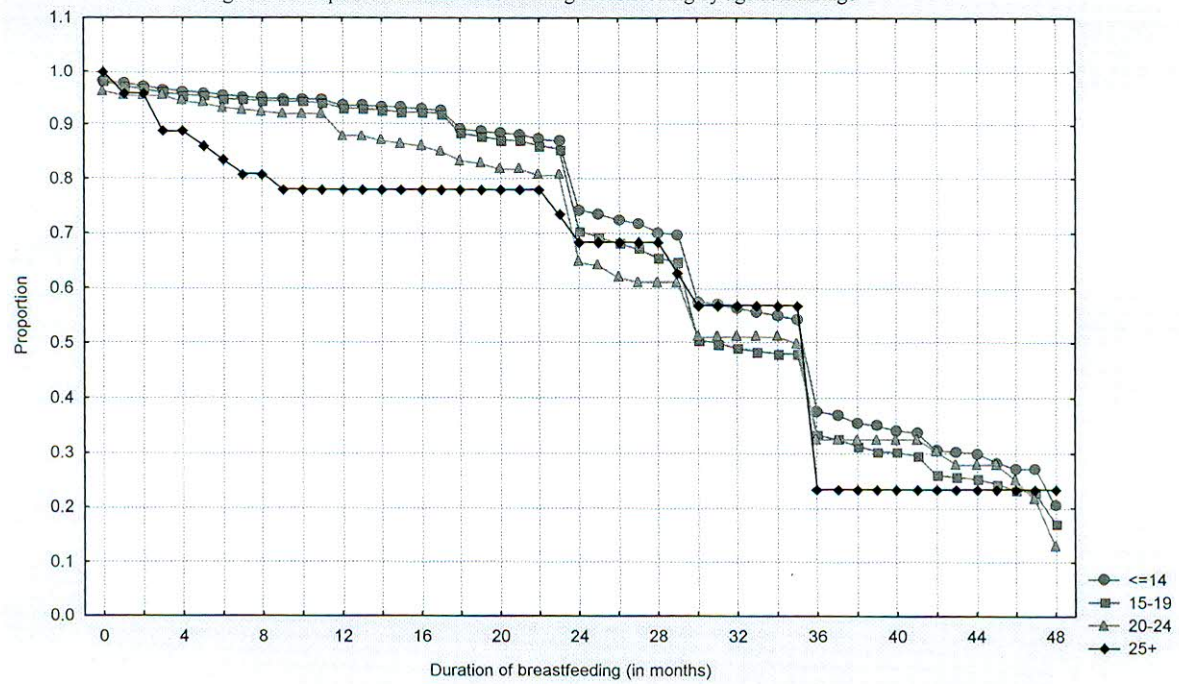


Figure 5.6: Proportion of women continuing breastfeeding by sex of index child

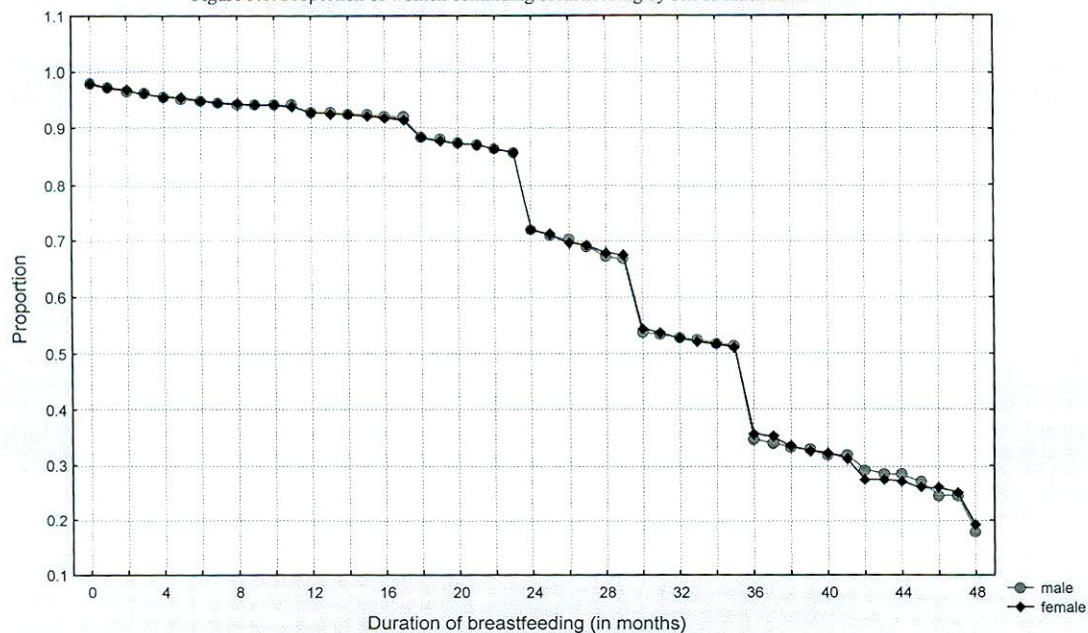


Figure 5.7: Proportion of women continuing breastfeeding by parities

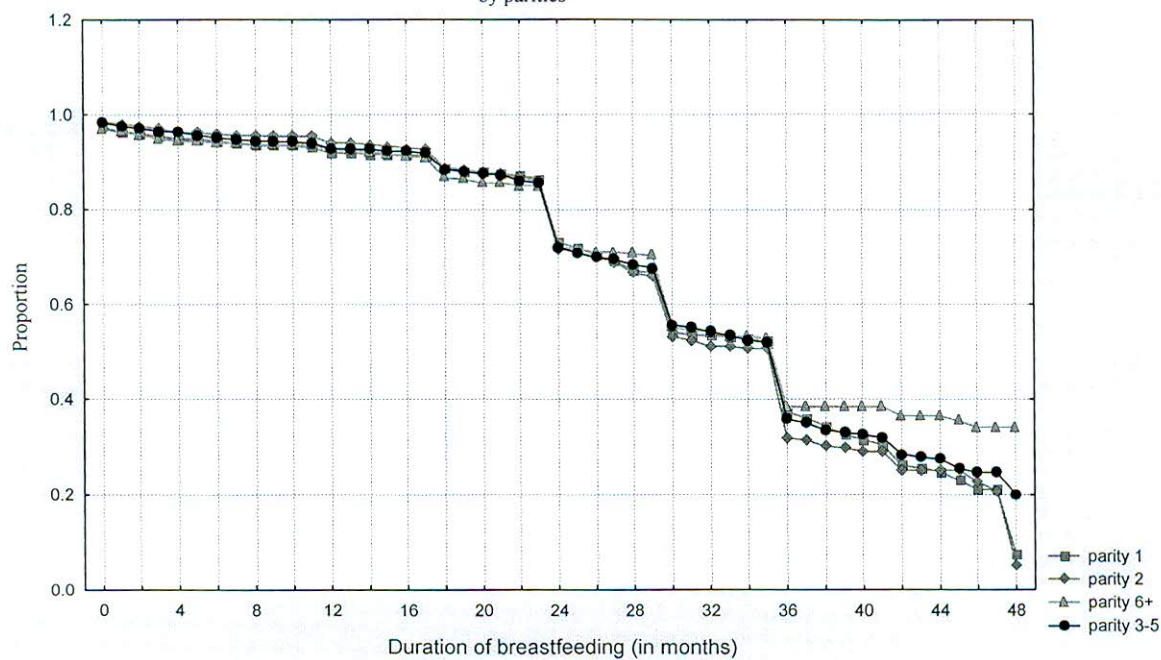


Figure 5.8: Proportion of women continuing breastfeeding by pace of residence

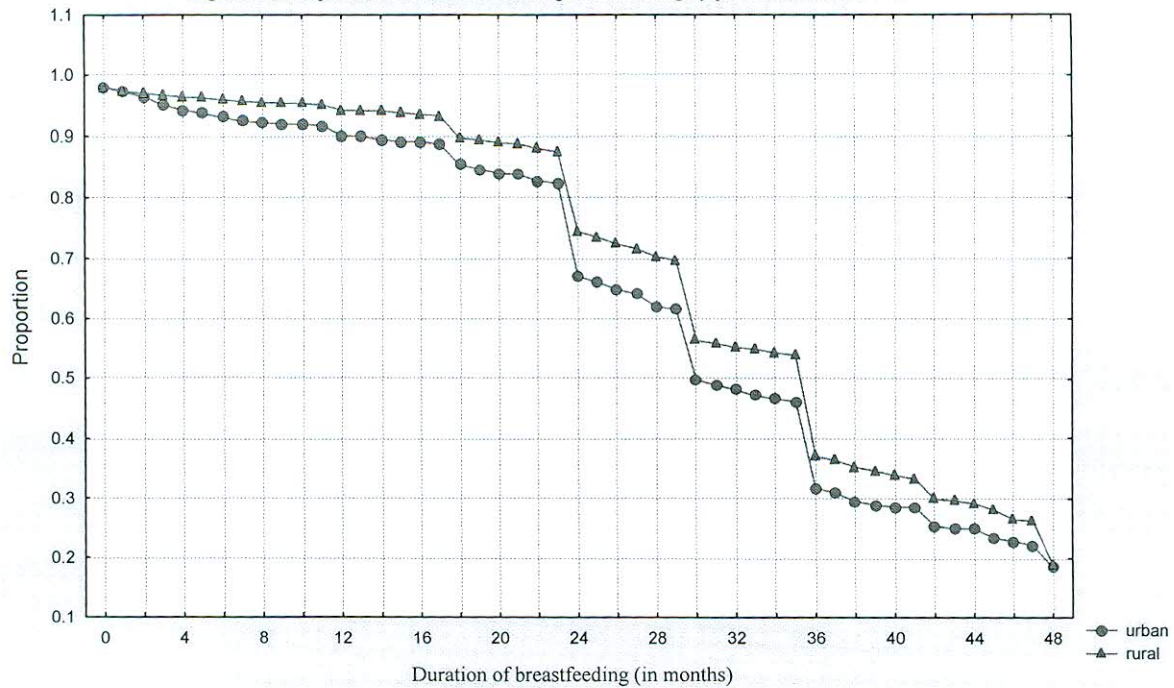


Figure 5.9: Proportion of women continuing breastfeeding by administrative division

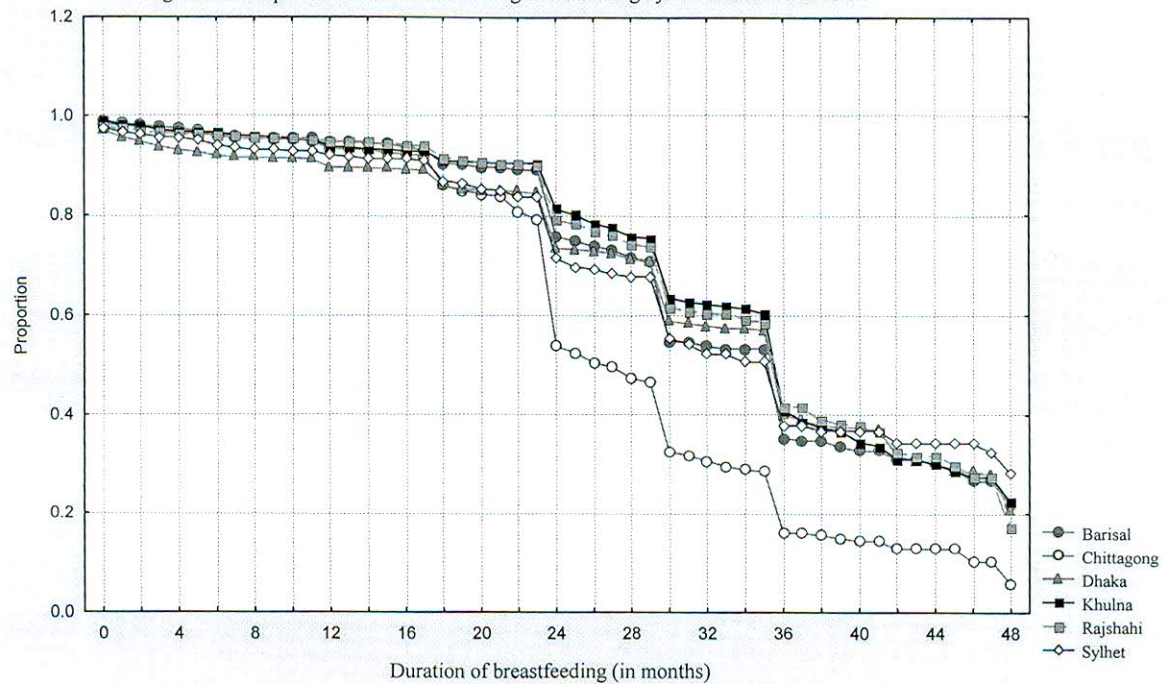


Figure 5.10: Proportion of women continuing breastfeeding by mothers educational level

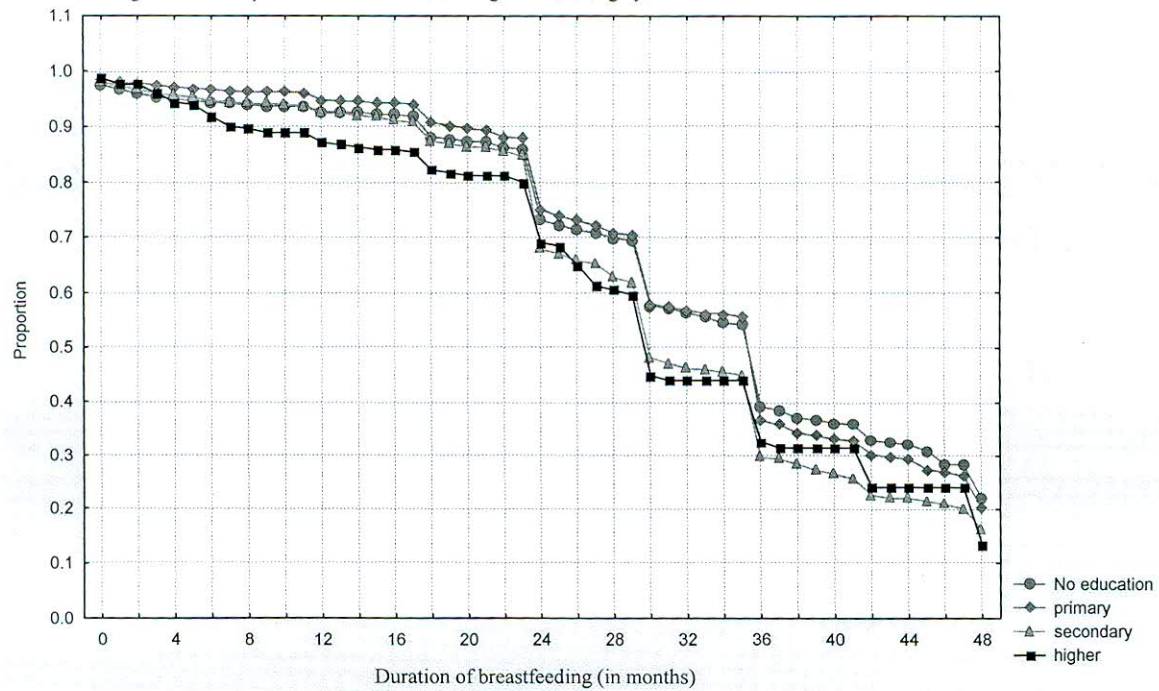


Figure 5.11: Proportion of women continuing breastfeeding by working status

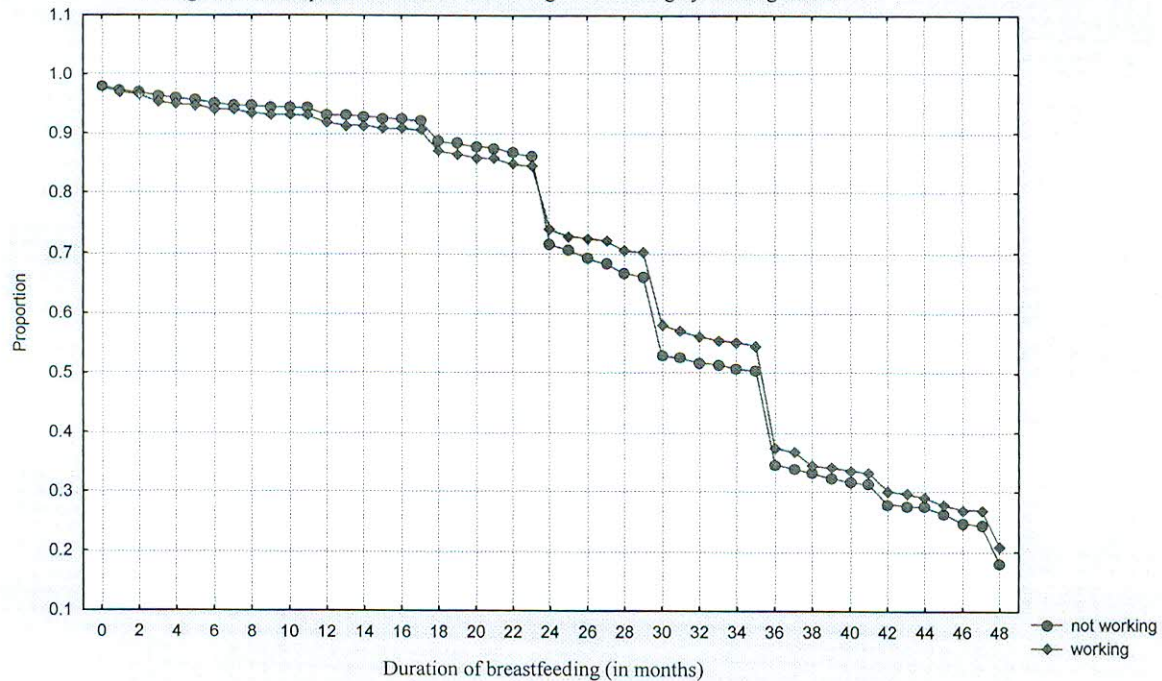


Figure 5.12: Proportion of women continuing breastfeeding by husband educational level

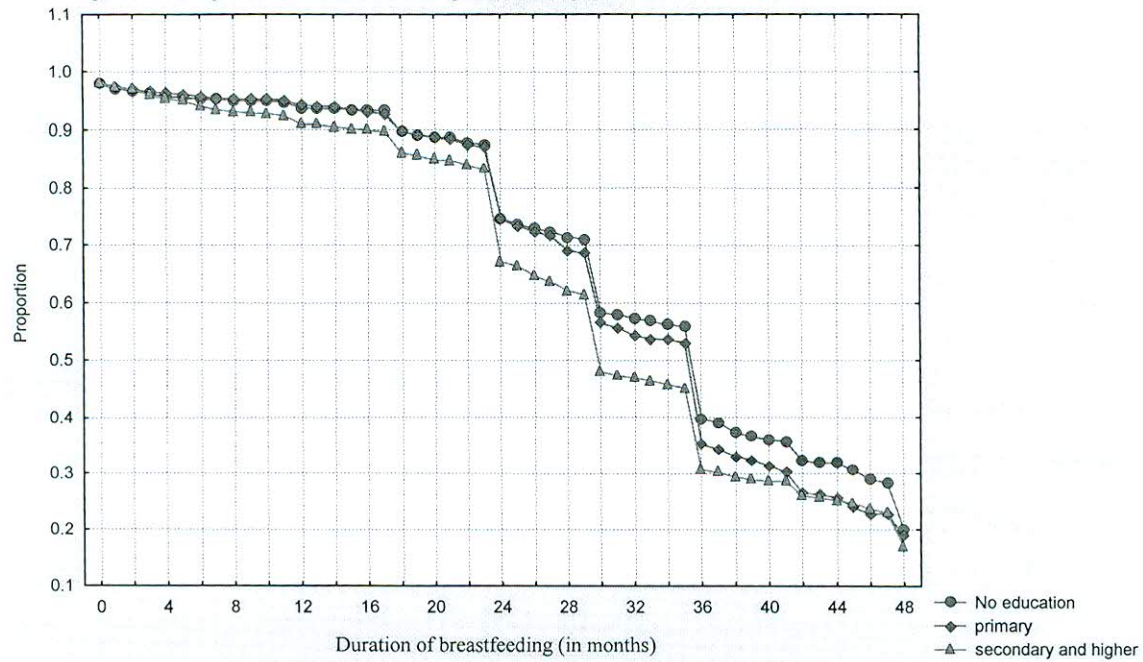
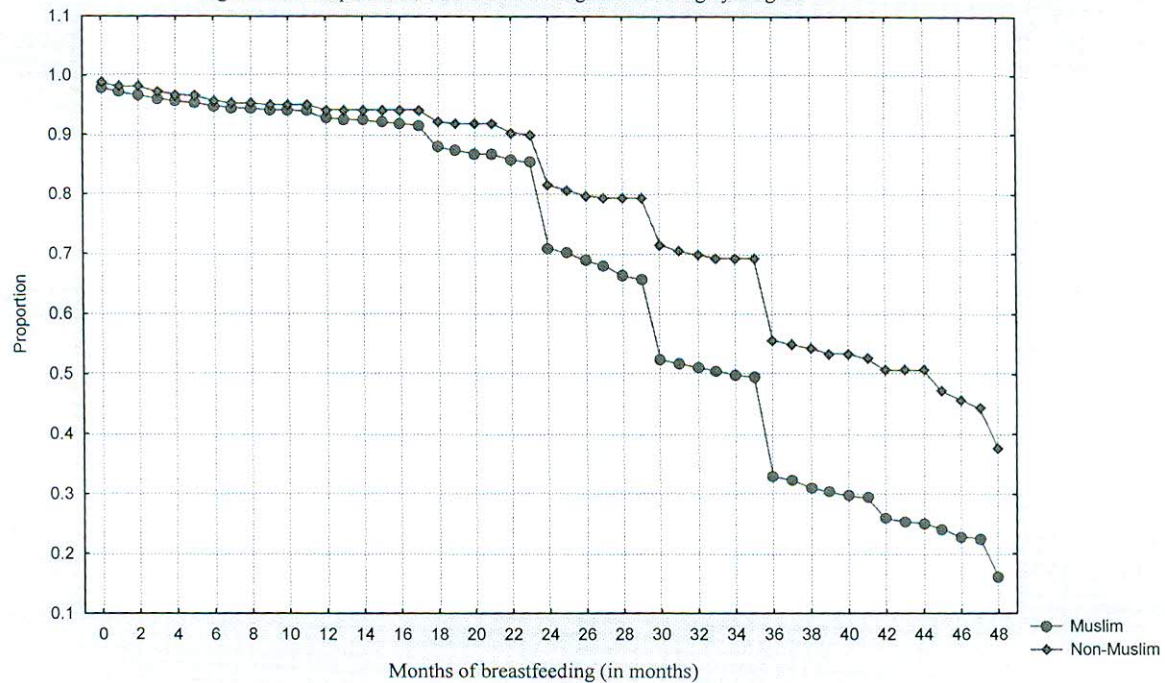


Figure 5.13: Proportion of women continuing breastfeeding by religion



CHAPTER SIX

**Differentials and Determinants of
Post-Partum Amenorrhoea**

Chapter Six

Differentials and Determinants of Post-Partum Amenorrhoea

6.1 Introduction

Post-partum amenorrhoea (PPA) is a biological variable associated with each conception regardless of its outcome. It is the most important factor for females' reproductive life and their health. It is defined as the time elapsed between the termination of pregnancy and the resumption of menstruation just after delivery. The length of PPA in women may vary from around a month to more than a year depending on a number of factors which may vary from woman to woman in a population and for a woman depending on age, marital duration, number of pregnancies, nutritional status of woman etc. (Jeliffe and Jeliffe, 1972; Tennekoon et al., 2005).

There is a large body of literature showing evidence for the positive association between duration of breastfeeding and the length of postpartum-amenorrhoea (Bongaarts and Potter, 1983; Rodriguez and Diaz, 1988; Huffman et al., 1987; Pinto et al., 1998, Aryal, 2005, 2007). Some researchers' are to investigate how breastfeeding pattern affect post-partum amenorrhoea and others are more interested in the relationship between hormonal factors, breastfeeding and the return of menses.

Recently the most consistent conclusion drawn from these studies is that long-term breastfeeding is associated with longer periods of post-partum amenorrhoea and lastly decline fertility (Kondel, 1977; Van Ginneken, 1978; Pinto et al., 1998; Aryal, 2007).

However, many mechanisms by which breast feeding behavior and other factors produce variability in the length of the amenorrhoea period, and thus the resumption of menses across populations as well as within a population in different social and cultural groups remain either unspecified or unknown. They are probably associated with biological characteristics and specific socio-economic and demographic characteristics. In attempting to understand better this process and its demographic significance, the purpose of this study is to examine the pattern and differentials of amenorrhoea period, to investigate the causal relationship between the length of post partum amenorrhoea and breastfeeding variables as well as other demographic and socio-economic factors that could modify the pace of both postpartum amenorrhoea and breastfeeding.

6.2 Analytical Methods

Post-partum amenorrhoea period is an important event for women's reproductive life-span. It is defined the period from the end of a women's pregnancy until the time that she begins to menstruate. For the bivariate analysis, the duration of post-partum amenorrhoea is grouped into monthly intervals of 0-10, 10-20, and 20-30 months. The association of the duration of post-partum amenorrhoea to each variable included in the analysis was first checked by using Chi-square statistic in a two-way cross tabulation. Chi-square statistic was used to test the significance of the explanatory variables included in the multivariable (Cox regression model) analysis. The analysis is restricted to ever-married women who had at least one live birth.

6.2.1 Life table technique

Many women had not yet resumed menses by the time of interview, but they could have menstruation later in their life. This right censoring means that if we compute the rate of resumption of menses as the number of women who have already had resumed menses divided by the total number of women in the sample under study, we will under estimate the rate of return to menses for women with incomplete information. If we exclude women with incomplete information in the denominator of the estimated rate, and thus

include only those women who were actually exposed to that risk of having menses resumed, we measure only the duration of time they were actually exposed to that risk.

Using the life table technique, the monthly failure probabilities at every duration at which menstruation returned have been estimated as the ratio of the number of women that have resumed menses divided by the number of women still at risk of returning to the menstruating state.

Therefore, the survival function calculated from these probabilities is an estimate of the proportion of women who had not yet menstruated at different durations after childbirth.

The mean duration is estimated under the following standard formula:

$$\text{Mean length of amenorrhoea } (a_i) = \frac{1}{2}(a_0 + a_{30}) + (a_1 + a_2 + \dots + a_{29}), i=1,2,3,\dots$$

Where, a_i is the probability of women not resuming menstruation by i th parity.

6.2.2 Cox Regression Model

The dependent variable in this study is defined as the interval-in months between parturition and the first incidence of menstruation. The amenorrhoea statuses of mothers who are still amenorrheic at the time of survey are considered as censored cases. In multivariate analysis this waiting time of post-partum amenorrhoea is treated as a continuous variable. In the present study our focus is on the risk of the resumption of the first post-partum menses.

The proportional hazard model represents the individual instantaneous probability of failing at any duration. It can be written as the product of the underlying hazard at time t and of an exponential linear combination of a set of covariates, which could be fixed or time-varying. The model provides a regression model that incorporates the ideas underlying the life-table technique. So, it permits the risk of the resumption of menses to depend on a set of individual characteristics represented by any set of covariates. The general function form could be expressed as:

$$h(t/z) = h_0(t) \exp(\beta z + \alpha z(t))$$

Where, $h_0(t)$ is the base line, βz is the fixed component and $\alpha z(t)$ is the time-varying component. Cox proportional hazard model described details in chapter five.

All other explanatory variables used for amenorrhoea multivariate analysis are grouped into categories as shown in Table 6.1

Table 6.1: List of explanatory variables with their category levels used in Cox proportional hazard model

Characteristics	Level
Place of Residence	1= Urban 0= Rural
Division	1= Barisal 2= Chittagong 3= Dhaka 4= Khulna 5= Rajshahi 0= Sylhet
Mothers Education	1= No education 2= Primary 3= Secondary 0= Higher
Respondent Work Status	1= Working 0= Not-working
Sex of Previous Child	1= Male 0= Female
Religion	1= Muslims 0= Non-Muslims
Contraceptive Use	1= User 0= Never use
Breastfeeding	1= Never 0= Ever breastfeed
Parity	1= 1- 2 2= 3-5 0= 6 and above
Delivery status	1= Normal 0 = caesarean

6.3 Distribution of post-partum amenorrhoea

Figure 6.1 displays the distribution of the duration of PPA for mothers of the last child at survey date.

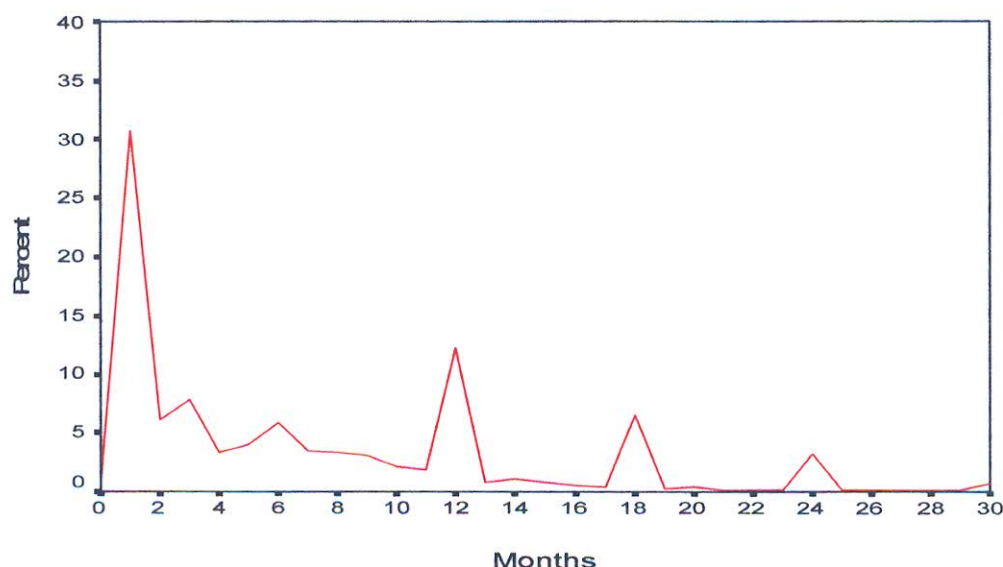


Figure 6.1: Percentage distribution of women by reported duration of amenorrhoea

Following a peak at 1-month duration the PPA distribution showed heaping at durations of multiples of 6 months. It was found that only 3 months were reported their amenorrhoea period before a months. There are some researchers has been found similar pattern of PPA heaping like India (Singh, 1993; Yadava and Jain, 1998), Bangladesh (Rahman, 1992) Nepal (Aryal , 2006) and Ghana (Amemuvegbé, 1994). Therefore the reasons for this heaping are misreporting of the duration (Rahman, 1992; Singh, 1993), lack of differentiation between post-partum bleeding and resumption to menses (Ofosu, 1989).

6.4 Duration of Post-partum Amenorrhoea by Parities

There are two types indicators used to describe the life table: the mean survival time or mean duration, and the survival functions of amenorrhoea post-partum for all women for

the different sub-population considered in this study. These estimates were calculated using both complete and censored data simultaneously.

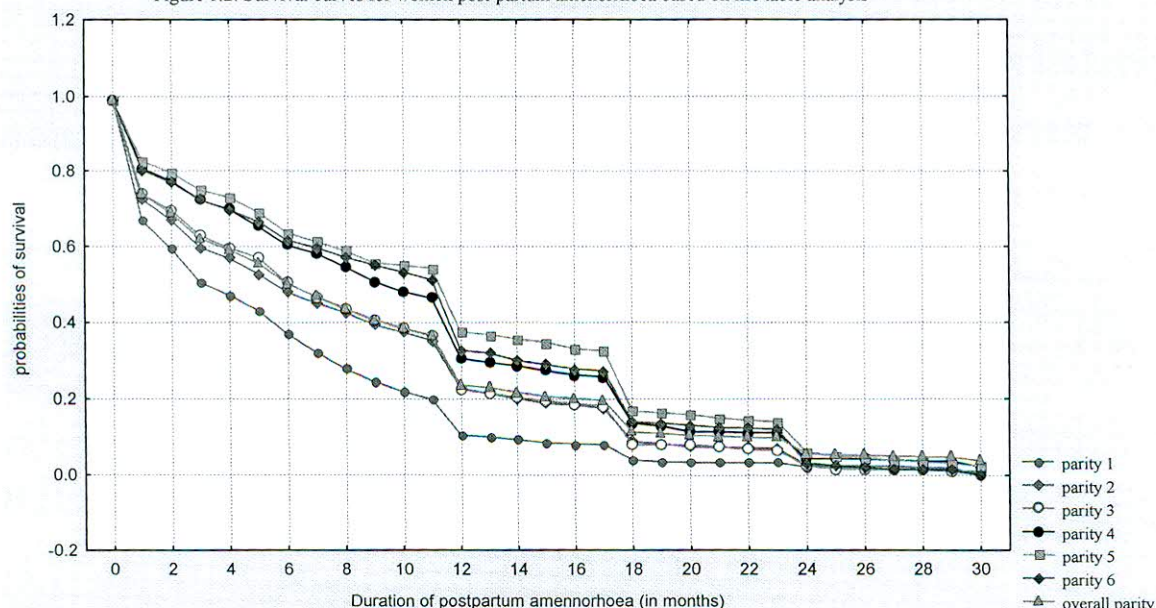
Table 6.2: Life table estimates for duration of post-partum amenorrhoea by parity of women in Bangladesh.

Ordinal Month (x)	Probability of women not resuming menstruation by parity(a_i)						
	1	2	3	4	5	6+	all
0	0.991670	0.991670	0.991670	0.991670	0.991670	0.991670	0.991670
1	0.669132	0.725752	0.738590	0.807326	0.826637	0.802455	0.739477
2	0.593500	0.669413	0.696385	0.773476	0.796302	0.769725	0.687953
3	0.505252	0.597044	0.629318	0.723070	0.749552	0.723148	0.620516
4	0.471323	0.568061	0.595708	0.698259	0.730374	0.697625	0.591065
5	0.430437	0.527151	0.570512	0.652858	0.690716	0.666674	0.555015
6	0.369504	0.479148	0.503828	0.602495	0.636674	0.616312	0.500784
7	0.320558	0.450489	0.467071	0.581489	0.612713	0.597092	0.468454
8	0.277762	0.426438	0.434454	0.544538	0.588205	0.571018	0.436695
9	0.244936	0.393418	0.405270	0.506640	0.556121	0.549796	0.406837
10	0.220143	0.373119	0.383798	0.480082	0.548922	0.532256	0.385498
11	0.199260	0.352140	0.364470	0.463347	0.541652	0.511706	0.366051
12	0.105913	0.226412	0.224399	0.305658	0.375274	0.326904	0.237100
13	0.101120	0.214581	0.215512	0.294379	0.367576	0.319590	0.228981
14	0.093031	0.200957	0.204851	0.285034	0.355391	0.299664	0.217374
15	0.084573	0.188105	0.195396	0.272748	0.346980	0.288536	0.207289
16	0.082391	0.184464	0.187289	0.262357	0.329950	0.277157	0.201394
17	0.080179	0.175710	0.182272	0.257030	0.325521	0.272163	0.196517
18	0.039525	0.087855	0.080819	0.136547	0.168532	0.139897	0.112943
19	0.036037	0.082448	0.080819	0.128436	0.163851	0.136464	0.109371
20	0.033712	0.075634	0.079003	0.114772	0.159169	0.131282	0.104577
21	0.032550	0.072884	0.075328	0.114772	0.149806	0.126100	0.102169
22	0.032550	0.072884	0.067888	0.111938	0.145125	0.124360	0.100353
23	0.032550	0.070108	0.066002	0.111938	0.140443	0.120832	0.098826
24	0.021700	0.026641	0.023295	0.043053	0.060859	0.031985	0.056956
25	0.021700	0.025201	0.016639	0.043053	0.051121	0.026502	0.054759
26	0.017631	0.025201	0.014262	0.043053	0.046009	0.020823	0.052511
27	0.014810	0.023674	0.014262	0.040183	0.040897	0.017037	0.050560
28	0.014810	0.020408	0.014262	0.037313	0.035785	0.015144	0.049251
29	0.011848	0.018708	0.011410	0.037313	0.030280	0.013125	0.047598
30	0.008886	0.000891	0.000000	0.022388	0.024224	0.002187	0.037945
Mean	5.66	7.85	8.04	9.98	11.08	10.22	8.51

As we will see the different figures, the survival function always takes the shape of a monotonically decreasing function at every distinct duration at which menses has returned. Figure 6.2 illustrate the patterns for resumption of menstruation in the study.

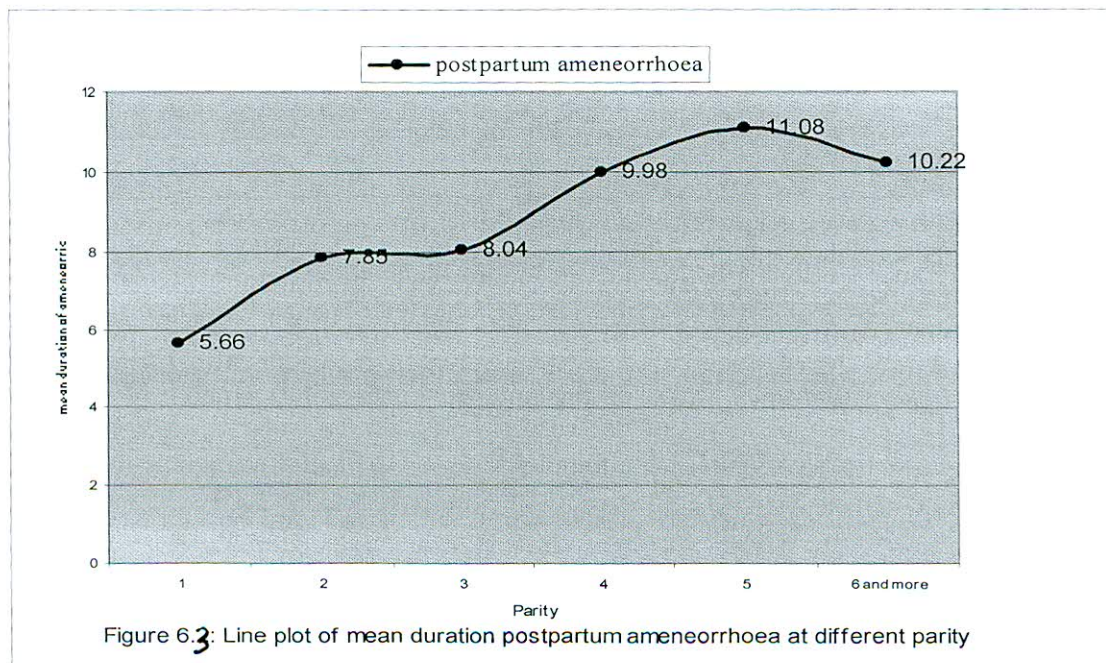
The decreasing stepped pattern observed in many survival functions reflects the heaping of the duration of amenorrhoea reported on multiples of six months. The survival curve clearly showed a decline trend up to 10 months and there after it decline rapidly. It is indicative that only few mothers are remaining to terminate their PPA duration after 2-years. Table 6.5 provides the mean durations for amenorrhoea by parity of mother's.

Figure 6.2: Survival curves for women post-partum amenorrhoea based on life table analysis



Also, the proportions of women still amenorrheic of months elapsed since are presented in Table 6.2. In general the proportion of women amenorrheic drops off rapidly as the number of months since birth increases from 0 to 9, but this percentage drops off slowly at longer duration. About half of the (49.9%) total women return to menstruation after 6 months, about 60 percent return to menses after 9 months, 80 percent resumption of menses one and half year later and 96 percent after 30 months of delivery do so. The mean duration of amenorrhoea computed from the life table values, by the standard procedure, shows that the mean duration of post-partum amenorrhoea irrespective of the parity of the women in Bangladesh is found to be 8.5 months. The period of amenorrhoea

increases with parity from 5.7 months after the first child to 11.08 months up to the five child but for six and higher parity mean duration of amenorrhoea is drop off which is about 10.22 months (Table 6.2).



The line graph 6.3 provides information on mean duration of post-partum amenorrhoea in Bangladesh. Its X axis represents parities and Y axis describes mean duration of amenorrhoea. As is presented, the average duration of amenorrhoea gradually increases up to 5 parities of women and then there is downward trend with minimally. According to the Figure 6.3, initially in the first parity, the mean duration of amenorrhoea is under 6 months i.e. approximately 5.7 months. But from this parity, there is an upward trend in the amenorrheic period and it reaches a peak in parity 5 amounting well above 11 months. Then from parity 6 and more, there observes a slight downward trend in the average amenorrheic periods. Finally, it can be concluded that with increased parities increased mean duration of post-partum amenorrhoea.

6.5 Differential of Post-partum Amenorrhoea: Life table analysis

In order to investigate the differential of post-partum amenorrhoea (PPA) by selected socio-demographic characteristics life table technique is used to take account the issue of censoring in duration of PPA. Considering each observation separately and identifying whether the observation is censored or uncensored, the life table technique provides better estimates of the PPA. Life table is used to examine the duration probabilities of the resumption of menstruation according to the characteristics of the mother and children. The life table analysis calculates the probability distribution of mothers who continue to be aemorrhoeic at specific PPA durations since the birth of the child. The association of the duration of PPA with all the variables included in this study is first checked by the chi-square statistic in a two-way of each variable with the duration of PPA (Table 6.3). Chi-square has also been used to test the goodness of fit of the model as well as the significance of the explanatory variables. Various summary measures based on this distribution are also calculated which is presented in Table 6.3.

In this study, the over all mean duration of post-partum amenorrhoea is found to be 8.5 months for Bangladesh. Various studies suggested that the length of post-partum amenorrhoea has been falling in Bangladesh, with important potential consequences for fertility levels (Salway et al. 1993, Huffman and others, 1978). The 1974 Bangladesh Fertility Survey reported a mean length of post-partum amenorrhoea of 14.6 months (Singh and ferry, 1984). The 1989 Bangladesh Fertility Survey found the overall median length of post-partum amenorrhoea to be 12 months (Huq and Cleland, 1990).

Table 6.3: Mean duration of amenorrhoea by different socio-demographic characteristics based on life table technique, Bangladesh

Characteristics	Level	Number	Mean	Cal. χ^2	p value
Place of Residence	Urban	1684	7.03	$\chi^2=39.53$ d.f= 2	0.000
	Rural	3680	8.60		
Division	Barisal	614	8.61	$\chi^2= 29.53$ d.f= 10	0.001
	Chittagong	1109	8.63		
	Dhaka	1191	7.71		
	Khulna	728	7.24		
	Rajshahi	1085	8.15		
	Sylhet	637	8.38		
Mothers Education	No education	1866	9.70	$\chi^2=180.23$ d.f= 6	0.000
	Primary	1649	8.38		
	Secondary	1510	6.01		
	Higher	339	4.73		
Respondent Work Status	Working	970	9.16	$\chi^2= 29.65$ d.f= 2	0.000
	Not-working	4395	7.85		
Sex of Previous Child	Male	2730	8.45	$\chi^2= 7.39$ d.f= 2	0.02
	Female	2634	7.75		
Religion	Muslims	4874	8.06	$\chi^2=0.907$ d.f= 2	0.635
	Non-Muslims	490	8.45		
Contraceptive Use	Ever use	4488	7.66	$\chi^2= 2.02$ d.f= 2	0.365
	Never use	876	10.90		
Breastfeeding	Never breastfeed	71	4.53	$\chi^2=7.93$ d.f= 2	0.009
	Ever breastfeed	5283	8.15		
Months of Breastfeeding	0-5	910	6.40	$\chi^2=324.61$ d.f= 4	0.000
	6-12	786	7.92		
	13 and more	3587	8.42		
Parity	1- 2	2875	6.81	$\chi^2=163.85$ d.f=4	0.000
	3-5	1927	9.35		
	6 and above	562	10.30		
Delivery Status	Normal	5094	8.31	$\chi^2=52.52$ d.f=4	0.000
	Caesarean	268	4.38		
Mother's Age	≤ 24	2627	6.88	$\chi^2=184.29$ d.f=4	0.000
	25-34	2174	8.92		
	35 and above	563	10.15		
Bangladesh	Bangladesh	5364	8.51	-	-

However, the median period of amenorrhoea continues to decline from more than 10 months in 1993-1994 to 8.4 months in 1996-1997 to 7.9 months in 1999-2000; and to 6.1 months in 2004 (Mitra et al., 1994, Mitra et al., 1997; NIPOORT et al., 2001; Mitra et al., 2005). According to Mitra et al. (2005) the mean length of post-partum amenorrhoea was

found to be 8.7 months which is too much close to our study. More recent research, however, has reported shorter lengths of post-partum amenorrhoea, with significant differentials evident by socio-demographic status.

In the same Table, place of residence shows significant variation of post-partum amenorrhoea at 1% level. In rural areas mothers have longer durations of amenorrhea than mothers in urban areas. The mean duration of amenorrhoea is 8.60 months for rural women and 7.03 months for urban women. **Figure 6.4** shows that greater proportion of women who were amenorrheic is observed in rural areas. Thus, the mean amenorrhoeic period is more prolonged among the rural mothers than the urban mothers.

It is seen from Table 6.3 that there is significant difference in the mean length of amenorrhoea period by different administrative division at 1% level with 10 degrees of freedom. The mean duration of amenorrhoea is found to be remaining steady amounting of nearly 8.6 months for Barisal, and Chittagong division, but in Dhaka and Khulna division are comparatively lower duration of amenorrhoea amounting of 7.7 months and 7.3 months respectively. Beside in Rajshahi division the average duration of amenorrhoea is 8.2 months and 8.4 months for Sylhet division. **Figure 6.5** shows that survival curves are approximately same pattern except Khulna division.

Mothers' education is highly statistically associated with duration of post-partum amenorrhoea at 1% level of significant. The mean duration of post-partum amenorrhoea are 9.7 months for no educated, 8.4 months for primary educated, 6.0 months for secondary educated and 4.7 months for higher educated women. The mean duration of amenorrhoea appears to decline as mother's level of education increases. For example, the mean difference between mothers with no education and those with higher education

is about 5 months. Mothers with primary education have a slightly longer mean duration of amenorrhoea than those with no education. Thus mother with no education have the longer duration of amenorrhoea, while secondary and higher educated women have comparatively short duration of amenorrhoea. This differential may suggest that mother with low education who could be in poorer economic and nutritional conditions and continuous episodes of intense breastfeeding resume menstruations later than women in better social and economic conditions (Pinto, 2005). The survival functions (**Figure 6.6**) shows that higher educated women have more rapid resume menstruations than the less educated ones at every duration of post-partum amenorrhoea. Mother's educational status showed an inverse relation to the duration of amenorrhoea, which is a consistent finding to other researchers (Aryal, 2007, 2005; Pinto, 2005; Yadava and Jain, 1998).

Women working status is significantly associated with the variation of amenorrhoeic period. Women who work outside the home have longer duration amenorrhoea period than who do not work outside. The mean length of amenorrhoea is 9.2 months for employed women's correspond to 7.9 months for those women who do not work except household work.

The results indicated that religion is not significantly associated with the variation of postpartum amenorrhoea. Non-Muslim mother found to be slightly longer duration of amenorrhoea period than Muslim counterparts. The average length of amenorrhoea period is 8.1 months for Muslim mother and is 8.5 months for non-Muslim mother. The lack of variability in amenorrhoea can be verified by looking at **Figure 6.8**. Here, the amenorrhoea survival functions have almost the same shape and several points of intersection; that is they are not clearly differentiated.

As we can see in Table 6.3, contraceptive use is another variable that has insignificant effects on amenorrhoea period. The analysis result reveals that mother who use contraceptive have 7.7 months of mean duration of amenorrhoea, while it is 10.9 months in case of non-user counterparts. Therefore, those who have used any contraceptive method after having their last child tend to have shorter amenorrheic periods than who never used it.

According to Table 6.3, both breastfeeding status and months of breastfeeding significantly associated with post-partum amenorrhoea at 1% level. Breastfeeding status shows that women who never breastfeed their last child resume menses earlier than women who were ever breastfeeding them. The estimated waiting times for these cases are found to be 4.5 months and 8.2 months, respectively. However, the longer duration of breastfeeding, the longer mean duration of amenorrhoea. The mean duration of amenorrhoea among mothers who breastfeed their children 13 months and more, is almost 2 months longer than women who did five months or less. We found that in mothers with lower duration (0-5 months) of breastfeeding the anovulatory period lasts approximately 6.4months; while in mothers with the highest duration (13 months and more) this period last 8.4 months. Thus, in women with the longer duration of breastfeeding, the periods of intense lactation that causes prolonged anovulatory periods tend also to be longest. This indicated that there is a strong positive association between the duration of post-partum amenorrhoea and breastfeeding.

Figure 6.10, the survival functions for amenorrhoea were shown who never breastfeeding and who were ever breastfeeding. As we expected, the functions for women who never breastfeeding are suddenly drop off from 2 months and this tendency continue up to 12

months; while the survival functions for women who ever breastfeeding are gradually decreasing with increasing duration of amenorrhoea periods.

In Figure 6.11 illustrates the effects of breastfeeding duration on the duration of amenorrhoea. According to the figure, the functions also decrease steadily over time. Women who had breastfeed their children lower duration have the faster resumption of menstruation during the first six months; subsequent point survival function tends to slow down steadily. Women who breastfeed on longer duration resumed menstruations more slowly, and the rate of resuming menstruation are lower than those in the other two curves. Moreover, the survival functions for lower (0-5 months) and higher (13 months and over) duration of breastfeeding women are completely different between 1 to 11 months, and the remaining months maintain the same level. So, a positive and strong association is found between the duration of post-partum amenorrhoea and breastfeeding status of mothers, which is also a consistent result to the other findings elsewhere (Aryal, 2007, 2005; Yadava and Jain, 1998).

Table 6.3 shows that parity is found to be significantly associated with the duration of amenorrhoea period at 1% level. Women with higher parity have longer mean duration of amenorrhoea than women with lower parity. Women with parity 6 and more have 10.3 months mean length of amenorrhoea, where as (1-2) parities women have only 6.8 months mean duration amenorrhoea. Lower parity mothers are found to have higher chance of terminating post-partum amenorrhoea during early than that of the higher parity mothers. Thus, the average length of postpartum amenorrhoea increased with increases in the parity of mothers. **In Figure 6.12**, the amenorrhoea survival functions for parity of women are quite different from each other, and it is clear that women who have lower parity had, in fact, faster return on menses.

From table 6.3 we want to see whether the women delivery status of the last child has substantial affects on the length of the post-partum amenorrhoea. We observe that those women who procreate their last child in caesarean cases have shorter amenorrheic periods than their normal delivery counterparts. As we can see in Table 6.3, caesarean mother resume menses 4.4 months after childbirth, while normal delivery mother do after 8.3 months. The mean length of post-partum amenorrhoea for caesarean mother is two times lower than the normal delivery mother. As we see from the **Figure 6.13**, the survival function for caesarean mother lags many months than the normal delivery mother. The figure also illustrate that the survival curve for caesarean mother drop quickly between the duration of the first months and the twelve months of amenorrhoea period, while another curve gradually decline with little bit fluctuations. It is remarkable fact that by months 20 there are no women still amenorrheic among those who delivered their last child in caesarean method.

Mother's age is found to statistically significantly relate to the duration of amenorrhoea at 1% level. The mean length of post-partum amenorrhoea is found to be 6.88 months for younger mothers (current age below 24 years) whereas it increased gradually to 10.15 months among older mothers (current age 35 years and more). The results suggested that women with younger age have longer duration of amenorrhoea, while older women (35 years and more) have shorter length of amenorrhoea. Aryal (2007) found similar results in his study. **In the Figure 6.14** shows the survival functions of the oldest age group (35 years and above) women that exhibits greatest proportion, while the proportion gradually decreasing in case of age group ≤ 24 years and 25-34 years of aged women.

The present findings suggest that younger mothers are most likely to have a shorter post-partum amenorrhoea than older mothers, and post-partum amenorrhoea duration varied

largely by parity, sex of child, and type of delivery. A number of empirical evidences have shown the consistent results that the duration of post-partum amenorrhoea is directly related to the age of mother and her parity (Yadava and Jain, 1998; Brewis and Regni, 2007).

6.6 Hazard Analysis of Post-partum Amenorrhoea

In order to determine the effects of some selected socio-economic and demographic factors on the duration of amenorrhoea or risk of the first menstruation after delivery Cox regression hazard model is used. The relative risk (RR) of resumption of menstruation of each level (group) of factors is estimated in comparison with base line group in multivariate analysis. Values greater than one mean that the relative risk of resuming to menses post-partum is greater for this group when compared with the reference group. Values less than one indicate the risk is lower for the group being analyzed when compared with the baseline group. There are three Cox proportional hazard models are fitted, each one with additive effects among their explanatory variables. In the first one, the main effects of the duration of breastfeeding variables on post-partum amenorrhoea is presented in Table 6.4. The second model (Table 6.5) considers several demographic covariates and lastly the third model (Table 6.6) is estimated both demographic and socio-economic variables simultaneously. For multivariate analysis those explanatory variables were not statistically significant to check by chi-square test statistic, they are not included in the analysis.

6.6.1 Model 1: Effects of breastfeeding variables on post-partum amenorrhoea

Table 6.4 provides the information of the regression results of the breastfeeding variable effects on the dependent variable. As we can see, the strongest effects at 1% level on the time to the first menses after childbirth is the duration of breastfeeding. When, we

included all variables amounting of the overall model chi-square is 622.77 (model-3), while including breastfeeding variable only the model chi-square value is 389.70.

Table 6.4: Effects of breastfeeding variables on the duration of post-partum amenorrhoea: Cox proportional hazard estimates. **Model-1**

Variables	Coefficient (β)	S.E (β)	Wald χ^2	Sig.	Relative Risk exp (β)	95% CI
Duration of Breastfeeding*						
(in months)						
0-5	0.860	0.055	247.34	0.000	2.362	2.122-2.630
6-12	0.669	0.049	183.27	0.000	1.952	1.772-2.151
(13 and above)	...	...	...	...	1.000	
Log-likelihood	: 63422.521					
Model Chi-square	: 389.70					
Degrees of freedom (d.f)	: 2					
P	: 0.000					
*at 1% level of significant						

The effect of lower duration of breastfeeding (0-5 months) on the risk of resumption menstruation after childbirth is 2.362 times higher than the risk of those mothers who breastfeed their child with longer duration (13 months and over). For the effect of intermediate breastfeeding group (6-12 months), the risk is 1.952 times higher than that of the reference group. The duration of breastfeeding is highly associated with the duration of amenorrhoea. Therefore, the duration of breastfeeding is inversely related to the hazard of resuming postpartum menses.

6.6.2 Model 2: Effects of breastfeeding and demographic variables on amenorrhoea

Table 6.5 provides information of the Cox regression results for the main effects of breastfeeding and demographic variables on duration of amenorrhoea in Bangladesh. As we can see that, among the included demographic variables age of mother, sex of child, duration of breastfeeding and type of delivery has the significant effects on the time to the first menses after childbirth. The overall chi-square value increases from 389.70 in the first hazard model to 547.87 in the second one. As we can see that, there is a noticeable improvement in the fit.

The duration of breastfeeding is still the strongest significant determinant of the time to the resumption of menstruations among the included variables in model 2 (Table 6.5). The women with lower duration (0-5 months) of breastfeeding is 2.258 times higher risk to resume menses than the risk for higher duration (13 months and over) of breastfeeding, while the intermediate (6-12 months) breastfeeding women is 1.857 times higher than the base line one. However, if we compare these values with those found in the first model, controlling for demographic variables has produced a slight reduction in the relative risk associated with these breastfeeding factor. These changes suggest that the role of breastfeeding variables in the resumption of menses may mediate the effect of the demographic covariates.

Table 6.5: Effects of breastfeeding and demographic variables on the duration of post-partum amenorrhoea: Cox proportional hazard estimates. **Model-2**

Variables	Coefficient (β)	S.E (β)	Wald χ^2	Sig.	Relative Risk exp (β)	95% CI
Duration of Breastfeeding*						
0-5	0.814	0.055	219.16	0.000	2.258	2.027-2.515
6-12	0.619	0.050	154.94	0.000	1.857	1.684-2.047
(13 and above)	...	...	...	...	1.000	
Mothers Age* (in years)						
<=24	0.331	0.069	30.01	0.000	1.392	1.217-1.594
25-34	0.149	0.061	23.08	0.000	1.160	1.030-1.307
(35 and more)	...	...	...	...	1.000	
Sex of Child*						
Male	-0.097	0.031	9.94	0.002	0.907	0.854-0.964
(Female)	...	...	...	...	1.000	
Parity						
1-2	0.149	0.069	4.59	0.032	1.160	1.013-2.515
3-5	0.031	0.063	0.25	0.620	1.032	1.684-2.047
(6 and above)	...	...	...	...	1.000	
Delivery status*						
Normal	-0.387	0.071	29.39	0.000	0.679	0.591-0.781
Caesarean	...	...	...	...	1.000	
Log-likelihood	: 63270.38					
Model Chi-square	: 547.87					
Degrees of freedom (d.f)	: 8					
P	:0.000					
* at 1% level of significant						

The first demographic covariate included in the model 2 is the age of the mother. This variable is found to be highly significant at the 1% level of significance. The analyzed result shows that the women with less 24 years and (25-34) years of age are found to be 1.392 and 1.160 times higher risk of resumption menses than the older women (35 years and more). Thus, younger women resume menses much faster than in older women so the length of amenorrhoea period is higher in older women. Different studies have found that older age decreases the risk of earlier return to menses (Jones, 1988; Huffman, 1978)

One or two parity of women has significant effect on the probability of resuming menses out of all parity levels in this model. Mother with one or two parities have a risk of return menses is 1.60 times higher than mother with six children or more, while the risk of menstruation for mothers with three, four or five children is 1.032 times higher than the risk observed for mothers in the base line group for parity. Pinto et al. (1998) was found the same relation. Thus, high parity of mothers is associated with longer duration of amenorrhoea.

The effect of child sex is significant, because its biological effect on the length of amenorrhoea post-partum operates through breastfeeding. In context of Bangladesh male offspring has given top priorities for breastfeeding than female. The women who give births female child are 0.907 times lower risk resuming menses than male birth mothers.

Finally we want to see that weather there is any effect of mother delivery status on duration of amenorrhoea and found that they have significant effects ($p < 0.001$). Table 6.5 divulge that women with normal delivery status has 0.679 times less chance that is 32% lower chance of resuming menstruation than the risk observed for caesarean women. So we may conclude that women with normal delivery have longer duration of amenorrhoea than women with caesarean counterparts.

6.6.3 Model 3: Effects of breastfeeding and socio-demographic variables on amenorrhoea

Along with breastfeeding and demographic variables, four socio-economic covariates are taken into account in the third model (Table 6.6). The improvement of fit is considerable, the model chi-square increases from 547.87 to 622.77, which is highly significant. The socio-economic covariates are included as residence, region of residence, mother's education, and mothers working status. In the model 3 included breastfeeding, demographic and socio-economic variables are all significant except parity, according to the respective test of significance.

We can see that when education, occupation, residence and region of the mother are added to our baseline model (Model 1), the breastfeeding variables reduce their net effects on the resumption of menses. The coefficient estimated in the third model is small than those found in the first model. The most important reductions occurred in the parity of women and shows insignificant effect on the resumption of menses. Despite there are observed reductions in the effects of breastfeeding and demographic variables, they are still significant at highest (1%) levels.

First, the most important determinants of the time to the first menstruation is still the duration of breastfeeding. Table 6.6 reveals that the risk of resumption of menstruation is 2.236 times higher among short duration (0-5 months) of breastfeed women as compared with longer duration (13 months or more) of women. In model 1, without such controls, the relative risk is 2.362, always in relation to the higher duration. For the medium group (6-12months), the change goes from 1.952 in Model 1 to 1.810 in the model 3.

Table 6.6: Effects of socio-economic, breastfeeding and demographic variables on the duration of post-partum amenorrhoea: Cox proportional hazards estimates. **Model-3**

Variables	Coefficient (β)	S.E (β)	Wald χ^2	Sig.	Relative Risk exp (β)	95% CI
Duration of Breastfeeding* (in months)						
0-5	0.805	0.055	210.30	0.000	2.236	2.006-2.493
6-12	0.593	0.050	140.98	0.000	1.810	1.641-1.997
(13 and above)	...	...	...	...	1.000	
Mothers Age* (years)						
<=24	0.341	0.070	24.02	0.000	1.406	1.227-1.612
25-34	0.149	0.061	5.97	0.000	1.160	1.030-1.308
(35 and more)	...	...	...	...	1.000	
Sex of Child*						
Male	-0.089	0.031	8.38	0.004	0.915	0.861-0.972
(Female)	...	...	...	...	1.000	
Parity						
0-2	0.038	0.072	0.283	0.595	1.039	0.902-1.198
3-5	-0.001	0.064	0.000	0.984	0.999	0.882-1.131
(6 and above)	...	...	...	...	1.000	
Delivery Status*						
Normal	-0.235	0.075	9.78	0.002	0.791	0.683-0.916
Caesarean	...	...	...	...	1.000	
Place of Residence**						
Urban	0.085	0.034	6.19	0.013	1.088	1.018-1.163
(Rural)	...	...	...	...	1.000	
Administrative Division**						
Barisal	-0.143	0.065	4.81	0.028	0.867	0.763-0.985
Chittagong	-0.121	0.058	4.34	0.037	0.886	0.791-0.993
Dhaka	-0.094	0.057	2.72	0.099	0.911	0.815-1.018
Khulna	-0.039	0.063	0.376	0.540	0.962	0.850-1.088
Rajshahi	-0.073	0.058	1.559	0.212	0.930	0.829-1.042
(Sylhet)	...	...	...	...	1.000	
Respondent's Education*						
No education	-0.410	0.073	31.50	0.000	0.664	0.575-0.766
Primary	-0.347	0.072	23.39	0.000	0.707	0.614-0.814
Secondary	-0.217	0.070	9.64	0.000	0.805	0.702-0.923
(Higher)	...	...	...	...	1.000	
Respondent's Work Status*						
Not-working	0.141	0.040	12.14	0.000	1.515	1.063-1.246
(Working)	...	...	...	...	1.000	
Log-likelihood	: 63199.598					
Model Chi-square	: 622.77					
Degrees of freedom (d.f)	: 18					
P	: 0.000					
* at 1% level of significant						

Note: Reference category is in the parenthesis (...), $p < 0.01$, $p < 0.05$, $p < 0.10$ and $p < 0.20$

Thus it is clear that the duration of amenorrhoea is directly related with breastfeeding status of women. Those who breastfeed their child 13 months and more has longer

duration of amenorrhoea and those who breastfeed 0-5 months their child has shorter duration of amenorrhoea. The observed reduction in the coefficients of the breastfeeding variables, after adjusting for other variables, means that some demographic and socio-economic covariates are actually confounding variables.

Table 6.6 shows that age of mother have significant negative effect on the duration of amenorrhoea. By increasing age, the risk of resumption of menstruation is increasing. The relative risk for age ≤ 24 years is 1.406, and for age (25-34) years it is 1.160 i.e., the risk of resumption menses is significantly increases by 1.160 times and 1.406 times compared with mother whose age is 35 years and more. In fact coefficients, relative risk of the estimates for Model 2 and Model 3 remain steady, but chi-square value changes minimally below 35 years.

In Model 3 sex of child has still negative significant effect on resumption of menstruation as yet (Table 6.6). However, there is slight change of coefficient, chi-square value and relative risk from Model 2. It is observed that the relative risk ratio for male child is 0.915 compared with female child. Thus the resumption of menstruation is decreased significantly by 8% by the mother whose previous child is male as compared with mother whose previous child is female.

Parity or number of children has insignificant effect on the resumption of menstruation. The relative risks are 1.039 & 0.999 for parity (1-2) and (3-5) respectively, indicates that women with lower parity have higher risk of resumption of menstruation than those with parity 6 and more. In Model 2 shows significant effect, while in Model 3 risk is insignificant due to include socio-economic factors.

Type of delivery status is another significant factors influence on the post-partum amenorrhoea. In both the Models 2 & 3 divulge that this variable has highly significant effect on the resumption of menses, beside their regression estimates values are remaining same. As we can see, normal delivery women are 0.791 times less likely to resume menses as compared to as caesarian delivery women

Table 6.6 indicates that place of residence has a strong significant effect on the resumption of menstruation. The relative risk for urban women is 1.088 that is the relative risk for resumption of menstruation for urban women is 1.088 times higher than rural women. Which means that urban mother have shorter duration of amenorrhoea than rural mother.

From the table it shows that administrative division has little impact on resumption of menstruation. Though only Barisal and Chittagong division shows statistically significant result it reveals that as compared with sylhet division the risk of resumption of menstruation is lower for all other division. Among all other division it is 0.962 times lower in khulna division and .0867 times lower in Barisal division.

Education of respondents is strongly and negatively effect on the duration of amenorrhoea. The risk ratio for illiterate, primary and secondary educated mother is 0.664, 0.707 and 0.805 respectively, that is the risk of resumption of menstruation is decreased significantly by $((1-.664)*100=0.336)$ 34% among illiterate mother, 29% among primary educated mother and about 20% among secondary educated mother as compared with higher educated mother.

The effect of maternal education may act through the intervening variables such as women's employment status, family income, and socio-cultural factors. There are many

factors that could affect the relationship between female employment and the prevalence of breastfeeding: place of work, type of work, and the existence of alternatives for child care. The place and type of work influence lactation by affecting the access to the infant as well as the time available with him. It seems that breastfeeding is more compatible with part-time work or work that much flexibility in scheduling adequately the hours of work, for instance, when women work at home or can easily alternate household activities with their formal work.

Respondent work status has highly positive significant effect on the resumption of menstruation. The risk of resumption menses is 1.515 times higher among nonworking women as compared with working women which means the duration of amenorrhoea is lower for nonworking mother than working mother. Therefore, working status shows reverse result as our expectations.

6.7 Conclusion

This chapter has been investigated the important differentials of PPA. In bivariate analysis all explanatory variables are statistically associated with duration of amenorrhoea periods except religion and contraceptive use. In life table analysis overall mean duration of amenorrhoea is about 8.5 months for women in Bangladesh. The life table results also indicated that mean duration amenorrhoea periods gradually increases with increases parity.

The proportional hazards analysis is used to evaluate the important determinants of duration of amenorrhoea. The results suggested that palace of residence, working status, breastfeeding status and parity have significant effect on the duration of amenorrhoea, whereas administrative division, mother's education, sex of child and age at marriage have negative significant effect on post-partum amenorrhoea. Urban women are more

likely to resume menstruation than rural counterparts. When mother's education level increases the relative risk of resumption menstruation increases. The relative risk of termination of amenorrhoea period for women is lower for all administrative divisions than Sylhet division. Working women have lower hazards of resumption of menstruation than non-working counterparts. Increase of parity is associated with a decreasing risk of resumption of menstruation, but in case of age at marriage gives reverse results.

Figure 6.4: Survival function of those women who live in urban and rural areas at different months of post-partum durations.

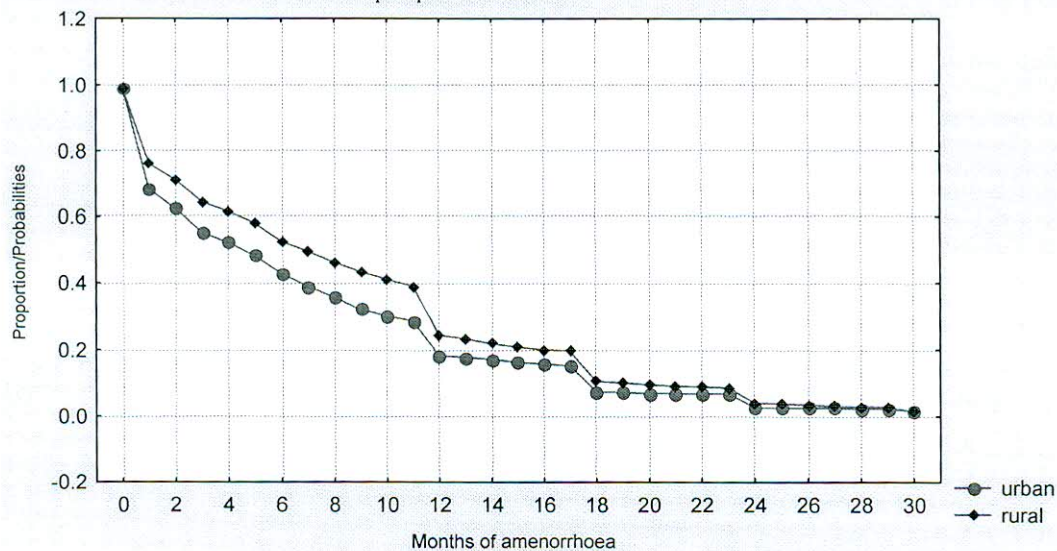


Figure 6.5: Survival function of those women who live in six division at different months of post-partum durations.

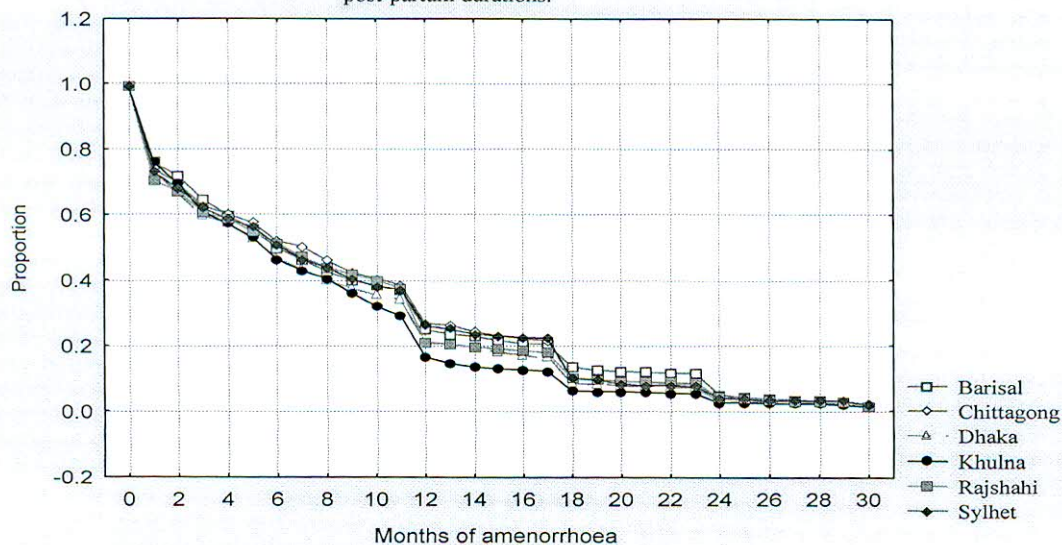


Figure 6.6: Survival function of those women who have no, primary, secondary and higher education at different months of post-partum durations.

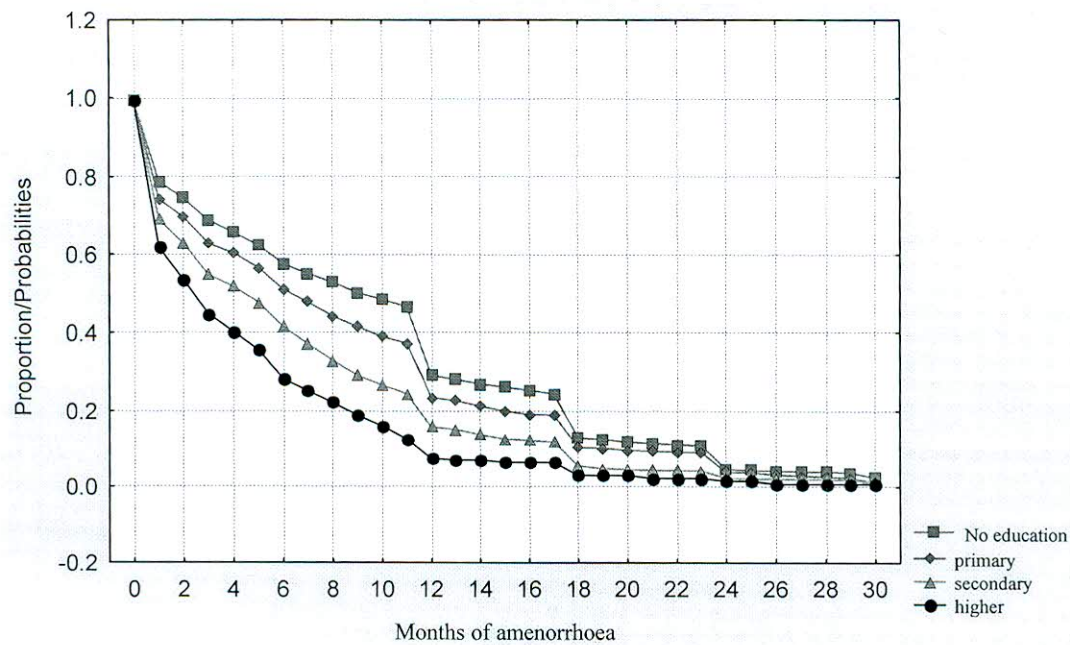


Figure 6.7: Survival function of those women who are not working and working at different months of post-partum durations.

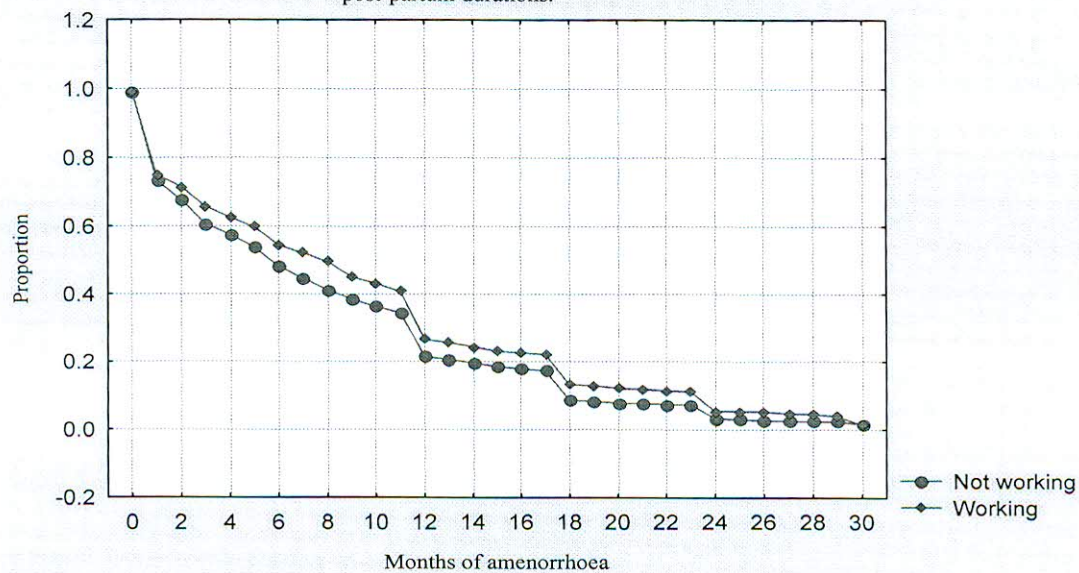


Figure 6.8: Survival function of women's religion at different amenorrhoea periods

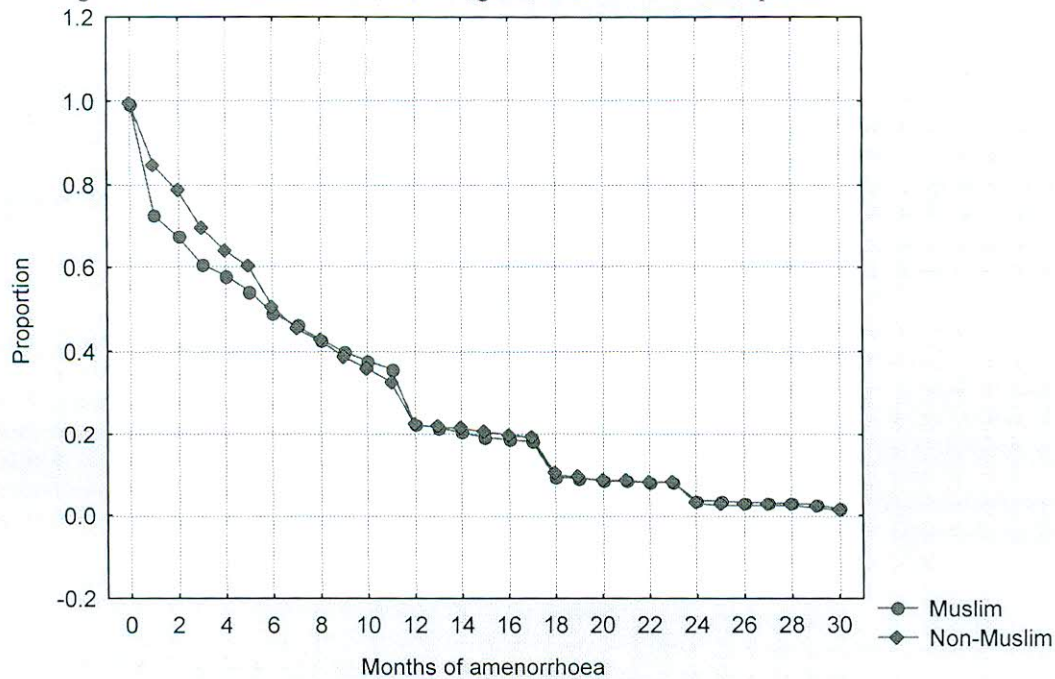


Figure 6.9: Survival function of those women who have female and male child at different months of post-partum durations.

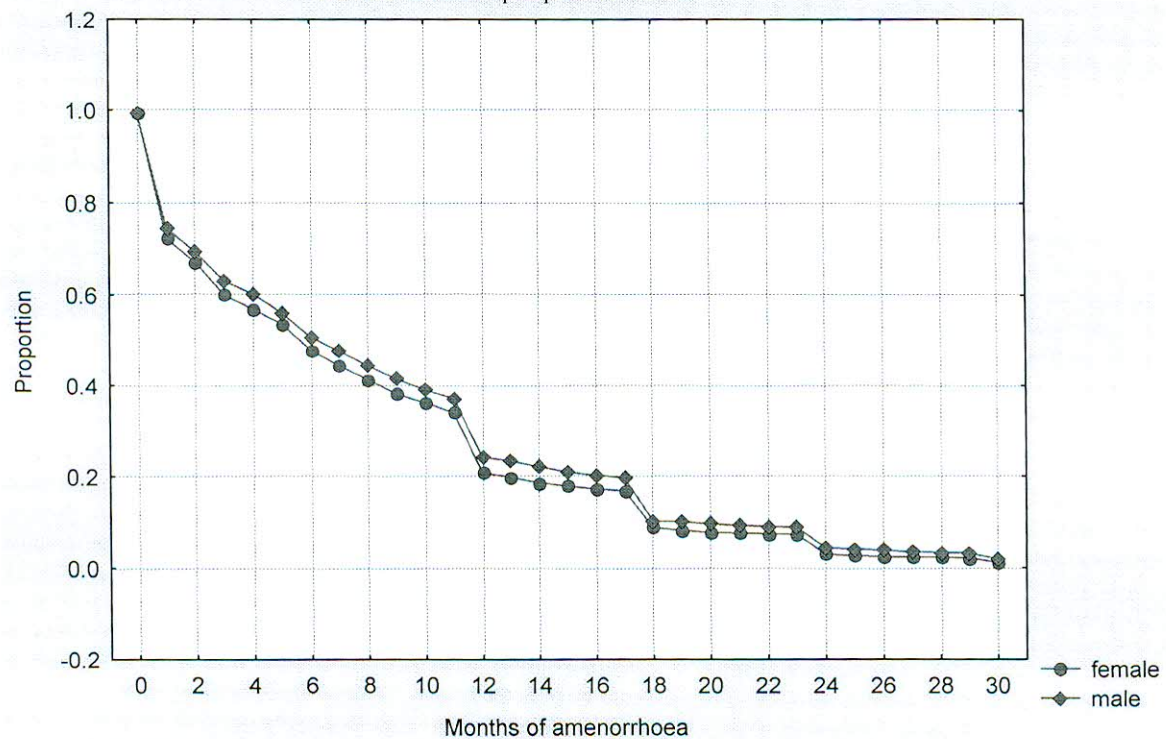


Figure 6.10: Survival function of those women who breastfeed ever and never at different months of post-partum durations.

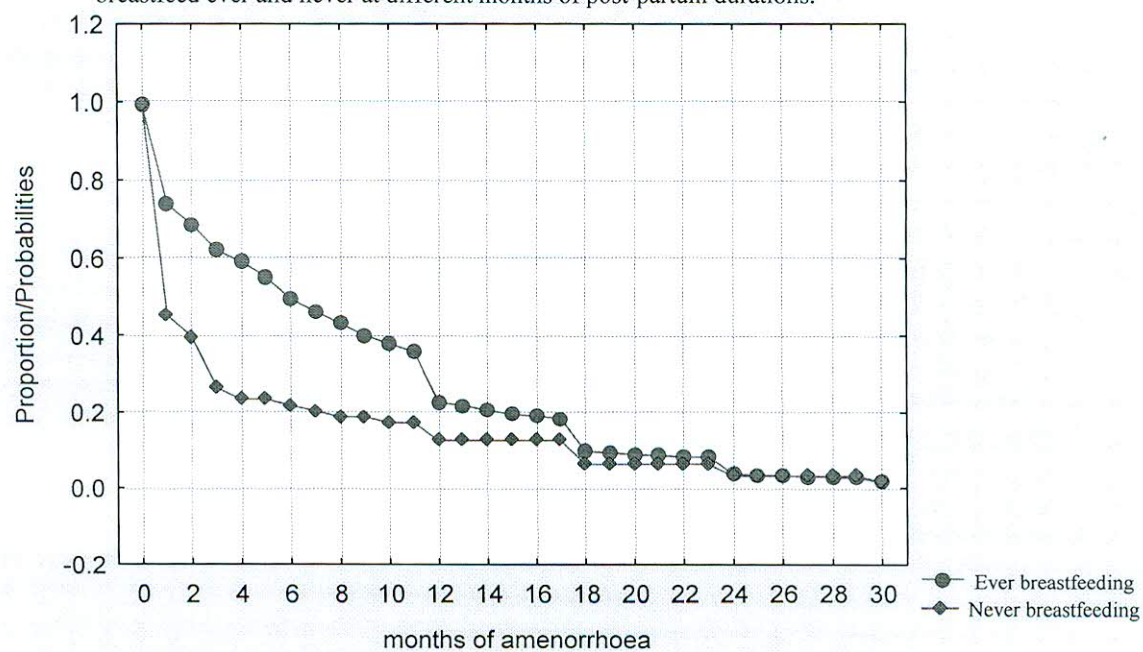


Figure 6.11: Survival functions of those women who are breastfed for (0-5), (6-12) and 13+ months at different months of post-partum durations.

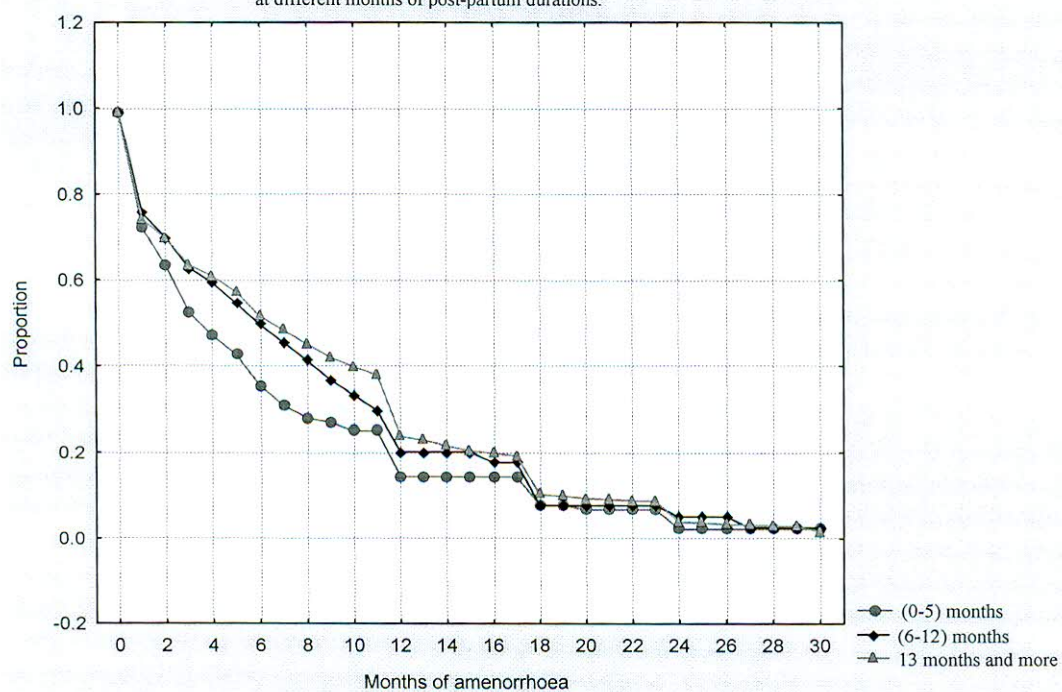


Figure 6.12: Survival function of those women who are (0-2), (3-5) and 6+ parity of mother at different months of post-partum durations.

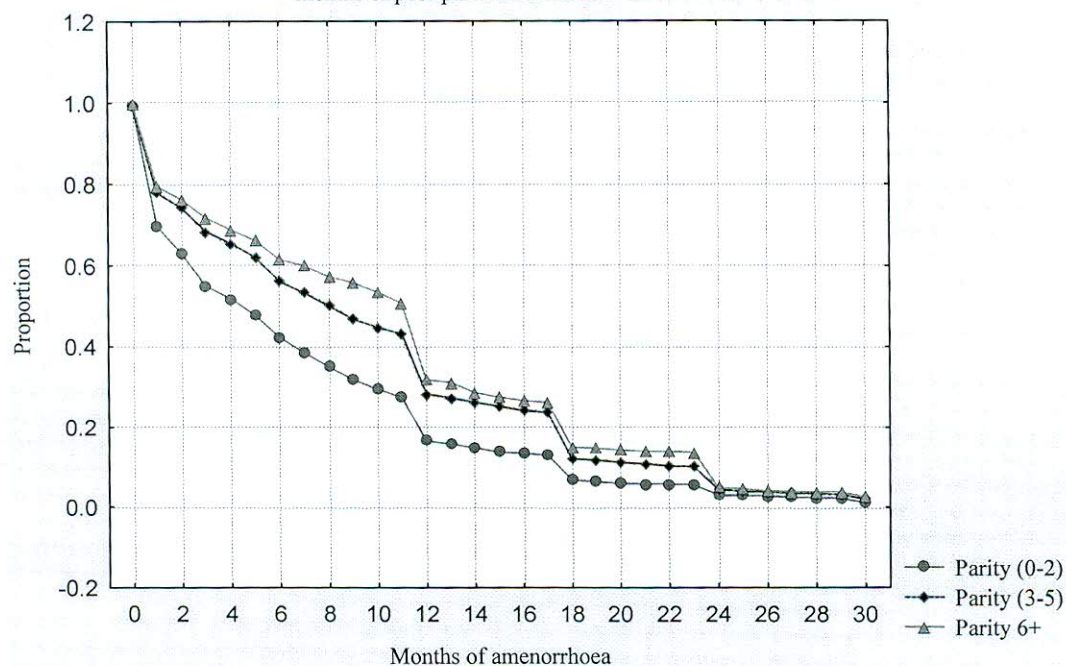


Figure 6.13: Survival function of those women who delivery child in normal and caesarean way at different amenorrhoea durations

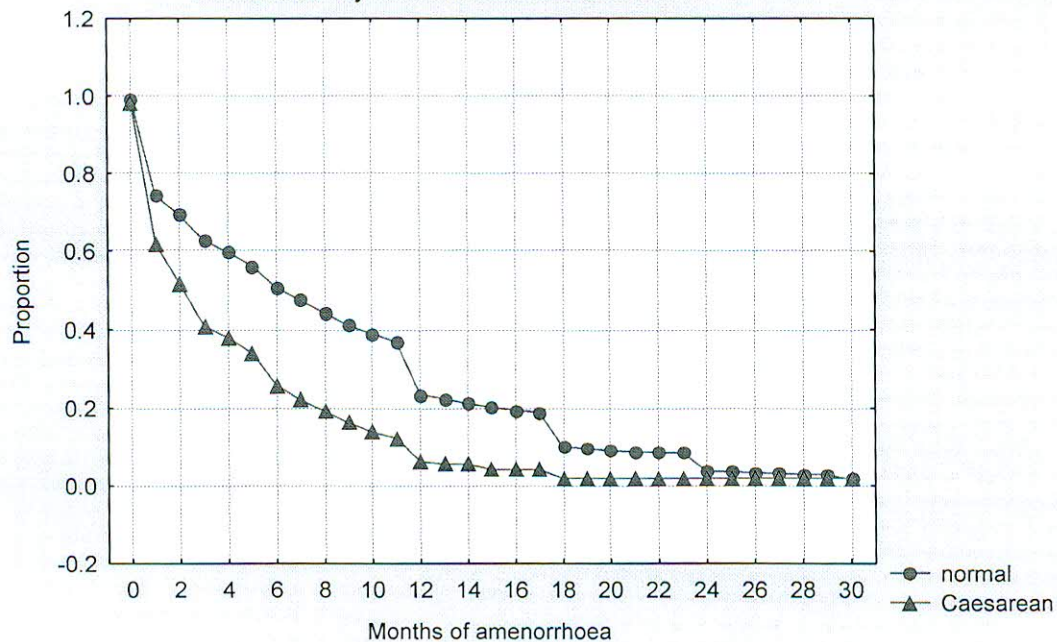
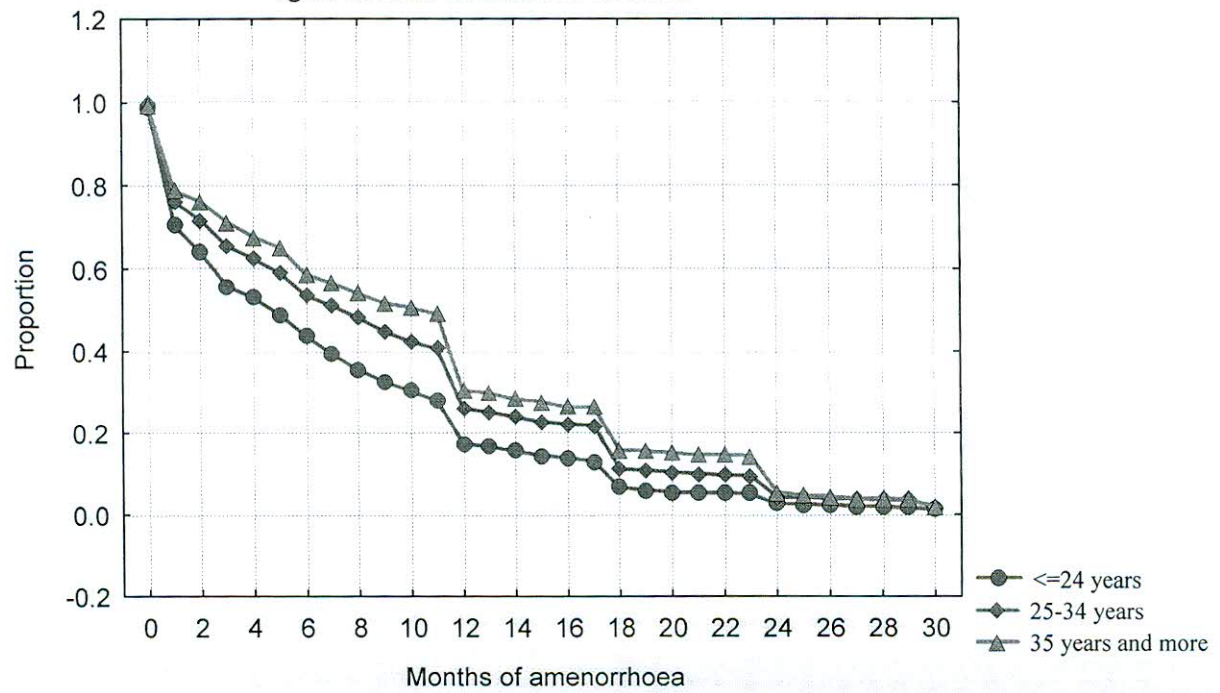


Figure 6.14: Survival function of those women who are ≤ 24 , 25-34, and 35+ years of age at different amenorrhoea durations



**CHAPTER
SEVEN**

**Influence of Birth Spacing on Child
Survival**

Chapter Seven

Influence of Birth Spacing on Child Survival

7.1 Introduction

There is a renewed programmatic interest in the effects of birth spacing on infant, child and maternal health and survival because family planning programs have the potential to affect the timing of pregnancies (Davanzo et al., 2004). The infant and child mortality is a revealing indicator of the impact of government intervention policies and programmes and of socio-economic development in general. A variety of studies dealing with this general issue have consistently shown that the lower socio-economic strata in our society have been and continue to be characterized by an external pronounced disadvantage when it comes to infant survival (Syamala, 2004).

The association between short intervals and impaired child survival are well established (Yerusalmy, 1945; Hobcraft et al., 1985; Koenig et al., 1990; Boerma and Bicego, 1992). It is generally accepted that if closely spaced births were delayed, particularly in countries where mortality and fertility are still high, child mortality levels would fall (World Development Report, 1993). The relationship between short birth intervals and high infant and child mortality has been established in a wide range of populations (e.g. Miller et al., 1992; Miller, 1991; Winkoff, 1983; Millman and Cooksey, 1987; Rutstein, 2000, 2003a, 2003b). Increasing the interval between births to improve the health of women and children has thus become one of the primary rationales for family planning programmes (World Development Report, 1993; Locoh, 1992).

Despite the existence of a large body of evidence on the association between birth spacing and child survival, many questions remain regarding the strength and nature of the association, and the magnitude of mortality reductions that can be expected from family planning programmes are still the subject of debate (Bongaarts, 1987; Trussell, 1988; Potter, 1988).

In this chapter we want to examine the associations between birth spacing and mortality in childhood using Bangladesh Demographic and Health Survey (BDHS, 2003-04) data. Firstly to explore the extent to which a child death shortens the length of time between subsequent births and; then to examine the association between a short preceding birth interval and neonatal, post-neonatal and child mortality.

7.2 Analytical Methods

7.2.1 Conventional Life Table Technique

The conventional life tables are employed to have an overall idea of influence of birth spacing on child survival. The tables are based on probability of dying and survival up to three years that is third birth day. In calculating the probability, numerators are the numbers of children dying and the denominators are the number of children entering each age group. The ratios are therefore, probabilities of death.

i.e. The age specific probability of dying is calculated as:

$$\text{Probability of dying} = \frac{(S_x - S_{x+n})}{S_x} = \frac{\text{Number of deaths between ages } x \text{ and } x+n}{\text{Number alive at age } x}$$

where S_x = Number of living children entering age x

S_{x+n} = Number of living children entering age $x+n$

7.2.2 Logistic Regression Model

Cox (1958) is the pioneer of logistic regression model. Subsequently this model illustrated by Wailker and Duncun (1967) and Cox himself (1970). More recently Lee (1980) and Fox (1984) have further illustrated the Cox's model. Logistic regression is part of statistical models called generalized linear models. An excellent treatment of generalized models is presented in Agresti (1996). The logistic regression model can be used not only to identify risk factors but also to predict the probability of success. The general logistic model expresses a qualitative dependent variable as a function of several independent variables, both qualitative and quantitative (Fox, 1984). Binomial (or binary) logistic regression is a form of regression, which is used when the dependent is a dichotomy and the independents are of any type. Let Y is a dichotomous dependent variable, which takes values 0 and 1, i.e.

$$Y_i = \begin{cases} 1, & \text{if death} \\ 0, & \text{otherwise} \end{cases}, i = 1, 2, 3, \dots, n$$

Also let there is a collection of k independent variables, which will be denoted by the vector, $X' = (x_1 x_2 x_3 \dots x_k)$ and β be a $(k+1) \times 1$ vector of unknown parameters.

For simplification, we can use the quantity $\pi(X) = P(Y=1|X)$ the probability that the event occurs conditional on the value of X . Hence, The basic form for the logistic regression models is:

$$\log \left[\frac{\pi_i}{1 - \pi_i} \right] = \beta_0 + \sum_{i=1}^k \beta_i x_i$$

Which can also be written as:

$$\pi_i = \frac{1}{1 + e^{-(\beta_0 + \sum_{i=1}^k \beta_i x_i)}}$$

Where, π_i in this case is the probability of death or survival of a child and β_i is the parameter estimate for the intercept and independent variables. The results of logistic regression analysis are given as coefficients, odds ratios (if greater than unity, the probability of being survived than that of death), P values, to assess the relative importance of the selected variables.

7.3 Correlation between preceding birth interval and child survival

Since considered factors, preceding birth interval and child survival i.e age at death of child may be correlated with each other interrelationship among the factors are investigated and the results are as follows:

Table 7.1: Correlation between preceding birth interval and mortality at 0 months, (1-5) months, (6-11) months, (12-23) months and (24-35) months as a whole study population, Bangladesh

	Birth interval	0	(1-5)	(6-11)	(12-23)	(24-35)	Birth
Birth interval	1.000	-.737**	-.661*	-.659*	-.721**	-.709**	-.538*
0		1.000	.982**	.984**	.972**	.937**	.884**
1-5			1.000	.988**	.973**	.933**	.939**
6-11				1.000	.971**	.912**	.910**
12-23					1.000	.938**	.891**
24-35						1.000	.903**
Birth							1.000

Table 7.2: Correlation between preceding birth interval and mortality at 0 months, (1-5) months, (6-11) months, (12-23) months and (24-35) months where preceding child died before conception, Bangladesh

	Birth interval	0	(1-5)	(6-11)	(12-23)	(24-35)	Birth
Birth interval	1.000	-.826**	-.841**	-.798**	-.866**	-.846**	-.834**
0		1.000	.966**	.968**	.991**	.965**	.899**
1-5			1.000	.977**	.984**	.995**	.968**
6-11				1.000	.969**	.974**	.969**
12-23					1.000	.979**	.928**
24-35						1.000	.967**
Birth							1.000

Correlation Table 7.1 constructed for the study population as a whole and correlation table 7.2 constructed only for those population whose preceding child had died before conception. From the correlation Table 7.1 we observe that birth interval is significantly and negatively correlated ($r=-0.737$) with infant mortality, i.e. when birth interval increases the neo-natal mortality (mortality at 0 months) decreases. Death at age (1-5) months, (6-11) months, (12-23) months and (24-35) months are also observed to be negatively and significantly correlated with birth interval.

From Table 7.2 we observe that in these case preceding birth interval is also negatively and significantly correlated with child mortality at age 0 months, (1-5) months, (6-11) months, (12-23) months and (24-35) months. But the most noted things is that here value of r is much higher than previous table. It is expected and not surprising, because here birth interval is much lower than previous one as this table is based only for those populations where preceding child had died before conception.

7.4 Influence of preceding birth interval on survival of child

In order to understanding the size of the effects of birth spacing and identifying the groups for whom they are greatest, age specific probability of dying and survival upto three years will provide useful information. Table 7.3 and 7.4 shows the analysis of the influence of the preceding birth interval on child survival and probability of child survival up to three years, as several countries have already began using a three year spacing message (Davanzo et al., 2004).

Table 7.3: Age specific probability of dying and survival up to third birth day of index child by length of preceding interval in the study population as a whole, Bangladesh,

Preceding birth interval	Age at death of index child					Prob ^y of sur. to 36 months	Total Birth	Percent
	0	1-5	6-11	12-23	24 -35			
<12	0.119792 (576)	0.035503 (507)	0.022495 (489)	0.016736 (478)	0.019149 (470)	0.80000 (461)	576	2.48
12-18	0.067806 (1873)	0.025773 (1746)	0.017049 (1701)	0.019737 (1672)	0.018304 (1639)	0.859 (1609)	1873	8.08
18-24	0.056853 (3940)	0.026911 (3716)	0.015763 (3616)	0.015173 (3559)	0.012839 (3505)	0.878 (3460)	3940	16.99
24-30	0.044328 (3993)	0.020178 (3816)	0.012303 (3739)	0.009207 (3693)	0.010112 (3669)	0.907 (3622)	3993	17.22
30-36	0.035042 (3453)	0.019208 (3332)	0.011628 (3268)	0.010526 (3230)	0.009074 (3196)	0.917 (3167)	3453	14.89
36-42	0.028125 (2560)	0.013264 (2488)	0.005295 (2455)	0.006552 (2442)	0.013603 (2426)	0.936 (2393)	2560	11.04
42-48	0.020219 (1830)	0.009481 (1793)	0.004505 (1776)	0.00509 (1768)	0.002843 (1759)	0.958 (1754)	1830	7.89
48-54	0.016393 (1281)	0.011905 (1260)	0.001606 (1245)	0.003218 (1243)	0.001614 (1239)	0.966 (1237)	1281	5.52
54-60	0.01466 (955)	0.004251 (941)	0.004269 (937)	0.003215 (933)	0.001075 (930)	0.973 (929)	955	4.12
60-66	0.019374 (671)	0.004559 (658)	0.001527 (655)	0.006116 (654)	0.004615 (650)	0.964 (647)	671	2.89
66-72	0.025295 (593)	0.013841 (578)	0.001754 (570)	0.000000 (569)	0.001761 (568)	0.958 (567)	593	2.56
72-78	0.026737 (374)	0.010989 (364)	0.008333 (360)	0.000000 (357)	0.002801 (357)	0.952 (353)	374	1.61
78-84	0.022201 (318)	0.022508 (311)	0.003289 (304)	0.000000 (303)	0.00033 (303)	0.950 (302)	318	1.37
84+	0.022164 (767)	0.021333 (750)	0.00545 (734)	0.000 (730)	0.00274 (730)	0.949 (728)	767	3.31
Total	0.039769 (23184)	0.017878 (22262)	0.009834 (21864)	0.009192 (21649)	0.009277 (21450)	0.917 (21251)	23184 4	100

Table 7.3 constructed for a total of 23184 births of second and higher order births for which the length of the preceding birth interval and age at death or survival to third birth day of the index child were known. Table 7.4 constructed for a total of 5049 births where the preceding child died before the index child had been conceived. The mentioned tables are all constructed on the same principle but are based on different samples of the study population; the rows represent different birth interval of the index children and the column relates to different age group of the same index children. Each cell represents the mortality experience related to a given preceding birth interval for a specific age group.

Only children observed during the full three years or dying the three years for the interval seven years (84 months) and above were included in calculating the probability of dying. Table 7.3 shows influence of preceding birth interval on child survival for the study population as a whole. From the table we observe that birth interval of less than 12 months are very exceptional (2.48%) and even interval of greater than 60 months (5 years) are not frequent (2.89%), and after that it happens perfunctory. We noticed that at the interval (66-72) months it is only 2.56% and at interval (72-78) months it is only 1.61%. Maximum births occur between the intervals (18-24) months and (24-30) months which is 16.99% and 17.22% respectively. When we noticed at age specific probability of dying we see that it is highest (0.1198) at age zero and birth interval less than 12 months.

Age specific probability of dying decrease when preceding birth interval increase up to 54-60 months which is 0.0147. But afterwards the probability of dying increases a little bit. Considering all age group less than three years we observe that age specific probability of dying is highest for birth interval less than 12 months, and lowest for preceding birth interval 54-60 months. So we may conclude that (54-60) months are the standard time to take a new child and it is less perilous for both baby and her mother. It is observed that the probability of surviving to its third birth day ranges from a low of 0.800 when the interval is less than 12 months to a high of 0.973 when the preceding birth interval is (54-60) months. The most noticeable things is that after 5 years duration the probability of survival decrease monotonically. For first five years when length of preceding birth interval increases the probability of survival increases but afterwards when length increases probability of survival decreases. So long birth interval is also pernicious for child survival. Several studies argued with this interpretation of child survival (Davanzo et al., 2004). Age specific probabilities of dying for children born less than 12 months are not easy to interpret because of smallest numbers except for index children during first six months of life. In this age group a preceding birth interval of less than 12 months seems to entail an excess risk (Azad, 2001).

Figure 7.1: Probability of Survival to 36 months by preceding birth interval

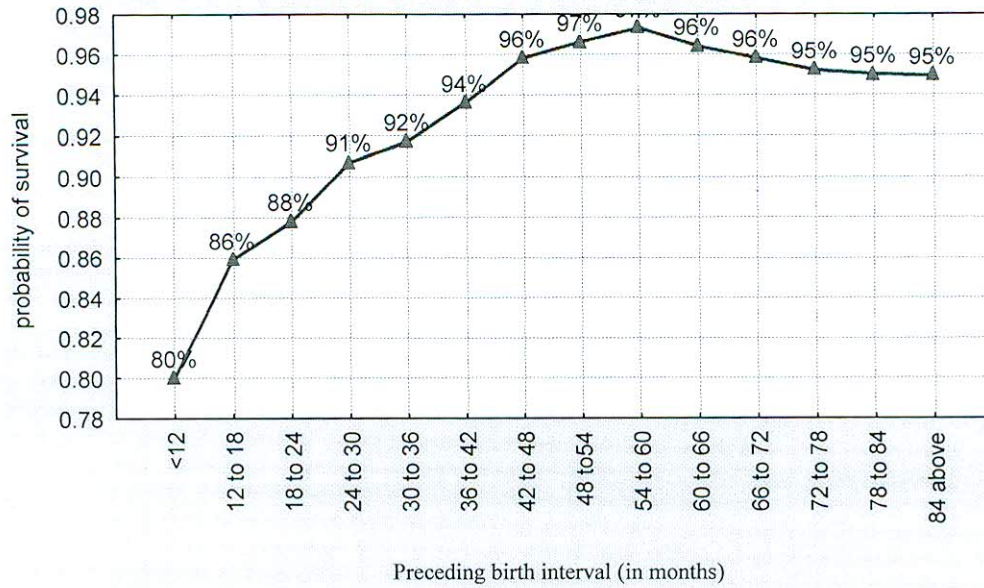
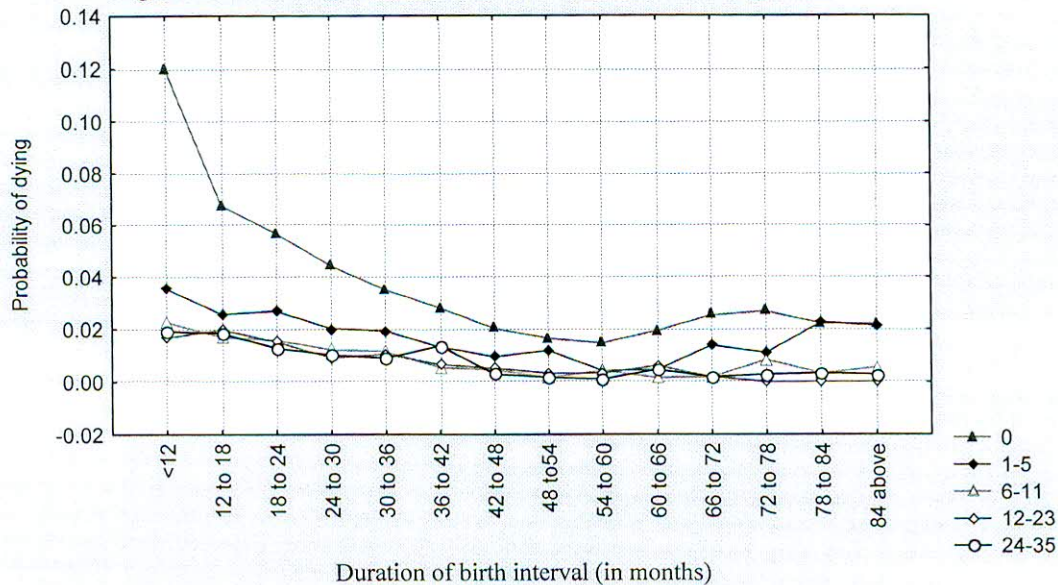


Figure 7.2: Probability of dying by different birth interval, Bangladesh



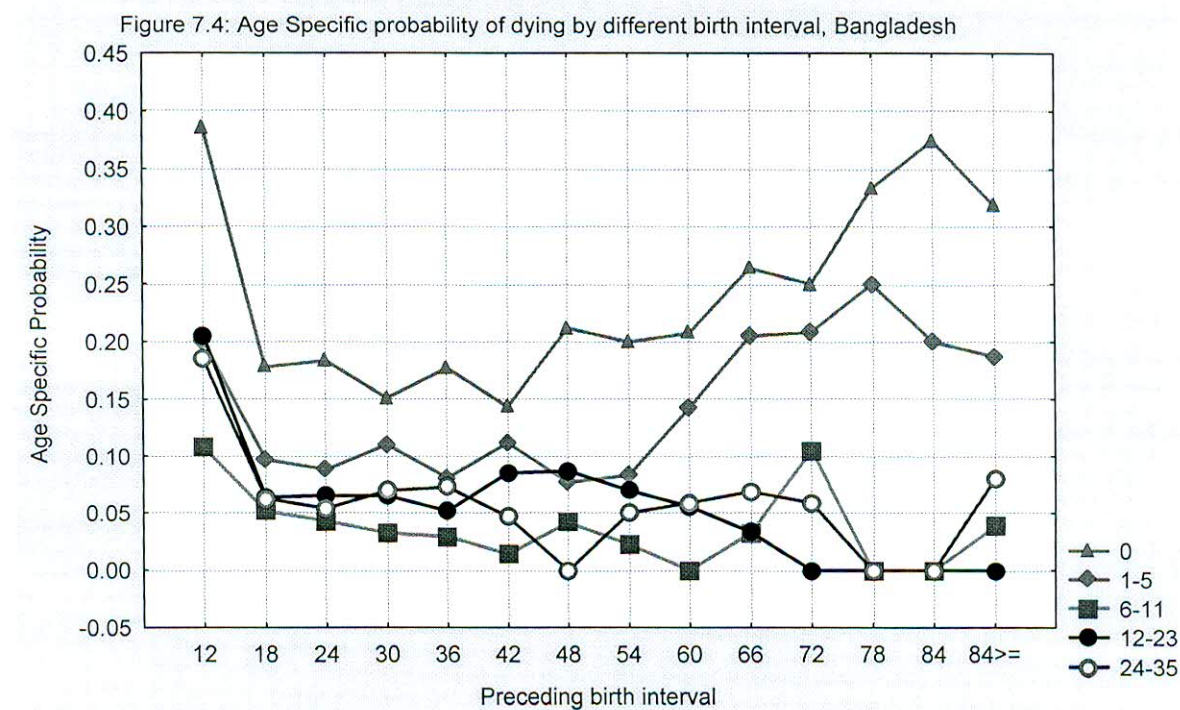
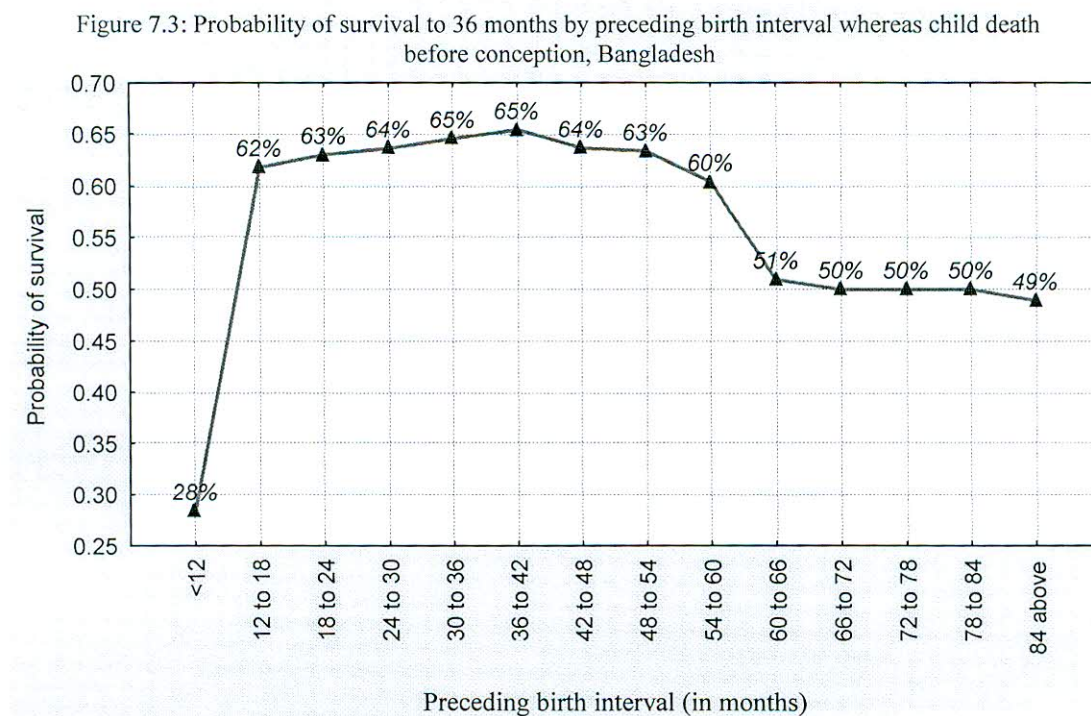
As we see in the Figure 7.1, the survival function takes the shape of a gradually increasing function at every distinct duration of preceding birth interval. The survival curve depicts an increasing trend up to 54 to 60 months of preceding birth interval amounting 97.7% chance of survival and thereafter it shows a moderately decreasing trend. It is indicative that the probability of survival is much lower for preceding birth intervals less than 12 months and it is much higher for (54-60) months. Figure 7.2 shows the

probability of dying at different age by different birth interval. The figures divulge that the probability of dying for different age group shows a monotonically decreasing trend. The trend begins initially for birth interval less than 12 months which is much higher, specially for age 0 months and then there is downward trend with minimally 60 months, but there after the trend is increasing and decreasing which is not clear.

Table 7.4 shows the influence of the preceding birth interval on child survival when preceding child died before the index child had been conceived. In this case the preceding intervals tend to be shorter (compare with table 7.3).

Table 7.4: Age-specific probability of dying and survival to third birthday of index child by length of preceding birth interval, where preceding child died before conception of the index child, Bangladesh

Preceding Birth interval	Age at death of index child (months)					Prob. of Sur. to 36 months	Total	Percent
	0	1-5	6-11	12-23	24-35			
<12	0.385604 (778)	0.200837 (478)	0.10733 (382)	0.205279 (341)	0.184502 (271)	0.284062 (221)	778	15.27
12-18	0.178132 (1381)	0.096916 (1135)	0.051707 (1025)	0.063786 (972)	0.062637 (910)	0.617668 (853)	1381	27.35
18-24	0.183755 (751)	0.088091 (613)	0.042934 (559)	0.065421 (535)	0.054000 (500)	0.629827 (473)	751	14.74
24-30	0.151079 (695)	0.110169 (590)	0.032381 (525)	0.064961 (508)	0.069474 (475)	0.635971 (442)	695	13.64
30-36	0.177215 (316)	0.080769 (260)	0.029289 (239)	0.051724 (232)	0.072727 (220)	0.645570 (204)	316	6.20
36-42	0.143617 (188)	0.111801 (161)	0.013986 (143)	0.085106 (141)	0.046512 (129)	0.654255 (123)	188	3.69
42-48	0.212121 (99)	0.076923 (78)	0.041667 (72)	0.086957 (69)	0.000000 (63)	0.636364 (63)	99	1.94
48-54	0.200000 (60)	0.083333 (48)	0.022727 (44)	0.069767 (43)	0.050000 (40)	0.633333 (38)	60	1.17
54-60	0.207547 (53)	0.142857 (42)	0.000000 (36)	0.055556 (36)	0.058824 (34)	0.603774 (32)	53	1.04
60-66	0.264151 (53)	0.205128 (39)	0.032258 (31)	0.033333 (30)	0.068966 (29)	0.509434 (31)	53	1.05
66-72	0.250000 (32)	0.208333 (24)	0.105263 (19)	0.000000 (17)	0.058824 (17)	0.500000 (16)	32	0.63
72-78	0.333333 (18)	0.250000 (12)	0.000000 (9)	0.000000 (9)	0.000000 (9)	0.500000 (9)	18	0.36
78-84	0.375000 (8)	0.200000 (5)	0.000000 (4)	0.000000 (4)	0.000000 (4)	0.500000 (4)	8	0.56
84+	0.319149 (47)	0.18750 (32)	0.038462 (26)	0.00000 (25)	0.080000 (25)	0.489362 (23)	47	0.93
Total	0.183403 (5049)	0.097744 (4123)	0.04086 (3720)	0.066143 (3568)	0.059424 (3332)	0.620717 (3134)	5049	100



The figure 7.3 provides information on probability of survival by preceding birth interval where preceding child died before conception. As is presented the trend of probability of

survival begins initially for preceding interval less than 12 months, where chance of survival is much lower (28%) and the trend increases very rapidly in preceding interval 12 to 18 months amounting well above 62 %, and gradually increase up to interval 36 to 42 months which is 65%. After 42 months the probability of survival again shows decreasing trend.

Figure 7.4 shows the pattern of probability of dying at different age group by different preceding birth interval. The figures clearly depicts that the probability of dying is much higher for 0 months of age. The trends begins initially for preceding interval less than 12 months and observe that in these interval the probability of dying is much higher, and afterwards it shows increasing and decreasing trend. The trend lays highest pick at preceding interval 78 to 84 months for age 0 months. For other age group the trend also shows that the probability of dying is much higher for preceding interval less than 12 months and afterwards it shows zigzag pattern that is ups and downs trend. Actually this may because, the figure is constructed for those children only who's preceding child died before the index child had been conceived.

7.5 Probability of Survival and Dying by Birth Order

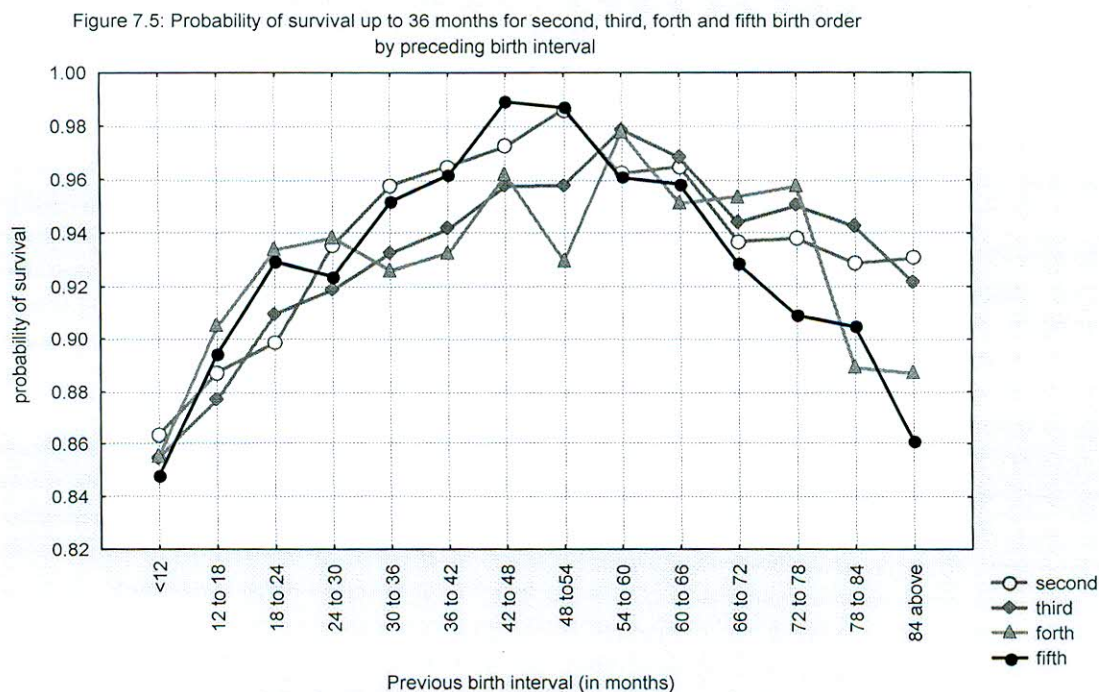
Table 7.5 shows probability of survival and dying by different birth orders of child. The previous Tables (7.3 and 7.4) are constructed on the basis of index child second and higher order births taken together. But in order to better understanding the age specific probability of dying, probability of dying or survival to its third birth day by each birth order of child this table is constructed.

Table 7.5: Probability of survival and death up to 36 months by second, third, fourth and fifth birth order by length of preceding birth interval, Bangladesh

Previous Interval	Probability of survival to 36 months				Probability of death to 36 months			
	Second	Third	Fourth	Fifth	Second	Third	Fourth	Fifth
<12	0.863568	0.854893	0.855346	0.848259	0.136432	0.145107	0.144654	0.151741
12-18	0.887305	0.877049	0.904645	0.894295	0.112695	0.122951	0.095355	0.105705
18-24	0.898510	0.909542	0.933692	0.929260	0.101490	0.090458	0.066308	0.070740
24-30	0.935511	0.918699	0.938163	0.923729	0.064489	0.081301	0.061837	0.076271
30-36	0.957664	0.932432	0.925806	0.951613	0.042336	0.067568	0.074194	0.048387
36-42	0.965058	0.941452	0.932540	0.961538	0.034942	0.058548	0.067460	0.038462
42-48	0.972292	0.957447	0.961538	0.989011	0.027708	0.042553	0.038462	0.010989
48-54	0.985876	0.957806	0.929577	0.986842	0.014124	0.042194	0.070423	0.013158
54-60	0.962264	0.978723	0.977778	0.960784	0.037736	0.021277	0.022222	0.039216
60-66	0.965000	0.968254	0.950980	0.958333	0.035000	0.031746	0.049020	0.041667
66-72	0.936937	0.943820	0.953488	0.928571	0.063063	0.05618	0.046512	0.071429
72-78	0.938053	0.950000	0.957447	0.909091	0.061947	0.05	0.042553	0.090909
78-84	0.928571	0.942308	0.888889	0.904762	0.071429	0.057692	0.111111	0.095238
84+	0.930612	0.921466	0.886792	0.861111	0.069388	0.078534	0.113208	0.138889
Total	0.919245	0.909407	0.915973	0.888152	0.080755	0.090593	0.084027	0.111848

The information about total births, age at death, and age specific probability of dying for second, third, fourth and fifth birth orders by length of preceding birth interval are shown on appendix (Table 7.5a1 to 7.5a4). Whereas this table is based on probability of survival and dying to its third birth day for 2nd, 3rd, 4th, and 5th birth order. From table 7.5 we found that probability of survival is much higher for second birth order (0.919245) and comparatively lower for third and fourth birth orders which are 0.909407 and 0.915973 respectively. And much lower for fifth birth order (0.888152). Like Table 7.3 and 7.4 we observe from table 7.5, for all birth orders probability of survival is much lower for preceding birth interval less than 12 months and 12-18 months and also the probability of dying is much higher in this interval. For second birth order probability of survival is highest (0.985) for preceding birth interval (48-54) months, for third and fourth birth order the probability of survival is highest in same interval (54-60) months and for fifth birth order it happens in (42-48) months. For each birth order the same is true by seeing the value of probability of death which is much lower than other value. So short

preceding birth interval is much perilous for child survival and also higher birth interval is harmful. As probability of survival is much lower between interval (42-60) months, this time is suggested to be appropriate time to have another child.



In order to have a general eye vision and easily understanding about the situation of the probability of survival to its third birth day by preceding birth interval for each of birth orders, second, third, fourth and fifth, Figure 7.5 is constructed. The survival curve for different birth order indicate that the highest pick lying somewhere between 42 to 60 months. Which means that in these interval probabilities of survival is higher. The curve begins minimally with preceding interval less than 12 months, afterwards it shows increasing trends and laying at highest pick (in 48-54 months) it again shows downward trends.

7.6 Determinants of Mortality

For a better understanding of the contribution of the preceding birth interval and each of the socio-demographic factors on the dependent variable namely the survival status or mortality, a multivariate analysis using the logistic regression model is undertaken. Logistic regression model is performed considering four cases of mortality, neo-natal mortality, post neo-natal mortality, mortality between 12-35 months and child mortality that is mortality between ages 1 to 5 years. The results for the models are summarized in Table 7.6, Table 7.7, Table 7.8 and Table 7.9. The entire table constructed to show the influence of preceding birth intervals on child survival after controlling other variables.

7.6.1 Neonatal Mortality

Table 7.6 shows the results of logistic regression analysis for neo-natal mortality along with regression co-efficient (β) and standard error. The odds ratios (exponential of the regression co-efficient) and 95% confidence interval are also presented for each variable in the study. The significance level (p) shows how significantly a particular regression co-efficient differs from that of the reference category. All the variables in the model, with the exception of birth order have highly significant effects on neo-natal mortality risk (Table 7.6).

From the table we observe that the preceding birth interval shows negative significant effect on neo-natal mortality risk. An adverse effect of short preceding birth interval observes in this model. It is found that the relative risk of neo-natal mortality is higher for short preceding birth interval (less than 24 months). The mortality risk is twice as low for children born after 48 months and 0.643 times low for children born within (24-47) months. Thus when birth interval increases the relative risk of mortality decreases.

Table 7.6: Logistic regression estimate for the effect of preceding birth interval and socio-demographic factors on neo-natal mortality, Bangladesh

Explanatory Variables	Coefficient (β)	S.E (β)	Significance level (P)	Odds ratio	95% CI
Preceding Birth interval* (months)					
<24	...	...	...	1.000	0.456-0.907
24-47	-0.442	0.176	0.012	0.643	0.336-0.733
48 and above	-0.701	0.199	0.000	0.496	
Birth order					
2-4	-0.451	0.283	0.111	0.637	0.366-1.108
5-7	-0.304	0.261	0.243	0.738	0.443-1.229
7>	...	...	...	1.000	
Mother's age at birth* (years)					
<=24	-0.535	.293	0.009	0.586	0.330-1.040
25-34	0.038	0.235	0.068	1.039	0.655-1.648
35 and above	...	...	...	1.000	
Breastfeeding status*					
Ever breastfeed	-4.464	0.304	0.000	0.012	0.006-0.021
Never breastfeed	...	...	...	1.000	
Mother's education*					
No education	...	...	...	1.000	
Primary	-0.285	0.164	0.083	0.752	0.545-1.038
Secondary and higher	-0.708	0.224	0.002	0.493	0.317-0.764
Model χ^2 :	259.687				
d.f :	9				
P value :	0.000				
Cox & Sneel R-square:	0.032				

In particular children born after long intervals (lasting four years and more) appear to have better survival chances than do children in shorter preceding birth interval (two years or less). Boerma and Bicego found that (1992) during the neo-natal period, the relative risk of dying associated with short preceding birth intervals are substantially higher in African and Asian countries. Majumder et al (1997), Ezra and Gurum (2002), Pandey et al (1998) also found that short preceding birth interval is a crucial problem for neonatal mortality risk. So they provide a strong rationale for advocating child spacing to improve child survival.

In case of neo-natal mortality risk birth order becomes an unimportant factor as they shows no significant effects. Various studies of Bangladesh (Majumder et al., 1997) show that they have strong significant effect on child hood mortality risk. But in our study it gives unfortunate results. Though it reveals that the mortality risk is higher for higher birth orders and it is comparatively lower for smaller birth orders. Births of very high order may have mothers who are physically depleted at the time of conception and throughout pregnancy. They are thus 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 also born into families that already have a number of young children who compete for resources and parental care.

Children born to mothers under 24 years of age or over 35 years old are may likely to have elevated risks of mortality than medium maternal age group mother. But in our study they appear to have only marginal significant effect. We observe that the risk of neo-natal mortality is 0.586 times lower for younger age group (≤ 24 years) mother and 1.039 times higher for medium age group mother (25-34) as compared with older age group (35+) women. The maternal age at birth for various groups interacts with each other and in either case the result is in question.

Breastfeeding status of mother shows strong significant effect on neo-natal mortality risk. It is observed that the chance of survival at neo-natal period is much higher for babies who ever breast feed. The relative risk of mortality is 0.012 times lower for babies who ever breast feed as compared with babies who never breast feed. Considerable reduction in mortality risk is associated with breast feeding specially in a society where poverty is rampant and prolonged breastfeeding is a norm. Nonetheless the roll of breast

feeding plays in reducing mortality risks of children and in prolonging birth intervals, which in turn plays a role of fertility reduction should be emphasized.

Education of mother also shows significant effect on risk of neonatal mortality. From the table we find that as compared with illiterate mother the risk of mortality is 0.752 times lower for primary educated mother and 0.493 times lower for secondary and higher educated mother. In developing countries, mothers' educational level tends to have a strong effect on the mortality of young children (Govindasamy and Ramesh, 1997; Hobcraft et al., 1984; Mosley and Chen, 1984; United Nations 1985, 1991, 1998). Literate mothers usually give birth healthier babies because they themselves tend to be healthier than mothers who are illiterate. In addition, literate mothers are more likely to provide their children with a healthier environment and nutritious food than illiterate mothers, even when other conditions are similar. Lastly, literate mothers are 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 are likely to result in lower mortality of children at all ages under five (Caldwell, 1994; Cleland and Kaufman, 1993; World Bank, 1993).

7.6.2 Post-Neonatal Mortality

Table 7.7 presents the results of logistic regression analysis for post-neonatal mortality. This model also considers the same factors as independent variables as in Table 7.6. From Table 7.7 we see that all our included explanatory variables have significant effect on post neo-natal mortality except mother's age at birth. Though mother's age at birth showed significant effects on neo-natal mortality.

Table 7.7: Logistic regression estimate for the effect of preceding birth interval and socio-demographic factor on post-neonatal mortality, Bangladesh

Explanatory Variables	Coefficient (β)	S.E (β)	P value	Relative risk	95% CI
Preceding Birth interval** (months)	...	...	...	1.000	
<24	-0.288	0.225	0.200	0.749	0.482-1.164
24-47	-0.575	0.260	0.027	0.563	0.338-0.937
48 and above					
Birth order*					
2-4	-1.024	0.327	0.002	0.359	0.189-0.682
5-7	-0.789	0.287	0.006	0.454	0.259-0.798
7>	...	...	...	1.000	
Mother's age at birth (years)					
<=24	-0.559	0.361	0.121	0.572	0.282-1.159
25-34	-0.257	0.272	0.345	0.774	0.454-1.318
35 and above	...	...	...	1.000	
Breastfeeding status*					
Ever breastfeed	-2.375	0.389	0.000	0.093	0.043-0.199
Never breastfeed	...	...	...	1.000	
Mother's education*					
No education	...	...	...	1.000	
Primary	-0.342	0.211	0.105	0.710	0.469-1.074
Secondary and higher	-0.974	0.332	0.003	0.377	0.197-0.724
Model χ^2 :	83.141				
d.f :	9				
P value :	0.000				
Cox & Snel R-square:	0.010				

We observe that preceding birth interval shows significant negative effect on post-neonatal mortality. Unlike the results in table 7.5 the odds of dying diminish with the increase in preceding birth interval. As compared with preceding birth interval less than 24 months the risk of dying is 0.749 times lower for interval group 24-47 and it is 0.563 times lower for interval group 48 years and above. So, there is no doubt that lower birth interval is more perilous both for neo-natal and post-neonatal mortality of children.

Birth order shows negative significant effect on post-neonatal mortality risk. The risk of post-neonatal mortality is 0.359 times lower for birth order of mother 2-4 and it is 0.454

times lower for birth order 5-7 as compared with birth order 7 and above. Thus we see that the mortality risk increases with the increase in birth order. During these stages of child development, mortality is more likely to depend on the care they receive than on biological factors. Children of high order births face competition from older siblings for food and parental attention. They also face exposure to infectious childhood diseases from their siblings. In addition, the mother's nutritional status, which affects birth weight and lactation, may decrease with high birth orders (Pandey et al., 1998).

Mother's age at birth shows no significant effect on post-neonatal mortality. But it reveals that mother who gave birth at older ages have greater chance of post-neonatal mortality. As compared with mother's age at birth 35 and above the relative risk is 43 percent lower for mothers age at birth group less than 24 years and it is 23 percent lower for mothers age at birth group 25 to 34 years. In fact women over 35 years may experience age related problems during pregnancy and delivery.

Both for neo-natal and post neo-natal mortality breastfeeding status show highly significant risk. The risk of mortality is 0.093 times lower for child who ever breast feed as compared with never breast feed child. Thus we observe that the relative risk of neo-natal mortality is 91 percent lower for children who ever breastfeed than never breastfeed children. In fact breastfeeding has highly nutritious, provides all the elements needed for infant health during the first six months of life and many of those are needed for months there after (Buchanan, 1975). Breastfeed infants have a better pattern of growth and experience substantially lower mortality risk than infant who are not breastfeed particularly in the first year of life (James, 1984; Pallani and Millan, 1986; Rahman et al., 2005).

Education of mother shows significant effect both for neo-natal and post-neonatal mortality. As compared with illiterate mother the relative risk is 0.710 times lower for post-neonatal mortality and it is 0.377 times lower for secondary and higher educated mother. Numerous arguments support a direct causal relationship between mother's literacy and infant and child mortality. Some studies however indicate that the causal relationship is not clear, but rather that mother's literacy is often just a good indicator of other socio-economic factors that affect infant and child mortality directly (Desai and Alva, 1998; Hobcraft, 1993).

7.6.3 Mortality for age 12-35 months

Table 7.8 shows the results of logistic regression analysis on mortality for children at 12-35 months. This table considers the same variables as in table 7.6 and 7.7. From the table we observe that among the socio-demographic variables birth order and mother's age at birth has no significant effect on mortality between 12-35 months. From this model we observe that for both the previous three model there is no change in factors preceding birth interval, breastfeeding status, and mother's education on mortality risk of children. So these variables has strong significant effect but the variables birth order and mother's age at birth shows less significant effect.

From the Table 7.8 we see that as compared with preceding birth interval less than 24 months the risk of mortality is 0.542 times lower and it is 0.261 times lower for birth interval 48 months and above.

Table 7.8: Logistic regression estimate of the effect of preceding birth interval and socio-demographic factors on mortality 12-35 months, Bangladesh

Explanatory Variables	Coefficient (β)	S.E (β)	P value	Relative risk	95% CI
Preceding Birth interval* (months)	...	...	...	1.000	
<24	-0.613	0.272	0.024	0.542	0.318-0.923
24-47	-1.344	0.360	0.000	0.261	0.129-0.527
48 and above					
Birth order					
2-4	-0.390	0.483	0.419	0.677	0.262-1.745
5-7	-0.101	0.434	0.816	0.904	0.386-2.117
7>	...	...	...	1.000	
Mother's age at birth (years)					
<=24	-0.375	0.492	0.446	0.687	0.262-1.802
25-34	-0.136	0.397	0.731	0.873	0.401-1.899
35 and above	...	...	...	1.000	
Breastfeeding status*					
Ever breastfeed	-2.351	0.496	0.000	0.095	0.036-0.252
Never breastfeed	...	...	...	1.000	
Mother's education**					
No education	...	...	...	1.000	
Primary	-0.599	0.302	0.047	0.549	0.304-0.992
Secondary and higher	-0.670	0.378	0.076	0.512	0.244-1.073
Model χ^2 :	45.148				
d.f :	9				
P value :	0.000				
Cox & Snel R-square:	0.006				

Though birth order of child shows no significant effect on mortality at ages 12-35 months it reveals that as compared with higher order births the risk is 0.677 times lower for birth order 2-4 and it is 0.904 times lower for birth order 5-7. Mother's age at birth also shows insignificant effect on mortality risk. The risk of mortality is 0.687 times lower for younger age at birth group mother, and it is 0.873 times lower for mother's age at birth between ages 25-34 years as compared with older age (35+) at birth group mother.

Breast feeding status of child shows strong significant effect on mortality risk of children between ages 12-35 months of children. The risk is 95 percent lower for ever breastfeed

child than their counterparts. Breastfeeding is the unique source of nutrition that plays an important role in the growth, development and survival of infants. The benefits of breastfeeding, especially exclusive breastfeeding, are well established (Victora et al., 1987, Huttly et al., 1997) particularly in poorer environments where the early introduction of other milk is of particular concern because of the risk of contamination and over dilution of milk leading to increased risks of morbidity and under nutrition.

Mother's education also shows significant effect on mortality risk on children at ages 12-35 months. From the results (Table 7.8) we observe that the risk of mortality is 0.549 times lower for primary educated mother, and 0.512 times lower for secondary and higher educated mother than their illiterate counterpart. So mother's literacy emerges as an important factor associated with mortality during 12-35 months of life, especially after the first month.

7.6.4 Child Mortality

Table 7.9 shows logistic regression estimate of the effects of preceding birth interval and socio-demographic factors on child mortality. From the table we find that all the included variables have statistically significant effect on child mortality. Among the variables preceding birth interval, breastfeeding status and mother's education shows strong significant effect and birth order and mother's age at birth shows less significant effect. From the previous table (Table 7.6, 7.7 & 7.8) we observe that survival chances losses much from short preceding birth interval for both neo-natal, post neo-natal, and children between ages 12-35 months, the same pattern is true for table 7.9. It reveals that the risk of child mortality is much higher for shorter preceding birth interval. As compared with birth interval less than 24 months the risk is 0.783 times lower for birth interval 24-47 months and it is twice lower for 48 and above months.

Birth order shows negative significant effect on child mortality. When birth order increases the chance of survival decreases. From the table we observe that the risk of mortality is 0.463 times and 0.671 times lower for birth order 2-4 and 5-7 respectively as compared with birth order 7+.

Mother's age at birth also have negative significant effect on child mortality. It shows that the risk of child mortality is much higher for those women who give birth at older ages. As compared with older age at birth (35+years) the risk of child mortality is 0.558 times and 0.775 times lower for age at birth group less than 24 years and 25-34 years respectively.

Table 7.9: Logistic regression estimate of the effect of preceding birth interval and socio-demographic factors on child mortality, Bangladesh

Explanatory Variables	Coefficient (β)	S.E (β)	P value	Relative risk	95% CI
Preceding Birth interval* (months)	...	...	...	1.000	
<24	-0.244	0.167	0.144	0.783	0.565-1.087
24-47	-0.793	0.202	0.000	0.452	0.305-0.672
48 and above	...	...	...	1.000	
Birth order**					
2-4	-0.770	0.260	0.003	0.463	0.278-0.771
5-7	-0.399	0.229	0.081	0.671	0.429-1.051
7+	...	...	...	1.000	
Mother's age at birth** (years)					
<=24	-0.584	0.274	0.033	0.558	0.326-0.954
25-34	-0.255	0.210	0.226	0.775	0.513-1.170
35 and above	...	...	...	1.000	
Breastfeeding status*					
Ever breastfeed	-2.363	0.329	0.000	0.094	0.049-0.179
Never breastfeed	...	...	...	1.000	
Mother's education*					
No education	...	...	...	1.000	
Primary	-0.441	0.163	0.007	0.643	0.467-0.885
Secondary and higher	-0.835	0.234	0.000	0.434	0.274-0.686
Model χ^2 :	130.958				
d.f :	9				
P value :	0.000				
Cox & Snel R-square:	0.016				

Breastfeeding status of child shows highly significant effect on child mortality. The risk of mortality is much lower for ever breastfeed child than never breastfeed. The chance of survival is 90% higher for ever breastfeed child than never feeding counterpart. So there is no perilous that breast feeding plays an important role to increase survival chances of child. It is the unique source of nutrition that decreases neo-natal mortality, post neonatal mortality, mortality between ages 12-35 months and even there after that is child mortality.

Mother's education is an important factor to decrease mortality risk of child. The Table 7.8 illustrates that the risk of mortality is much lower for primary educated and secondary or higher educated mother. As compared with illiterate mother the risk of mortality is 0.643 times and 0.434 times lower for mothers who are primary and secondary or higher educated mothers respectively. Various studies reveal that (e.g. Pandey et al., 1998; Chakrobarty et al., 1996) education increases awareness both for child and mothers health and thus decrease child mortality.

7.7 Conclusion

In this chapter we studied the influence of preceding birth interval on child survival. For these purpose we first check the correlation between preceding birth interval and child survival, and found that they are highly correlated. Conventional life table analysis has been performed to investigate the influence of preceding birth interval on survival of child. When we consider the study population as a whole we found that, the probability of survival is much higher (0.973) for preceding birth interval (54-60) months and lowest (0.8000) for preceding birth interval less than 12 months. The life table results indicate that the probability of survival to its third birth day is 0.917. We compare this life table by preparing another life table which is based only for those study population whose previous child had died before conception. And investigate that in these cases the

preceding birth interval is much lower and maximum births occur before 18 months of interval. For these reason the probability of dying is much higher than previous one. Again here the probability of dying is maximum (0.386) for age 0 months and preceding birth interval less than 12 months. The overall result for probability of survival to its third birth day is 0.6207. So we may conclude that short preceding birth interval is almost perilous deed for child survival of mother. Logistic regression analysis is performed to evaluate the important determinants of child mortality. The results suggested that preceding birth interval and breastfeeding status have strong negative significant effect on child survival, whereas birth order and mother's age at birth has less significant effect. Mother's education is the unique socio-economic characteristic in our study that have strong negative significant effect both on neo-natal post-neonatal and under five child mortality whereas higher educated mother has less risk.

CHAPTER EIGHT

CONCLUSION AND POLICY IMPLICATION

Chapter Eight

CONCLUSION AND POLICY IMPLICATION

Birth spacing is an important measure of the pace of child bearing. Differentials in fertility in a population are usually attributed to variation in the exposure to the risk of pregnancy and the interval between births when exposed. While the entry in to the marriage generally signals the beginning of exposure to risk of becoming pregnant, the occurrence of the first conception and the birth ensures the actual initiation of process of child bearing. The future courses of child bearing then depend on the behavior of birth spacing. Breast feeding and post-partum amenorrhoea has also been a matter of rapidly growing interest, as they are important not only for maternal and child health but also for its fertility reducing effect through post-partum amenorrhoea. Hence for a complete understanding of the process of family building, an attempt has been made to analyze the birth spacing pattern, its differentials and covariates and also examine the pattern of breastfeeding practice, duration of breastfeeding and post-partum amenorrhoea as well as their determinants in Bangladesh. This study also explores the influence of birth spacing on child survival. For the completion of this work, the data is extracted from the Bangladesh Demographic and Health Survey conducted in 2004.

An overview of birth spacing, breast feeding patterns and child survival along with study objectives is given in chapter one. Only basic materials have been discussed and supplemented with references leaving room for in depth and detailed information, wherever it is necessary. The fringes of role and the significance of covariates and

cofactors have been touched in literature review in order to keep the size of the dissertation to an optimum.

The most important part of a research is its methodological aspects. Appropriate tools and techniques should be amenable to build up models to analysis. Otherwise the analysis may lead us to wrong results. Chapter two of this dissertation is contributed to the discussion of methodological aspects. Another important point for statistical analysis is the mode of collection and size of data. We know that a large size of data may also lead to a wrong conclusion if it is not collected systematically and from reliable source. As BDHS is widely accepted and highly qualified data, their mode of collection is appended shortly in this chapter. The covariates and the factors and also the concepts and terminology of the essential variables mentioned briefly in chapter two.

The reproductive process can be described as a sequence of events in a woman's life and the ages at which those events take place; the beginning of the biological capacity to reproduce, initiation of sexual relations, occurrence of her first birth, second, etc. and finally termination of reproduction either through her death, end of sexual relations, or sterility, whichever comes first. Attention has focused in recent years on the birth interval and on its determinants, because, within a given reproductive span the number of births a woman may have depends upon how quickly births follow one another. Chapter three and four of this dissertation describe the patterns and differentials of birth intervals and their covariates and also present the quantum and tempo of fertility.

Since birth intervals varied substantially between countries, with birth order, with maternal age, some times with education, with economic status and in many cases over time. So it is essential to recourse patterns and differential of birth interval. From the findings of chapter three it is evident that maximum births occur in the interval 12-23 and 24-35 months, 45 percent women give first birth below 24 months, but for higher parity

have experienced lower percent. About 82 percent of the women take their first birth with in the first three years of marriage, and for first to second child this percentage is lower, which is 64 percent. It is again higher for fourth and fifth birth order. It is revealed that the percentage of taking subsequent child begins to decrease after 5 years and after 7 years this percentage is very lower. The results indicate that, both the distribution of marriage to first birth interval and subsequent birth intervals are positively skewed and unimodal peaks lying some where 12-23 months for marriage to first birth and 24-35 months for subsequent birth. It is also observed that the mean length of birth interval is lowest for first birth which is 31 months, and is highest for second birth which is 44.09 months. For third birth it is 36.91 months for fourth and fifth month it is 33.81 and 31.33 months respectively. This chapter also provides empirical evidence for association between some selected socio-demographic variables and subsequent birth intervals. After investigation by applying Chi-square test revealed that age of respondent, age difference between spouses, age at marriage, residence, region, couples education, child survival status and watches T.V is more or less have significantly associated with birth interval, but the variable religion has no significant effect. Due to interrelationships among many of the socio-economic factors themselves and due to the effects of demographic covariates the bivariate type relations assessed may or may not represent the actual existing relationships. So there is a need to look into the effect of each of the factors while controlling for the influences for other factors. This requires a multivariate type analysis in which all the socio-economic and demographic covariates are included. Towards this purpose, Cox (1972) proportional hazard regression model has been used and the results are presented in chapter three. Cox proportional hazard model is used to estimate the relative risk of birth intervals from first to fifth birth according to thirteen covariates and reveals that all the variables have more or less significant effect on birth intervals for

various birth orders except the variables place of residence, religion, watches TV and sex of previous child. Age at first marriage, region, and child survival status have high significant effect on birth interval. Age at marriage shows significant effect on the first and fourth birth but an insignificant effect for the second, third, and fifth birth. Those who got married before 25 years have longer birth intervals than those married at higher age (i.e. 25 years and above). The risk of termination of first birth interval is 0.527, 0.699 and 0.878 times lower for age at marriage ≤ 14 , (15-19) and (20-25) years respectively as compared with women with age at marriage 25 years and above. Spousal age difference is another cofactor which has significant impact on first birth interval and insignificant effect for remaining intervals. It reveals from the analysis results that when spousal age difference is lower they have lower risk of terminating first birth interval and their birth interval is longer but when the spousal age difference is greater (10+) they have shorter birth interval. Place of residence shows significant results only for third birth interval, but the study results unfold that urban women have shorter first and third birth interval but longer birth intervals for second and higher orders than rural women. Region of respondents is another important factor shows highly significant results for first three birth intervals and reveals that all the regions Barishal, Chittagong, Dhaka, khulna and Rajshahi have lower risk of terminating birth interval than Sylhet division and women in this region has longer birth interval than Sylhet. Respondent education shows significant result only for first birth interval, so education of women related only with first birth interval and reveals that birth intervals is comparatively lower among primary, secondary and higher educated group as compared with no educated group. But partner's education shows reverse results. As we give our attention on contraceptive use of respondent the result is surprising so but natural, because the result shows that the risk of terminating first birth interval is 11.158 times higher for ever user group than never user. For second

and third birth interval they have lower risk but again higher risk for fourth and fifth order. Respondent work status also has an impact on birth interval. The study result demonstrates that working women have longer first but shorter second interval. For four and fifth birth order they again have longer intervals. The cofactors wealth index, watches T.V and sex of previous child of respondent have little significant impact on length of birth interval but child survival status have highly significant effect for all birth orders.

The study indicate that the odds ratio for second to fifth birth is 1.257, 1.151, 1.366 and 1.379 respectively. This implies that the women whose previous child is dead during childhood have 25%, 15%, 37% and 38% more chance of terminating birth quickly than women whose previous child is alive. Thus, the study consolidate that woman who losses child have shorter birth interval in contrast who did not losses. The results speculate that the child survival affects timing of birth not only for first births but also for higher orders, indicating not only that woman tend to replace a child who has died in infancy, but they do it rapidly for all parities.

The intensity of fertility performance of women in a population depends upon the proportions of women who progress from marriage to their different birth orders and the time involved to make the progression from marriage to first order and other successive higher order births. These two dimensions of fertility- the quantum and tempo dimensions of successive birth transition are the two main indicators that are studied in chapter four by applying standard life table techniques. Life table analysis of different order birth intervals enables to investigate whether there are changes in the family building process among women. The study result presents cumulative proportions of women progressing to a higher parity at selective durations (16, 32 and 60 months) for different birth transitions derived from life tables for married women aged 15-49 years. Examining the

first order transition, that is from marriage to first birth; it indicates that only 25 percent women have their first birth within 16 months of marriage. This percentage increased to 60 by 32 months and to 86 by 60 months duration. The mean and median value for first birth interval is about 23 months. The data on progression from first to second birth suggest that the proportion of women who progressed to a second birth within 60 months of their first birth is 79 percent, decreased by 7 percent as compared to first birth. The mean and median value is much higher for second birth than first birth which is about 31 months. It could be possible that the extended breastfeeding and the resultant amenorrhoea combined with the low nutritional status of women in this state are delaying their second order fertility. The percentage of women to have their third, fourth, and fifth birth order within 60 months of their corresponding previous birth shows decreasing trend which is 71 percent, 68 percent and 63 percent respectively. After having second birth, the average birth interval and median birth interval also decreases with increasing birth order, which is 31 months for 3rd, 30 months for 4th and 29 months for 5th birth order. To gain insight into how the differing socio-demographic variables of women influence the quantum and tempo dimensions of their various birth order transition, this chapter details the results of the life table analysis for different socio-demographic groups in the sample. The differential analysis of quantum and tempo of fertility indicates that urban women have higher quantum of fertility for marriage to first birth than their rural counterparts. But for all subsequent birth intervals the quantum is higher for rural women than urban women. The tempo of fertility which is measured by trimean, is higher for rural women than their urban counterparts incase of marriage to first birth but for second through higher orders there is substantial difference in the trimean or average birth interval. Education levels have shown substantial effect on the quantum and tempo of fertility which increases with the increase of level of education incase of first birth interval but

decreases incase of second through higher birth. For educated women mean birth interval is lower for first birth but higher for subsequent birth. To examine more incisively the effect of age at marriage on birth interval we have constructed life table for two groups ≤ 15 and $15+$ years. The results which are summarized in chapter three demonstrate that birth interval is higher for those who married when less than 15 years than those who married at age 15 and older. The proportion of women married before age 15 who had a first birth within five years of marriage was 0.847 compared to 0.881 for those who married at age 15 and older. Most of this difference in the first birth interval by age at marriage can be attributed to the adolescent sub-fecundity and adolescent sterility. Age at marriage has a pronounced cohort effect on the timing of first birth, with the tri-mean being nearly 25 months for women marrying before age 15 compared with 21 months for women marrying at age 15 and above. As we move to higher order births, the effect of age at first marriage is minimal, since there is little significant difference in the trimean. In fact the trimean varies from 29 months to 31 months.

To assess the magnitude of the effect of child mortality on fertility, the results constructed life tables by birth order according to whether or not previous child survived. It is evident for each of the birth orders, the death of the previous child increases the proportion of women who go on to have another child within five years and reduces the waiting time before the next birth. The death of the first child in the first year of life reduces the average birth interval 32 months to 27 months. Similar pattern is observed for higher orders.

Studies from many parts of the world consistently demonstrate that breastfeeding is associated with delayed return of menstrual cycles and ovulation, reduced fecundability and long birth intervals. So it is important to study the duration of breast feeding in

Bangladesh and the factors affecting it. Chapter five of this study is associated with the determinants and differentials of breast feeding in Bangladesh. It is seen that the retrospective data on breast feeding exhibit dramatic peaks at multiple of six months. Such heaping in breast feeding data is not entirely due to recall bias and reporting error of the respondents. It is possible that they are due to certain religious and cultural norms. In a predominately Muslim country like Bangladesh, it is possible that women continue breast feeding until 24 months according to Islamic values as seen in other Muslim countries. The study results show that women in Bangladesh have very positive attitudes towards breastfeeding. Universal and long durations of breast feeding are the norm in this country. Little portion women weaning their child (0-12) months and a mere 36-48 months. Maximum women breastfeeds in the duration (24-36) months. For women whose age at marriage is less than 14 years about 39.2% women breast feed their children (24-36) months, but for mother with age at marriage 25 years and over 47.4% breast feed within interval 0-12 months. From the percentage distribution of breastfeeding we see that urban muslim mother in Khulna region has the highest duration of breast feeding than their counterparts. Higher educated mother breast feed their children less time period as compared with illiterate and other educational category. Breastfeeding pattern shows markedly variation between employment and unemployment status and contraceptive user and non-user of women. Working mother breastfeed comparatively more duration than non-working mother. Delivery status of women shows highly significant variation and the duration of breastfeeding is higher among normal delivery type women as compared with caesarean women. For caesarean women the highest portion (42.5%) shows duration of breast feeding to be (0-12) months whereas for normal delivery type women the highest portion (38.2%) shows breastfeeding duration to be (24-36) months. Applying standard life table technique we found that the mean duration of breastfeeding

is 31.99 months which is close to other studies of Bangladesh. For first parity it is 32.42 months and for subsequent parity it is nearly same. We observe that the probability of continuing breastfeeding is highest at 0 months which is 98 percent and up to 23 months it is 85%. After 23 months there is a step falls in probability values and at 48 months it is only 18%. The differential patterns of breastfeeding by different socio-demographic characteristics are also observed by life table methods and their consistency is tested by statistically more powerful method chi-square. It is observed that age at marriage, parity, place of residence, administrative division, mother's education, husband education, religion, contraceptive use and delivery status of respondent has significant association with duration of breastfeeding. From the life table results indicated that the mean duration of breast feeding is highest for younger age group (≤ 24 years), which is 32.69 months and also highest for younger age at marriage group (≤ 14 years) which is 32.70 months. When age at marriage increases the mean duration of breastfeeding decreases, thus for higher age at marriage group (25+) it is lowest (28.85 months). The study results reveals that sex of previous child and work status of respondent has no significant association with duration of breastfeeding. The mean duration of breastfeeding is higher (32.42 months) for parity one and it steadily decrease with higher parity. Urban mother breastfeeds about 30.51 months and it is comparatively higher in rural mother (32.71 months). Among the six administrative divisions Khulna division has the highest duration of breast feeding. Illiterate and primary educated mother with the same educational level of husband has longer duration of breastfeeding than their higher educated counterparts. Non-Muslim mothers breastfeed longer duration with a lead of 6 months as compared with Muslim mother. Contraceptive use and delivery status of respondents shows highly significant effect on duration of breastfeeding and demonstrates

that mother with normal delivery and those who currently used contraception has longer duration of breast feeding than their non-contraception counterparts.

The effects of socio-demographic covariates can be derived by more reliable survival technique namely proportional hazard model when other variables are controlled and are fitted for three cases. Firstly the effect for demographic variables, secondly for socio-economic variables and finally for both demographic and socio-economic variables on the duration of breastfeeding are studied. It is revealed that the demographic variables current age of respondent, age at marriage, parity, contraceptive use and delivery status of respondent has highly significant effect but the variables sex of child has no significant effect on duration of breastfeeding. The socio-economic variables region, religion, education of respondent and work status has strong impact on duration of breastfeeding, but the variables place of residence and husband's education has no significant impact. When we study the combined effect of socio-demographic variables on duration of breastfeeding it divulges the same variables as significant and insignificant and reveals that the demographic covariates influence remarkable on breastfeeding duration than socio-economic covariates.

Post-partum amenorrhoea (PPA) is an important event for the females' reproductive life and health, so it is needed to examine the differential and determinants of PPA according to various socio-demographic characteristics. Chapter six discusses the differentials and determinants of PPA in Bangladesh. The duration of PPA among Bangladeshi mothers has been studied using most acceptable life table technique and also using this technique important differentials of PPA period were identified. PPA distribution showed a heaping at the multiple of six months. It was found that about half of the (49.9%) total women return to menstruation after 6 months, about 60 percent return to menses after 9 months,

80 percent resumption of menses after one and half year later and 96 percent do so after 30 months of delivery. The mean duration of amenorrhoea computed from the life table values, by the standard procedure, shows that the mean duration of post-partum amenorrhoea irrespective of the parity of the women is 8.5 months. The period of amenorrhoea increases with parity from 5.7 months after the first child to 11.08 months up to the five child but for six and higher parity mean duration of amenorrhoea is drop off which is about 10.22 months. Along with life table technique the standard chi-square test reveals that place of residence, administrative division, respondents education and work status, sex of previous child, breastfeeding status, parity, delivery status and current age of mothers has highly significant association with duration of amenorrhea. But the variables religion and contraceptive uses has no significant association. It was found that average duration of PPA higher for higher parity, older mother and normal delivery type mother. It was also found that urban mother have shorter duration of amenorrhoea than rural mother. Working women have longer duration of PPA than nonworking women. An inverse and strong relationship was found with level of education, the higher the educational attainment the lower is the duration of PPA. To determine the effects of breastfeeding and some socio-demographic factors on the duration of amenorrhoea or risk of first menstruation after delivery Cox regression model is used and it is found that duration of breastfeeding is highly associated with duration of amenorrhoea. When we want to investigate the effect of breastfeeding and demographic variables on duration of amenorrhoea it is found that breastfeeding is still the strongest significant determinant along with demographic variables age of mother, sex of child and delivery status. But the variables parity has no significant effect. Along with breastfeeding and demographic variables four socio-economic covariates are also taken into account to see the significant factors with duration of amenorrhoea. The most important determinants of the time to the

first menstruation are still the duration of breastfeeding but reduce their net effects on the resumption of menses along with other variables. According to the respective test of significance the variables duration of breastfeeding, mother's age, sex of child, delivery status, place of residence, respondent education, and respondent work status has highly significant effect, administrative division has less significant effect but parity has no significant effect at all.

Birth spacing and child survival status has achieved an emerging issue in this century because short preceding birth interval may have an adverse effect on child survival and appropriately spaced birth may decrease the trend of dying during infancy and child hood. Various studies have also showed that infant and child mortality is affected by a number of socio-economic and demographic factors. So it is necessary to study the influential factors of birth spacing and socio demographic factors on child survival and chapter seven of this dissertation is contributed to this topics. The study results highlighted from chapter seven that preceding birth interval and child survivals are negatively and significantly correlated, which means that when preceding birth interval increases the risk of mortality decreases. Preceding birth interval is highly correlated with neo-natal mortality and the correlation is increases for all births when we studied only those populations whose preceding child had died before conception. When the study the age specific probability of survival and dying up to three years we see that the probability of survival is highest for birth interval (54-60) months and lowest for less than 12 months. Again the study depict the effect of preceding birth interval on child survival for the population whose previous child has died before conception and observe that here preceding birth interval is comparatively lower and probability of survival is much lower in these cases. The age specific probability of dying to its third birth day by birth order

demonstrates that the probability of survival is highest for birth interval length 42 to 60 months and birth interval greater than 84 months also perilous for child survival. By using a multivariate logistic regression model we want to reveals the contribution of preceding birth interval and each of the socio-demographic variables on survival status considering four cases of mortality namely, neo-natal, post neo-natal, mortality between 12-35 months and child mortality (1-5 years). For neo-natal mortality along with birth interval, mother's age at birth, breast feeding status, and mother's education has strong significant effect but the variables birth order has no significant effect. There is a little change in case of post neo-natal mortality. Here birth order has significant impact but mother's age at birth has no effect at all. For mortality between ages 12-35 months we see that both the variables birth order and mother's age at birth has no impact, but other variables has significant effect. The study results reveal that preceding birth interval, breastfeeding status, and mother's education has strong significant effect on child mortality and the variables birth order and mother's age at birth has less significant effect. So it is a conventional measure that preceding birth interval, breastfeeding status and mother's education is important influential factor to determine neo-natal, post neo-natal, mortality between 12-35 months, and child mortality.

It is believed that the findings may help policy makers and planners for designing appropriate policies and program for encouraging longer birth intervals and breastfeeding practices, improving mothers and their children's health as well as for reducing the existing fertility levels of a country.

Policy implications

A number of policy implications emerged from the findings of this study:

(1) Education appears to be the key factor through various causal mechanisms. Education delays marriage and the maturity that comes with age may result in more effective contraception and hence influence the birth interval. Education also increases the opportunity for paid employment in the modern sector and this competes with the demand for child bearing. Through increasing her odds of becoming employed out side the home and thus becoming an income producing member of a family, a woman is more likely to acquire a role in decisions concerning all aspects of family life, including the number and spacing of her children. Hence it can be tentatively concluded that an improvement in female education levels will help to increase the length birth interval and breastfeeding practices which their by reduced infant and child mortality. Hence Government should make school education up to 14 years free and compulsory for children.

(2) The post-ponement of female age at marriage to 18 years with a view to delay the onset of child bearing and proper spacing of births have noticeable effect in bringing down the level of infant mortality and thereby improving the health of women. In Bangladesh the legal age at marriage is 18 years but about 68% women married before 15 years of age especially in rural areas. Hence it is essential that Government should not only to regulate laws but also enforcement and strong punishment should make for those who violate laws.

(3) The government should strengthen its maternal and child health care activities in order to reduce the level of infant mortality. Antenatal and postnatal care service facilities should be provided to all pregnant women so that neonatal and postnatal deaths can be prevented or at least reduced. Because most deliveries take place at home and trained and skilled birth attendants do not attend most of these deliveries, improved health

care utilization by women could result in lower infant mortality, which contributes to a longer birth interval. Once parents get some assurance that child mortality is declining, their perceived child loss during infancy will be alleviated and they will be motivated to accept contraceptive methods to limit their family size. Great attention should also be given to the delivery of family planning service to women, particularly younger rural mother and to provide them with motivational messages about the health benefits of breast feeding and child spacing.

(4) The mass media can bring about dual benefits to help modernize the thinking of the people and help in other development activities as well as improve acceptance of family welfare programme services. The use of audio-visual aids like radio and television particularly in rural areas should be increased. Son preference can be diluted by highlighting the role of female children and gender equity, messages on the needs and benefits of breast feeding and small family, benefits of interspacing of birth for the health of mother and child etc. can be disseminated to affect common people's thinking and forward vision. Simultaneously, efforts to involve satisfied clients to motivate new accepters of family planning, efforts to remove fear about side effects of contraceptives, efforts for offering a wider contraceptive choice for various groups for women etc. also are to be promoted.

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APPENDIX

Probabilities of Progression to the Next Child

Table 4.1: Life table probabilities of continuance in the same parity status (l_{ix})^{*} (Based on ACBI and OBI, 0-120), BDHS 2004, Bangladesh

Ordinal months X	Parity (l_{ix}) [*]					
	1	2	3	4	5+	Combined
0	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000
6	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000
12	0.918325	0.989863	0.984573	0.981216	0.987565	0.965226
18	0.814963	0.953236	0.934682	0.923966	0.945591	0.902264
24	0.710678	0.874503	0.823876	0.794495	0.852334	0.801696
30	0.620132	0.783953	0.709236	0.656852	0.758656	0.700476
36	0.547603	0.690178	0.600702	0.543296	0.681691	0.609986
42	0.487241	0.611732	0.509461	0.452063	0.628419	0.536017
48	0.439181	0.540548	0.434559	0.393121	0.591727	0.476711
54	0.401637	0.479332	0.383756	0.353046	0.571933	0.432090
60	0.367383	0.424727	0.340690	0.326722	0.557248	0.393960
66	0.342555	0.381911	0.309994	0.305599	0.548654	0.365382
72	0.321070	0.336262	0.282969	0.286594	0.540318	0.337743
78	0.303711	0.305561	0.264017	0.272070	0.531748	0.317574
84	0.284241	0.271350	0.249349	0.262801	0.527085	0.297646
90	0.269171	0.244196	0.236131	0.254466	0.524495	0.281402
96	0.253950	0.217015	0.223507	0.248075	0.521824	0.265113
102	0.236589	0.191641	0.212853	0.240454	0.520925	0.248891
108	0.219945	0.165098	0.203941	0.229671	0.514397	0.23147
114	0.193889	0.135616	0.194852	0.217491	0.512289	0.210345
120	0.137042	0.077854	0.164874	0.19726	0.512289	0.163119
Mean** ($\bar{T}$)	55.80	60.81	56.89	78.44	59.76	59.73

(l_{ix})^{*} = probability of continuance in parity I at month x after the birth of ith child based on All closed birth intervals (ACBI) and the open birth interval (OBI);

Table 4.2: Life table probabilities of continuance in the same parity status (l_{ix})* (Based on LCBI and OBI, 0-120), BDHS 2004, Bangladesh

Ordinal months X	Parity (l_{xi})*					
	1	2	3	4	5+	Combined
0	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000
6	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000
12	0.906282	0.990415	0.983059	0.980761	0.982718	0.968730
18	0.782734	0.952477	0.938000	0.925838	0.914368	0.902583
24	0.673531	0.885316	0.843062	0.815369	0.782086	0.800013
30	0.582363	0.812273	0.741887	0.680932	0.654057	0.696151
36	0.509929	0.728021	0.639651	0.572192	0.535729	0.598797
42	0.443227	0.655675	0.547097	0.468898	0.452320	0.516735
48	0.395812	0.581938	0.461984	0.402701	0.404424	0.453413
54	0.355471	0.513365	0.398943	0.353736	0.377733	0.404657
60	0.319924	0.445210	0.343584	0.320436	0.358399	0.362359
66	0.297240	0.390097	0.303031	0.291919	0.344391	0.329913
72	0.274054	0.338799	0.270618	0.265343	0.332778	0.300667
78	0.259916	0.304665	0.248611	0.250421	0.322769	0.280977
84	0.234182	0.262564	0.226047	0.247175	0.316507	0.260260
90	0.213681	0.227555	0.211770	0.233196	0.313770	0.242826
96	0.194256	0.197415	0.197959	0.226915	0.311198	0.227738
102	0.167711	0.171033	0.180098	0.216785	0.307822	0.211054
108	0.164217	0.140708	0.175835	0.200526	0.301324	0.196284
114	0.136848	0.105298	0.168106	0.179853	0.301324	0.176719
120	0.060213	0.053723	0.141209	0.136252	0.293289	0.132326
Mean** ($\bar{T}$)	50.46	61.37	56.70	55.21	59.76	56.98

(l_{ix})* = probability of continuance in parity I at month x after the birth of i^{th} child based on All Closed Birth Intervals (LCBI) and Open Birth Interval (OBI)

Figure 4.1: Probability of continue to remain in the same parity by birth order (ACBI and OBI)

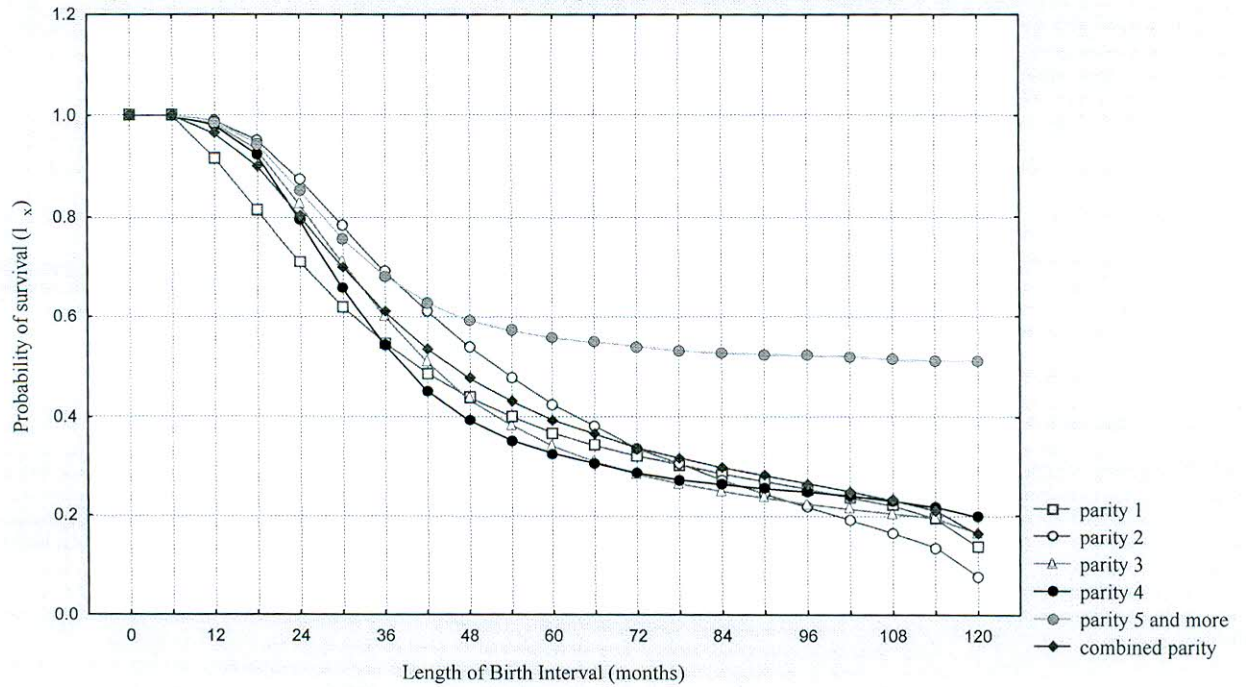
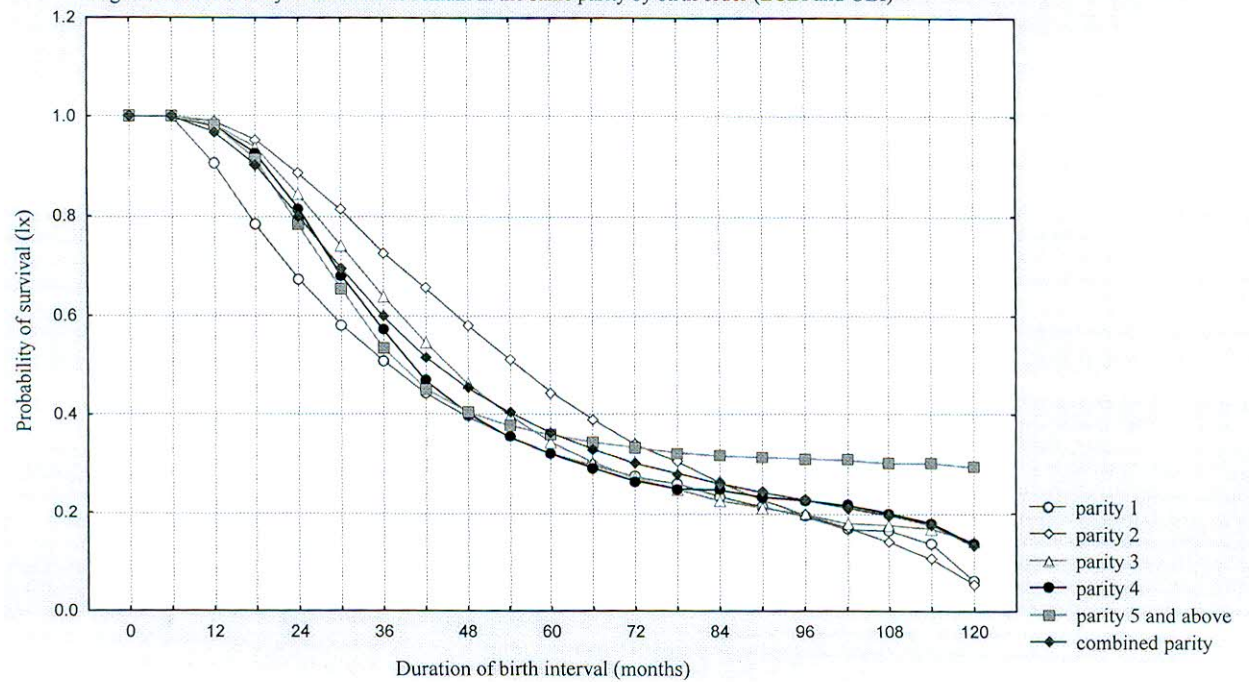


Figure 4.2: Probability of continue to remain in the same parity by birth order (LCBI and OBI)



Quantum and Tempo of Fertility

The details abridge life table constructed from second to fifth birth order are shown in the Table 4.4 to Table 4.7.

Table 4.4: Construction of abridged life table between first birth and second, BDHS 2004,
Bangladesh

Duration of Exposure	Censored Cases	Second Birth	Number observed start	Exposed through	Conditional probability of first birth	Unconditional probability of first birth	Cumulative probability of first birth	Interpolated cumulative probability
x, x+n	Cx	Ex	Nx	Nx*	qx	bx	Bx	B _{x+n}
<12	455	201	10095	9640	0.020851	0.020851	0.020851	0.026568
12 to 16	148	434	9439	9291	0.046712	0.045738	0.066589	0.073377
16 to 20	126	508	8857	8731	0.058183	0.054309	0.120898	0.133895
20 to 24	115	959	8223	8108	0.118278	0.103979	0.224876	0.236819
24 to 28	123	866	7149	7026	0.123256	0.095539	0.320415	0.330823
28 to 32	112	741	6160	6048	0.12252	0.083263	0.403678	0.415288
32 to 36	81	814	5307	5226	0.15576	0.092883	0.496561	0.506483
36 to 40	80	683	4412	4332	0.157664	0.079374	0.575935	0.582537
40 to 44	76	445	3649	3573	0.124545	0.052815	0.62875	0.635537
44 to 48	51	450	3128	3077	0.146246	0.054294	0.683044	0.68819
48 to 52	71	332	2627	2556	0.12989	0.04117	0.724214	0.728396
52 to 56	48	264	2224	2176	0.121324	0.033459	0.757673	0.761841
56 to 60	37	258	1912	1875	0.1376	0.033344	0.791017	0.794404
60 to 64	51	203	1617	1566	0.12963	0.02709	0.818108	0.820115
64 to 68	38	117	1363	1325	0.088302	0.016061	0.834169	0.837196
68 to 72	30	172	1208	1178	0.14601	0.024213	0.858382	0.860019
72 to 76	33	90	1006	973	0.092497	0.013099	0.871481	0.872848
76 to 80	25	73	883	858	0.085082	0.010935	0.882416	0.884021
80 to 84	16	84	785	769	0.109233	0.012844	0.89526	0.908352
84+	329	356	685	356	1	0.10474	1	
Total	2045	8050						

Table 4.5: Construction of abridged life table between second and third, BDHS 2004

Bangladesh

Duration of Exposure	Censored Cases	Third Birth	Number observed start	Exposed through	Conditional probability of first birth	Unconditional probability of first birth	Cumulative probability of first birth	Interpolated cumulative probability
x, x+n	Cx	Ex	Nx	Nx*	qx	bx	Bx	B _{x+n}
<12	371	122	8163	7792	0.015657	0.015657	0.015657	0.020239
12 to 16	124	281	7670	7546	0.037238	0.036655	0.052312	0.058184
16 to 20	103	355	7265	7162	0.049567	0.046974	0.099287	0.111243
20 to 24	74	715	6807	6733	0.106193	0.09565	0.194936	0.206838
24 to 28	116	698	6018	5902	0.118265	0.095211	0.290147	0.299404
28 to 32	76	535	5204	5128	0.104329	0.074058	0.364206	0.374829
32 to 36	82	603	4593	4511	0.133673	0.084989	0.449194	0.458003
36 to 40	86	489	3908	3822	0.127943	0.070472	0.519666	0.526231
40 to 44	77	356	3333	3256	0.109337	0.052518	0.572184	0.578219
44 to 48	73	319	2900	2827	0.11284	0.048275	0.620459	0.624938
48 to 52	82	229	2508	2426	0.094394	0.035826	0.656286	0.659659
52 to 56	70	167	2197	2127	0.078514	0.026987	0.683272	0.686884
56 to 60	42	175	1960	1918	0.091241	0.028899	0.712171	0.714558
60 to 64	55	112	1743	1688	0.066351	0.019098	0.731268	0.733347
64 to 68	57	94	1576	1519	0.061883	0.01663	0.747898	0.750197
68 to 72	27	102	1425	1398	0.072961	0.018394	0.766292	0.767889
72 to 76	52	68	1296	1244	0.054662	0.012775	0.779067	0.78047
76 to 80	34	58	1176	1142	0.050788	0.011221	0.790288	0.791793
80 to 84	39	60	1084	1045	0.057416	0.012041	0.802329	0.827038
84+	709	276	985	276	1	0.197671	1	
Total	2349	5814						

Table 4.6: Construction of abridged life table between third and forth birth, BDHS 2004,
Bangladesh

Duration of Exposure	Censored Cases	Forth Birth	Number observed start	Exposed through	Conditional probability of first birth	Unconditional probability of first birth	Cumulative probability of first birth	Interpolated cumulative probability
x, x+n	Cx	Ex	Nx	Nx*	qx	bx	Bx	B _{x+n}
<12	224	83	5752	5528	0.015014	0.015014	0.015014	0.01884
12 to 16	102	166	5445	5343	0.031069	0.030602	0.045617	0.052801
16 to 20	79	307	5177	5098	0.06022	0.057473	0.103089	0.11488
20 to 24	65	497	4791	4726	0.105163	0.094322	0.197411	0.209599
24 to 28	97	502	4229	4132	0.121491	0.097507	0.294918	0.303905
28 to 32	60	364	3630	3570	0.101961	0.071891	0.366809	0.376919
32 to 36	59	402	3206	3147	0.127741	0.080884	0.447693	0.455832
36 to 40	73	315	2745	2672	0.117889	0.065111	0.512804	0.518156
40 to 44	47	203	2357	2310	0.087879	0.042814	0.555618	0.560901
44 to 48	46	196	2107	2061	0.095099	0.04226	0.597879	0.60175
48 to 52	47	140	1865	1818	0.077008	0.030966	0.628845	0.631479
52 to 56	40	93	1678	1638	0.056777	0.021073	0.649918	0.653054
56 to 60	38	108	1545	1507	0.071666	0.025089	0.675007	0.677249
60 to 64	40	75	1399	1359	0.055188	0.017936	0.692943	0.694778
64 to 68	29	60	1284	1255	0.047809	0.01468	0.707623	0.709946
68 to 72	31	74	1195	1164	0.063574	0.018588	0.72621	0.727892
72 to 76	32	52	1090	1058	0.049149	0.013457	0.739667	0.740746
76 to 80	41	32	1006	965	0.033161	0.008633	0.7483	0.749383
80 to 84	33	31	933	900	0.034444	0.00867	0.756969	0.787348
84+	724	145	869	145	1	0.243031	1	
	1907	3845						

Table 4.7: Construction of abridged life table between forth and fifth birth, BDHS 2004 ,
Bangladesh

Duration of Exposure	Censored Cases	fifth Birth	Number observed start	Exposed through	Conditional probability of first birth	Unconditional probability of first birth	Cumulative probability of first birth	Interpolated cumulative probability
x, x+n	Cx	Ex	Nx	Nx*	qx	bx	Bx	B _{x+n}
<12	142	69	3845	3703	0.018634	0.018634	0.018634	0.022538
12 to 16	84	113	3634	3550	0.031831	0.031238	0.049871	0.055484
16 to 20	30	161	3437	3407	0.047256	0.044899	0.09477	0.107394
20 to 24	46	357	3246	3200	0.111563	0.10099	0.19576	0.208539
24 to 28	66	353	2843	2777	0.127116	0.102231	0.297991	0.305362
28 to 32	31	201	2424	2393	0.083995	0.058965	0.356957	0.366851
32 to 36	23	267	2192	2169	0.123098	0.079157	0.436114	0.442443
36 to 40	31	168	1902	1871	0.089792	0.050632	0.486746	0.491774
40 to 44	44	130	1703	1659	0.07836	0.040219	0.526965	0.531556
44 to 48	35	116	1529	1494	0.077644	0.036728	0.563693	0.567292
48 to 52	29	89	1378	1349	0.065975	0.028785	0.592479	0.595036
52 to 56	25	62	1260	1235	0.050202	0.020459	0.612937	0.615142
56 to 60	32	52	1173	1141	0.045574	0.01764	0.630577	0.632467
60 to 64	38	43	1089	1051	0.040913	0.015114	0.645692	0.647305
64 to 68	20	36	1008	988	0.036437	0.01291	0.658602	0.659925
68 to 72	17	29	952	935	0.031016	0.010589	0.66919	0.670558
72 to 76	29	29	906	877	0.033067	0.010939	0.680129	0.681001
76 to 80	22	18	848	826	0.021792	0.006971	0.6871	0.687897
80 to 84	23	16	808	785	0.020382	0.006378	0.693478	0.731793
84+	663	106	769	106	1	0.306522	1	
	1430	2415						

Table 7.5a1: Age specific probability of dying and survival up to third birth day of index child by length of preceding interval for the second birth, Bangladesh

Preceding Birth interval	Age at death of index child (months)					Prob. of Sur. to 36 months	Prob ^y . of death up to 36	Total birth
	0	1-5	6-11	12-23	24-35			
<12	0.072714 (1334)	0.027486 (1237)	0.011638 (1203)	0.018503 (1189)	0.012853 (1167)	0.863568 (1152)	0.136432	1334
12-18	0.052953 (1473)	0.025806 (1395)	0.011038 (1359)	0.012649 (1344)	0.015072 (1327)	0.887305 (1307)	0.112695	1473
18-24	0.05121 (1074)	0.021590 (1019)	0.011033 (997)	0.009128 (986)	0.012282 (977)	0.898510 (965)	0.10149	1074
24-30	0.028476 (1194)	0.012931 (1160)	0.005240 (1145)	0.007902 (1139)	0.011504 (1130)	0.935511 (1117)	0.064489	1194
30-36	0.023358 (685)	0.011958 (669)	0.000000 (661)	0.003026 (661)	0.004552 (659)	0.957664 (656)	0.042336	685
36-42	0.023295 (601)	0.003407 (587)	0.000000 (585)	0.006838 (585)	0.001721 (581)	0.965058 (580)	0.034942	601
42-48	0.017632 (397)	0.002564 (390)	0.000000 (389)	0.007712 (389)	0.000000 (386)	0.972292 (386)	0.027708	397
48-54	0.002825 (354)	0.002833 (353)	0.000000 (352)	0.005682 (352)	0.002857 (350)	0.985876 (349)	0.014124	354
54-60	0.023585 (212)	0.009662 (207)	0.000000 (205)	0.000000 (205)	0.004878 (205)	0.962264 (204)	0.037736	212
60-66	0.015000 (200)	0.010152 (197)	0.005128 (195)	0.000000 (194)	0.005155 (194)	0.965000 (193)	0.035000	200
66-72	0.027027 (111)	0.018519 (108)	0.018868 (106)	0.000000 (104)	0.000000 (104)	0.936937 (104)	0.063063	111
72-78	0.026549 (113)	0.018182 (110)	0.018519 (108)	0.000000 (106)	0.000000 (106)	0.938053 (106)	0.061947	113
78-84	0.035714 (56)	0.018519 (54)	0.018868 (53)	0.000000 (52)	0.000000 (52)	0.928571 (52)	0.071429	56
84+	0.024490 (245)	0.020921 (239)	0.021368 (234)	0.000000 (229)	0.004367 (229)	0.930612 (228)	0.069388	245
Total	0.040253 (8049)	0.017217 (7725)	0.007508 (7592)	0.009025 (7535)	0.009107 (7467)	0.919245 (7399)	0.080755	8049

Table 7.5a2: Age specific probability of dying and survival up to third birth day of index child by length of preceding interval for the third birth, Bangladesh

Preceding Birth interval	Age at death of index child (months)					Prob ^y . of Sur. to 36 months	Prob ^y . of death up to 36	Total birth
	0	1-5	6-11	12-23	24-35			
<12	0.073116 (889)	0.029126 (824)	0.015000 (800)	0.019036 (788)	0.016818 (773)	0.854893 (760)	0.145107	889
12-18	0.056466 (1098)	0.028958 (1036)	0.013917 (1006)	0.018145 (992)	0.011294 (974)	0.877049 (963)	0.122951	1098
18-24	0.037175 (807)	0.025740 (777)	0.013210 (757)	0.010710 (747)	0.006766 (739)	0.909542 (734)	0.090458	807
24-30	0.024390 (861)	0.025000 (840)	0.012210 (819)	0.009889 (809)	0.012484 (801)	0.918699 (791)	0.081301	861
30-36	0.023166 (518)	0.017787 (506)	0.010060 (497)	0.004065 (492)	0.014286 (490)	0.932432 (483)	0.067568	518
36-42	0.018735 (427)	0.016706 (419)	0.009709 (412)	0.007353 (408)	0.007407 (405)	0.941452 (402)	0.058548	427
42-48	0.017021 (235)	0.017316 (231)	0.008811 (227)	0.000000 (225)	0.000000 (225)	0.957447 (225)	0.042553	235
48-54	0.016878 (237)	0.012876 (233)	0.008696 (230)	0.000000 (228)	0.004386 (228)	0.957806 (227)	0.042194	237
54-60	0.014184 (141)	0.007194 (139)	0.000000 (138)	0.000000 (138)	0.000000 (138)	0.978723 (138)	0.021277	141
60-66	0.015873 (126)	0.016129 (124)	0.000000 (122)	0.000000 (122)	0.000000 (122)	0.968254 (122)	0.031746	126
66-72	0.022472 (89)	0.022989 (87)	0.000000 (85)	0.000000 (85)	0.011765 (85)	0.943820 (84)	0.056180	89
72-78	0.025000 (80)	0.025641 (78)	0.000000 (76)	0.000000 (76)	0.000000 (76)	0.950000 (76)	0.050000	80
78-84	0.019231 (52)	0.039216 (51)	0.000000 (49)	0.000000 (49)	0.000000 (49)	0.942308 (49)	0.057692	52
84+	0.026178 (191)	0.032258 (186)	0.000000 (180)	0.000000 (180)	0.022222 (180)	0.921466 (176)	0.078534	191
Total	0.038254 (5751)	0.024046 (5531)	0.010930 (5398)	0.010114 (5339)	0.010407 (5285)	0.909407 (5230)	0.090593	5751

Table 7.5a3: Age specific probability of dying and survival up to third birth day of index child by length of preceding interval for the forth birth, Bangladesh

Preceding Birth interval	Age at death of index child (months)					Prob ^y . of Sur. to 36 months	Prob ^y . of death up to 36	Total birth
	0	1-5	6-11	12-23	24-35			
<12	0.078616 (636)	0.018771 (586)	0.017391 (575)	0.023009 (565)	0.014493 (552)	0.144654 (544)	0.855346	636
12-18	0.04401 (818)	0.015345 (782)	0.012987 (770)	0.013158 (760)	0.013333 (750)	0.095355 (740)	0.904645	818
18-24	0.028674 (558)	0.016605 (542)	0.007505 (533)	0.011342 (529)	0.003824 (523)	0.066308 (521)	0.933692	558
24-30	0.028269 (566)	0.014545 (550)	0.003690 (542)	0.011111 (540)	0.005618 (534)	0.061837 (531)	0.938163	566
30-36	0.025806 (310)	0.013245 (302)	0.013423 (298)	0.017007 (294)	0.006920 (289)	0.074194 (287)	0.925806	310
36-42	0.023810 (252)	0.024390 (246)	0.000000 (240)	0.012500 (240)	0.008439 (237)	0.06746 (235)	0.93254	252
42-48	0.019231 (156)	0.000000 (153)	0.006536 (153)	0.013158 (152)	0.000000 (150)	0.038462 (150)	0.961538	156
48-54	0.028169 (142)	0.028986 (138)	0.007463 (134)	0.007519 (133)	0.000000 (132)	0.070423 (132)	0.929577	142
54-60	0.011111 (90)	0.011236 (89)	0.000000 (88)	0.000000 (88)	0.000000 (88)	0.022222 (88)	0.977778	90
60-66	0.019608 (102)	0.020000 (100)	0.000000 (98)	0.000000 (98)	0.010204 (98)	0.04902 (97)	0.95098	102
66-72	0.023256 (43)	0.000000 (42)	0.023810 (42)	0.000000 (41)	0.000000 (41)	0.046512 (41)	0.953488	43
72-78	0.042553 (47)	0.000000 (45)	0.000000 (45)	0.000000 (45)	0.000000 (45)	0.042553 (45)	0.957447	47
78-84	0.055556 (18)	0.058824 (17)	0.000000 (16)	0.000000 (16)	0.000000 (16)	0.111111 (16)	0.888889	18
84+	0.103774 (106)	0.010526 (95)	0.000000 (94)	0.000000 (94)	0.000000 (94)	0.113208 (94)	0.886792	106
Total	0.040843 (3844)	0.016002 (3687)	0.009096 (3628)	0.012796 (3595)	0.00789 (3549)	0.084027 (3521)	0.915973	3844

Table 7.5a4: Age specific probability of dying and survival up to third birth day of index child by length of preceding interval for the fifth birth, Bangladesh

Preceding Birth interval	Age at death of index child (months)					Prob ^y . of Sur. to 36 months	Prob ^y . of death up to 36	Total birth
	0	1-5	6-11	12-23	24-35			
<12	0.072139 (402)	0.02681 (373)	0.022039 (363)	0.022535 (355)	0.017291 (347)	0.848259 (341)	0.151741	402
12-18	0.043624 (596)	0.026316 (570)	0.009009 (555)	0.018182 (550)	0.012963 (540)	0.894295 (533)	0.105705	596
18-24	0.022508 (311)	0.023026 (304)	0.006734 (297)	0.010169 (295)	0.010274 (292)	0.92926 (289)	0.07074	311
24-30	0.031073 (354)	0.017493 (343)	0.005935 (337)	0.011940 (335)	0.012085 (331)	0.923729 (327)	0.076271	354
30-36	0.021505 (186)	0.005495 (182)	0.005525 (181)	0.005556 (180)	0.011173 (179)	0.951613 (177)	0.048387	186
36-42	0.012821 (156)	0.006494 (154)	0.013072 (153)	0.006623 (151)	0.000000 (150)	0.961538 (150)	0.038462	156
42-48	0.010989 (91)	0.000000 (90)	0.000000 (90)	0.000000 (90)	0.000000 (90)	0.989011 (90)	0.010989	91
48-54	0.013158 (76)	0.000000 (75)	0.000000 (75)	0.000000 (75)	0.000000 (75)	0.986842 (75)	0.013158	76
54-60	0.019608 (51)	0.000000 (50)	0.000000 (50)	0.000000 (50)	0.02.0000 (50)	0.960784 (49)	0.039216	51
60-66	0.020833 (48)	0.021277 (47)	0.000000 (46)	0.000000 (46)	0.000000 (46)	0.958333 (46)	0.041667	48
66-72	0.000000 (28)	0.071429 (28)	0.000000 (26)	0.000000 (26)	0.000000 (26)	0.928571 (26)	0.071429	28
72-78	0.090909 (22)	0.000000 (20)	0.000000 (20)	0.000000 (20)	0.000000 (20)	0.909091 (20)	0.090909	22
78-84	0.095238 (21)	0.000000 (19)	0.000000 (19)	0.000000 (19)	0.000000 (19)	0.904762 (19)	0.095238	21
84+	0.138889 (72)	0.000000 (62)	0.000000 (62)	0.000000 (62)	0.000000 (62)	0.861111 (62)	0.138889	72
Total	0.065037 (2414)	0.019052 (2257)	0.009033 (2214)	0.012306 (2194)	0.010614 (2167)	0.888152 (2144)	0.111848	2414

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