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# Covariates of Early Childbearing in Bangladesh

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# COVARIATES OF EARLY CHILDBEARING IN BANGLADESH

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By

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DEPARTMENT OF STATISTICS
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# COVARIATES OF EARLY CHILDBEARING IN BANGLADESH

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# DEDICATION

This dissertation is dedicated to my parents and honorable teachers, for advising me to maintaining patience, study, and willpower needed success in life.

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## CERTIFICATE

It is a pleasure for me to certify that the dissertation entitled, **"Covariates of Early Childbearing in Bangladesh"**, is an original work done by **Md. Roshidul Islam** under my supervision and Professor Samad Abedin. As far as I know, this has not been previously submitted for any degree or diploma under any University or Institute. I also certify that we have gone through the draft and final version of the dissertation carefully and found it satisfactory for submission to the Department of Statistics, Rajshahi University for the fulfill of the requirement for the degree of Doctor of Philosophy in Statistics.

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## DECLARATION

I do hereby declare that the dissertation entitled, **"Covariates of Early Childbearing in Bangladesh"**, submitted to the Department of Statistics, Rajshahi University for the degree of Doctor of Philosophy in Statistics, is an original research work of mine. This work is carried out by me under the supervision and guidance of Professor Dr. Md. Nurul Islam and Professor Samad Abedin, Department of Statistics of the Rajshahi University, Rajshahi, Bangladesh. The material embodied in this dissertation are original and no part of it in any from has been submitted to any other University or Institute for any degree or diploma. The sources incorporated in the dissertation have been duly referred and quoted for clarity.

**(Md. Roshidul Islam)**
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**October, 2008** **Md. Roshidul Islam**

# ABSTRACT

Early childbearing means the early growth that is the growth capacity of teen ages women. It is apparent that early childbearing vary with varying demographic and socio-economic variables. Very little attention is given as to how to capture the pattern of early childbearing with respect to age, age at marriage, duration of marriage, children ever born as well with varying socio-economic situation like education of women, education of husband and working status of women and so on. Among the studies available, most of the focus on the consequence for developed countries. Since relatively lower attention has been given to one of the major influential factors of fertility decline in Bangladesh, the early childbearing.

Early childbearing in human population is the achieved fertility of a woman or a group of women less than 20 years of age. While On-time childbearing involves less, both early and delayed childbearing involve high-risk also involves in having children in quick succession as well as in having children more than three or four. Thus childbearing occurs early or late, in quick succession and at higher parity (more than 3 or 4) involves high-risk and beyond these have some low-risk. Admitting that every pregnancy expulsion involves risk – more or less. The present study is an attempt to analyze the childbearing pattern that are termed as high-risk and low-risk and try to isolate the factors that discriminate and affect

significantly the high-risk and low-risk pattern in the context of current age of women.

## Methodology

The study uses 11 variables that include age of women, age at first marriage, duration of marriage, contraceptive use, place of residence, religion, education of women, education of husband, women's work status, occupation of husband and total children ever born. Such data are available from the 2004 Bangladesh Demographic and Health Survey (BDHS) implemented through a collaborative effect of the National Institute of Population Research and Training (NIPORT), Mitra and Associates, and ORC Macro (USA). Multi-stage random sampling was used to obtain the data. Data were obtained from all the administrative geographical divisions of Bangladesh. A total of 11440 ever-married women aged 10-49 were interviewed to collect data concerning fertility levels, contraceptive, infant mortality levels to improve the lives of mothers and children. There are 1703 ever-married women are eligible for our study (≤20 years) out of 11440.

Aside from rates and ratio used in the analysis of data, the study uses $\chi^2$-analysis to test the association between the attributes of risk of childbearing classified as high-risk and low-risk in terms of age indicates socio-economic and demographic phenomena. The study also employed by two

sophisticated statistical techniques namely, discriminant and logistic regression analysis.

## Findings

It is evident that early childbearing performance varies greatly with differences in religion, education residential status and so on. Majority of women (90.5 percent) are not currently working outside home. A considerable 70.8 percent of women live in rural area. About 28.1 percent of the study population has no formal education. About 65.6 percent women do not use contraceptive methods.

It was found that the variables viz., education of women, contraceptive use, women's working status, occupation of husband, duration of marriage, age at first marriage are the most significantly associated.

The variables that significantly discriminate the high-risk childbearing from the low-risk childbearing are marital duration, age at marriage, mother's education, place of residence, women's work status, religion and contraceptive use.

It was also found that the most significant variables that influence both the high-risk and low-risk childbearing are marital duration, contraceptive use, mother's education, age at marriage, religion, place of residence and women work status.

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# INTRODUCTION

## 1.1 Background of the Study

Women who bear children too early or too late in life, women who bear many children and those who bear children too close together, put themselves and their children in danger (Ecoholm and Newland, 1977). In other words, pregnancies of younger mother (below 20 years) too many pregnancies (5 or more) and closer birth interval of below twenty-four months are likely to produce high-risks to mother and child life (Perkin, 1968). For example, in developing countries younger women usually have many children and so their pregnancies fall high-risk categories. Likewise, women with large families tend to have closely spaced births. Also, women who marry very young may have early children before they reach age 20. These groups of women, who are doubly at risk, should be a special focus of primary health programs trying to reduce infant, child and maternal deaths. Among these pregnancies, there are greater risks of miscarriage, stillbirths, and death during infancy (Swenson, 1979; Chen et al., 1974 and Koenig et al., 1988).

When a woman is too young, pregnancy –wanted or unwanted – can be dangerous for both mother and infant (Senanayke and Ladjali, 1994; Population Reference Bureau, 1994; Stewart and Cuervo, 1994). Women ages 15 to 19 are twice as likely to die from early childbearing

as women in their 20s (Noble et al., 1996, Starrs, 1997). Women under age 17 face especially higher risk (Fraser et al., 1995; Miller, 1993). The health risks of early childbearing increase before age 20 and after age 39 (Okie, 1998' Ross, and Frankenberg, 1993). Among women ages 40-44, for example, the risk of death is five times higher than among women in their 20s (Royston and Lopez, 1987). Pregnancy before age 20 also poses risk to the younger women's infant (Sullivan et al., 1994). Young mothers, especially those under age 15, have higher rates of premature labour, spontaneous abortion, stillbirth and low birth weight infants than those of older mothers (WHO, 1989; Population Council, 1991; Mishra and Dawn, 1986; Fraser et al., 1995 and Population Reference Bureau, 1994). For the infant who survives, the higher risk of death persists throughout early childhood (Bachmann, 1988; Blum, 1991; Daly et al., 1994; UN, 1989; United Nations Children's Fund and Indian Council of Medical Research, 1987). The risk of maternal mortality rises dramatically early child birth (Garenne et al., 1997; Senanayke, 1995; Maine1991). These problems are also more likely among women with less than two years after previous pregnancy (Babson, 1997; Hay and Barbason, 1972 and Hobcraft, 1987).

For young women just beginning their adult lives, the risks of early childbearing do not end with delivery. Compared with a women who delays childbearing until her 20s, the women who has her first child before age 20 is more likely to obtain less education, have fewer job opportunities and lower income, be divorced or separated from her partner and live in poverty (Klepinger et al., 1995; Klitsch, 1993;

Ramirez, 1992; Rahim and Ram, 1993; Singh and Wulf, 1990). Pregnancies that occur before age 20 poses the risk of a wide variety of health problems for the child. These problems include low birth weight, birth defects, malnutrition, infectious diseases and lower physical growth and development. Despite these, however, Bangladesh still remains one of the countries where female life expectancy at birth is lower than that of males (male 60.7 and female 60.5) (BBS, 2000). While the progress was satisfactory with respect to reduction in fertility and child mortality, progress was inadequate with respect to maternal mortality and morbidity. Maternal mortality is a serious concern in Bangladesh. With the current maternal mortality ratio of 3 per 1,000 live births (BBS, 1999), the estimated lifetime risk of dying from pregnancy and childbirth is about 100 times higher than in the develop countries. One of the most tragic outcomes of these deaths is that about three fourths of the babies born to these women also die within first year of life and the survival of the other siblings is also at stake.

It is very important to note that 14 percent of pregnant women's deaths are associated with injury and violence. Also, the incidence of maternal mortality is decreasing, the incidence of violence against women in rising. In addition, most population based studies show that abortion complications are responsible for nearly a quarter of deaths of the mothers. The annual number of induced abortions would be 1,62,130 (BAPSA, 1998). Also an estimated 8,00,000 pregnancies are terminated each year in Bangladesh 2,62,000 induced abortion plus 5,18,000 MRs, at a rate of approximately 28 per 1,000 pregnant women aged 15-44

(Akhter, 1988; Rochat et al., 1981). Although this rate is moderate compared to levels worldwide, there is no room for complacency because the extent of undocumented and unsafe abortion is very high which in most cases result in life-threatening consequences.

About 70 percent of women suffer from nutritional deficiency anemia. Less than 40 percent of the population has access to basic care and 71 percent of pregnant women do not receive antenatal care, while 78 percent over years receive none (BDHS, 2004). The low level of antenatal care coverage in Bangladesh has improved only marginally during the last five years. Close to 54 percent do not have assistance from a trained attendant (Doctors, nurses, midwives and family welfare visitors). Almost all births (92 percent) in Bangladesh occur at home. Only 12 percent of births are assisted by medically trained personnel, doctors (7 percent), or nurses, midwives and family welfare visitors (5 percent) (BDHS, 1999-2000). Like maternal mortality, the situation of maternal morbidity in Bangladesh is the alarming. In Bangladesh, there are about 9 million women who have survived the rigors of pregnancy and child birth to suffer from lasting complications such as fistulae, uterine prolapse, inability to control urination and painful intercourse (BIRPERTH, 1998, 2000), with 37 percent during antepartum, 12 percent during intrapartum and 51 percent during postpartum. These reproductive morbidities diminish women's fertility, productivity and quality of life, as the health and survival of the next generation. These also make them social outcasts in some cases, turned out of homes and rejected by their husbands and families.

In Bangladesh, still children are born after a "too short" interval (Less than 24 months). Nearly one in six children (about 16 percent) are born after a "too short" interval (Mitra et al., 2000). Younger women have shorter birth intervals than older women. It helps to ensure her infants health when a woman avoids pregnancy for 24 months after a previous birth. A baby born too soon is vulnerable because the mother has not yet recovered from vitamin depletion, blood loss and reproductive system damage from the previous birth (Zhu et al., 1999). In Bangladesh, birth intervals are still five months shorter among rural women than among urban women (Mitra et al., 2000).

In Bangladesh, although almost all babies are breastfed at some time, only 17 percent are put to the breast within one hour of births and less than two-third (63 percent) are put to the breast within the first day of life (Mitra et al., 2001:134). Although the median length of any breastfeeding in Bangladesh is 30.5 months or slightly more than two and half years, the median duration of 1997 and to 31 months in 2004 (Mitra et al., 2001:136; 1997:132; 1994:120).

The mortality risks for infants of young mothers are high. The 2004 BDHS reports a neonatal mortality of 70 percent for mothers less than 20 years and an infant mortality rate of 106 per 1,000 live births. This is considerably higher than women in the older age groups: infant mortality is 79 per 1,000 live births for mothers 20-29 years and 87 per 1,000 live births for those 30- 49 years. The 2004 BDHS concludes that

approximately 19 percent of births in Bangladesh are exposed to a higher risk of death because the mother is less than 18 years. Delays in marriage and childbearing could lead to improve child survival prospects (Mitra et al., 1997). Maternal mortality rate is five times higher among women aged 10- 14 years than that of women aged 20-24 years (Chen et al., 1974). In the same study, maternal mortality rate is almost twice among age less than 20 years than of older women aged 20-30.

Levels of education attainment still remain low in Bangladesh with a strong differential persisting between males and females. Generally, education attainment is higher for males than for females, although this varies substantially by age. Twenty-eight percent of men and 38 percent of women age six years and above have not received any formal education. Substantial urban-rural gaps in educational attainment still persist. Thirty-one percent of rural men have never attended school, compared with less than one-fifth of urban men (18 percent). The differences are also striking for women 40 percent of rural women have never attended school, compared with only 29 percent of urban women (Mitra et al., 2001: 14).

## 1.2 Country Profile

Bangladesh, one of South Asian countries, is the eight most populous country in the world. Bangladesh is an irregular shaped and low- lying country with a total area of 56,977 square miles or 1,47,570 square kilometers of which 8,236 square kilometers is riverine and 1,971 kilometers is under forest. It is situated latitudinally between 20°34' and 26°38' north and longitudinally between 88°01' and 92°41' east. The country is bounded on the north and the west by India, on the east by India and Myanmar and on the south by the Bay of Bengal. Today's Bangladesh, with a population of about 140 million, 70.2 million are males and the rest 69.8 million are females in 2004, is the most densely populated country in the world. The annual population growth rate is still high of 1.54 percent (Bangladesh Population Census, 2001). Bangladesh occupy only 1/13000$^{th}$ of total land area of the world but population density is about 839 per square kilometer (GOB, 1999; Bangladesh Population Census, 2001). The country demonstrates the typically broad-based population age pyramid of a under-developed country. Only 37.0 percent male and 33.4 percent female are educated in Bangladesh (Bangladesh Population Census, 2001). Ethnically, Bangladesh is homogeneous and 98.8% of the populations have Bengali as their mother tongue.

For administrative purpose, the country is divided into 6 divisions, 64 districts and 507 thanas. Muslims constitute almost 90 percent of the population of Bangladesh. Hindus constitute about 9 percent, and others constitute about 1 percent.

Agriculture is the most important sector of the nation's economy. It accounts for 25 percent of the gross domestic product (GDP) and almost 80 percent of the population is directly engaged with it (BDHS 2004). The growth of industrial sectors is increasing with importance in national policies and as a result of foreign investment. The per capita income is only US$482 and half of Bangladesh's population is the poverty line (GOB, 1994: 2; World Bank, 1995: 17). Because of high young age structure and lack of employment facilities, out of 56 million of total civilian labor force, 20.1 million youth labor force (15-29) were unemployed. Unemployment/ under employment is a serious problem and pressure on the land in rural areas has led to movement of people from rural to urban areas.

The relatively young age structure of the population indicates continued population growth in the future; about 26.6 percent of the population is under 10 years of age, 67.3 percent are between 10 and 59 years and 6.1 percent are age 60 or over (Bangladesh Population Census, 2001). This young age structure constitutes a 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 total fertility rate has decline from about 6.3 in the period 1971-1975 to 3.0 in the period 2004 (BFS, 1975; BDHS, 1999-2004). The crude death rate has also fallen dramatically, from about 19 per 1,000 populations in 1975 to 4.8 in 2004. The infant

mortality rate was 150 deaths per 1,000 live births in 1975 and has fallen to 66 in the period 2004. Maternal mortality rate has decline from 6.2 per 1,000 live births in 1982 to 3.0 per 1,000 live births in 1999 (GOB, 1994:5; BBS, 1999). Life expectancy at birth was 46 years for males and 47 years for females in 1974 (UN, 1981: 60). It increased to 60. 7 years for males and 60.5 years for females (BBS, 2000:20). In 1975, when married women were asked how many children they would ideally like to have, the response was an average of 4.1 children (Huq and Cleland, 1990: 53,54). By 1993-94, the mean ideal family size had dropped to 2.5 (Mitra et al., 1994: 88). There has been a little improvement in the age at marriage. Marriage starts very early in Bangladesh, nearly about 12.5 years of age, progresses very fast and almost all women marry (Islam, 1996; Abedin, 1982). The median age at first marriage for females and males are 19.0 years and 25.3 years, respectively (Bangladesh Population Census, 2001).

Childbearing begins early in Bangladesh, with large majority of women becoming mothers before they reach the age of 20. The median age at first birth is between 17 and 19. The median age at first birth has increased slightly from about 17 for older women to about 19 for women in their early twenties. For example, in 1975, the median age at first birth among women aged 20-24 was 16.8 in 1989, it had risen to 18.0 in 1993-1994 to 18.4 in 1996-97 and by 2004 to 18.7 (BFS, 1975; BFS, 1989; BDHS, 1996-97, 1999-2000, 2004).

More than half (55 percent) of women aged 15-19 who have been married have at least one child, although most of them have had only one. At ages 20-24, 51 percent of ever-married women have had two or more births and 10 percent have already had at least four, 55 percent of women in their early thirties have had five or more children (Mitra et al., 1990). The age specific fertility rate indicates a pattern of early childbearing with a peak of age group 20-24. Three quarters of childbearing occurs before age 30 (Mitra et al., 2001; Mitra et al., 1997; Kantner et al., 1996).

Nearly one in six children (16 percent) are born after a "too short' interval (less than 24 months). More than half (57 percent) of non-first births occur three or more years after the previous birth. The median birth interval in Bangladesh is 39 months (Mitra et al., 2001: 39).

## 1.3 Review of Literature

Population of Bangladesh is characterized by young age structure (about 40 percent of total population still remain under 15 years of age), relatively high share of married women in the reproductive age span (15-49), low female age at marriage, relatively high rates of neonatal, infant, child and maternal mortality and increasing size of the aged population (population of age 60+). Bangladesh has undergone a remarkable demographic transition over the last two decades. Fertility in Bangladesh is high even by the standards of developing countries. Recent evidence suggests that the level of fertility has started to decline since mid-seventies in Bangladesh (Amin and others, 1993; Islam et al., 2001; Islam et al., 2003). The total fertility rate has declined from about 6.3 (per women) in 1975 to 3.3 in 2004 (BFS, 1975 and BDHS, 2004). A number of demographers have argued that the mechanism of this steep fertility decline was achieved primary due to a successful family planning (Amin and others, 1990; Cleland and others, 1994; cleland,1993; Cald et al., 1994; Islam et al., 1998), that succeeded in raising in contraceptive prevalence rate (CPR) from a low level of 8 percent in 1975 to as high as 53 percent in 2004 (Mitra et al., 2004). However, from 1993-94 the level of fertility appears to be unchanged at a level of 3.3 (TFR), as indicated by the last two Bangladesh Demographic and Health Surveys (BDHSs) in Bangladesh in 1999-2000 and 2004. On the other hand, during the period from 1999-2000 to 2004, the contraceptive prevalence rate was increased substantially from 44.6 percent to 53.8 percent (Mitra et al., 2004). In Indonesia, research suggests that fertility decline resulted mainly from a high rate of

increased use of contraception that was induced primarily through economic development and an increasing rate of female education as well as greater work force participation (Gertler and Molyneaux, 1994). Development programmes have, no doubt, contributed to the fertility decline. However, several biological, behavioural and cultural factors are also involved. Bongaarts (1978) termed these factors the proximate determinants of fertility since they directly affect fertility. It is likely that rapid fertility decline occurred in Bangladesh as a result of a family planning program that was introduced at a time of increasing openness to and expansion of social development innovations in the country in general and rural areas in particular (Amin et al., 1995).

Islam et al., (2001) suggested that in the recent years contraception has emerged as the highest fertility reducing factors in Bangladesh. Until early 1990s, postpartum infecundability was the most important and strongest fertility reducing factors in Bangladesh, but by 1993-94 contraception had become most important determinant of fertility and its fertility inhibiting effect is steadily increasing. There has been a little improvement in the age as marriage. Marriage starts very early in Bangladesh nearly 12.5 years of age, progresses very fast and almost all women marry (Islam, 1996 and Abedin, 1982).

Teenage early childbearing is very high in Bangladesh. According to the 2004 Bangladesh and Demographic and Health Survey, more than 90 percent cases of marriage occurred at an age below 20 years. As long as marriage and children are universal goals, no society can reasonably

expect to achieve replacement level of fertility (2.13) by only postponing union and spacing births. Permanent fertility reduction largely depends on desired completed family size at the end of the reproductive life span (Islam et al., 2004).

World Bank (1993) has conducted a study and concluded that the socio-economic development carried out since 1970 is in progress but at a very slow rate. Average economic growth reached 4.3 percent per annum during 1980-91. Decline in infant mortality (from 112 in 1986 to 66 per thousand births in 1999) (Mitra et al., 1994; BDHS, 2004) indicate improvements in socio-economic welfare in education attainment (BSA, 1993), which has led to increase in age at first marriage reduced family size and reduced fertility. The total effect of female education on fertility is found to be negative (Islam et al., 1995). Education may provide better employment opportunities outside the home and providing education to females, especially at the secondary and higher levels can increase age at marriage.

Educational attainment of the women is generally considered to be a useful index of socio-economic status as well as of the level of overall social sophistication. Improved education and an increase in the age at first marriage are key elements for improving the status of women (Widayatum, 1991; Islam et al., 1995). Women who begin early childbearing before age 20 complete less schooling than women who delay having children until they are in their 20s (Tam, 1993). While more women are delaying marriage, many continue to marry young and

begin early childbearing soon after marriage. In many developing countries most women marry before age 20 (McCauley and Salter, 1995) and many young women between ages 15 and 19 give birth (UN, 1994). The two most common reasons why young women do not complete secondary education are marriage and pregnancy (AGI, 1998). Most young women do not return to school after they become mothers (Lerman 1992). Women who do not finish school have fewer job opportunities and less income than others and are more likely to live in poverty (UN, 1994). Education may make people more receptive to new ideas- such as, infant, child and maternal mortality from high-risk and low-risk childbearing. Hobcraft (1984), using the data from World Fertility Survey for 28 countries found that mother's education and husband's occupation have strong effect on lower infant and child mortality. Bhuiya and Streatfield (1991) using data on Demographic Surveillance System (DSS) from ICDDR,B found that the higher socio-economic status of husband, higher education of mother and health intervention area have a lower infant and child mortality. The mother and father's education, hygienic improvement of water, sanitation and environment and modernization of the community decreased the infant and child mortality (Prakash, 1991). Caldwell (1979) suggested that general maternal education is a most effective means of infant and child mortality reduction.

An important indicator of women's status in society is their access to education. Education can have a profound impact on the position of women, particularly in strongly patriarchal societies where it allows girls to have a wider social network, new reference groups and greater exposure to the modern world than they might otherwise experience. In addition, exposure to schooling allows girls to be free from parent control for several hours a day and gives them experience in interacting with boys, strangers and authority figures other than their parents (Tan and Hainers, 1984). According to numerous Studies, the level of education of the wife is more strongly correlated with a couple's fertility than the educational level of the husband. Female education helps to "prevent" early marriage and early motherhood. Education is also considered to be associated with an increase in women's domestic power and their participation in extra-domestic employment before marriage (Mason et al., 1984).

Early childbearing of Bangladeshi women has significantly changed in the level but less markedly in the pattern though there are some indications of shifting of fertility from older age and teenage of reproduction to the young and middle ages of reproduction. The level of fertility can further be reduced by decreasing the level of fertility of the women belonging to these age categories (Abedin, 2003). Also, the combinations of age at marriage, contraceptive use and fertility desire influence the age pattern of fertility directly in Bangladesh.

In rural Bangladesh it was found that age at first marriage, education of partner, religion, availability of electricity in the household, and occupation of partner have significant effects on fertility. It has also been found that fertility is the lowest in those women whose husbands are service holders and the highest for those engaged in agriculture (Khan et al., 1993). Khan and Raeside (1997) have rightly reported that mother's age, women's working status, religion, place of residence are the important factors for explaining recent fertility pattern in Bangladesh. Age at marriage is one of the important demographic determinants of fertility (Islam et al., 1995). It determines the survival status of children and very much under the influence of socio-cultural and socio-economic situation. Low age at marriage not only contributes to population growth but also adversely affects the health of women resulting in maternal mortality. It also provides long childbearing span and results in a higher fertility in the societies where birth spacing is low. Higher fertility is encouraged by such societies, which are characterized by low socio-economic status, fatalism and high degree of religious and superstitious beliefs. Parents (mostly rural/slum areas) perform the marriage of their children particularly daughters soon after their puberty or even earlier due to various reasons such as to satisfy the wishes of grand parents; dowry problem, availability of suitable match (bridegroom) and to dispose off the responsibility. But this may affect the health of women and also result in early pregnancy, abortion and premature births, stillbirth, which will reflect on the health of the women. The early and frequent pregnancies not only destroy the health but also that of future generations as well (Kapoor, 1991). According to

the United Nations International Children Emergency Fund (UNICEF) document (1994), girls are forced into early marriage, pregnancy risk and higher rates of infection and death. Early marriage for females is customary in Bangladesh. In rural areas, majorities of girls marry before the age of 12 (BFS, 1978; Rahman, 1984). Although, the average age at marriage has increased during the last two decades, early marriages are still prevalent in rural Bangladesh (Shaikh, 1984; Rahman, 1984; Rob, 1987).

In Bangladesh, fertility is greatly influenced by among other socio-economic variables such as, working status of women and their levels of education (Abedin, 2003). She also showed that the influence of education is more than the influence of working status of women. Swenson and Thang (1993) have rightly that women's education is a prime determinant of fertility.

Fetal loss appears to have a significant direct positive effect on fertility in Bangladesh (Islam et al., 1995). In Bangladesh, mothers who have experienced fetal loss are found to have higher fertility. There is a tendency that mothers always try replace their dead child as early as possible. Such behavior is a result of social fear about the survival of children. Survival of preceding child is significant demographic covariate affecting the length of birth interval (Chandran, 1989; Gubhaju et al., 1991; Naquib et al., 1995 and Nur, 1982). These studies reported that child loss resulted in shorter birth intervals as well as higher fertility. Brittain (1992) for a Carribean population, Khalifa and Farhat

(1993) for an Egyptain population and Ren (1995) for a Chinese population observed that the spacing of births was significantly affected by the infant death of the index child. Nath et al. (2003) for the schedule caste population in the rural India observed a slower transition to the next birth an index child surviving more than a year. In a society where having children is related to the old age security concerns of parents, a higher probability of death for children also is more likely to boost fertility levels to compensate for the risk. The influence of infant death is found to be the strongest of all correlates.

The strong preference for having at least one living son in Bangladesh is well known (Abedin, 1981; Islam, 1991; Rahman and others, 1992). In rural Bangladesh, parents typically highly valued a son as an economic asset and old-age insurance as well as the bearer of the family name; it is less likely that they will accept contraception or other methods of fertility control until they have had at least one son. Thus, the sex of the child could be regarded as a determinant of the birth interval (Islam et al., 1996).

In many developing countries about 50 percent of pregnancy terminations occur among the early childbearing mothers (Rinehart and Kols, 1984), and the wide choice of family planning now available allow health programmes to offer an appropriate technique to avoid each type of early pregnancy and maternal, child and infant mortality. The early child childbearing was determined according to demographic factors such as age, pregnancy and birth interval. Pregnancies of young

mothers (below 18 years) and older mothers (above 35 years), too many pregnancies (5 or more), and closer birth interval of below twenty-four months are likely to produce high-risks to mother and child life (Perkin, 1968).

Education may make people more receptive to new ideas- such as, age at marriage, early childbearing patterns, and family planning and more willing to take risks- such as moving to a new place or taking a job outside the home. It has also been established by the social scientists that many other factors- such as women's status may explain much of the association (Nancy, 1997). In respect to socio-economic characteristics, women's education is strongly related to their domestic economic power and childbearing pattern. In almost every setting regardless of region, culture or level of development, well-educated women are observed to have fewer children than uneducated women. Yet, the parents in the relationship between women's education and their fertility are diverse, varying by region of the world, by level of development and over time (Cochrane, 1979; UN, 1987,1995). More women and those with more schooling have a greater say in economic decisions than do youngest brides and those with little schooling (Mason, 1996). Female education helps to prevent childhood marriage and childbearing (Hossain, 2000). Education is also considered to be associated with an increase in women's participation in extra-domestic employment before marriage (Mason, 1984). Kabir et al. (1988) found that the average age at marriage was more than two years higher for women who have completed secondary school compared to those who

did not complete secondary education. Improved education and an increase in the age at first marriage are the key elements for improving the status of women. There is a positive relation between education and age at first marriage (Hossain, 2000). The total effect of fertility is found to be negative (Islam et al., 1995; Chi and Hsin, 1996; Nar and Nair, 1996 and Yadava and Chadney, 1994). However, Hollas and Larsen (1992) found that birth intervals are uncorrected with the education of Nigerian women whose education levels were low. For Vietnamese birth intervals, Swenson and Thong (1993) observed that the education differentials were apparent only at higher levels of education.

Adolescent childbearing and motherhood are highly valued in Bangladeshi society since 78 percent of the births to adolescents were wanted births (Islam, 1999). According to a recent study, the median age at first births is between 17 and 18 years. Overall, 31 percent of female adolescents became mothers by age 19 years. Rural and illiterate females are more likely to become mothers during adolescence. On average, each currently married female aged 15-19 has 0.78 births. The annual age specific fertility rate for adolescents aged 15-19 is 147 births per thousand females, which accounts for about 23 percent of the overall TFR (Islam, 1999).

Due to physiological and social factors, adolescent women are more vulnerable than older women to pregnancy-related complications (WHO, 1996). Sexually active adolescent women experience higher levels of reproductive mortality and morbidity than women do in the 20s

and early 30s (Senderowitz, 1995). Although most adolescent women are physiologically mature enough to become pregnant, their bodies are often not sufficiently developed to carry a pregnancy to tern safely. They are at a particular risk for pre-eclampsia and obstructed labour due to cephalopelvic disproportion. Skeletal growth in women is not complete until the age of 18 and the birth canal is not mature until approximately 20 to 21 years of age although their ages vary substantially with nutritional levels among individuals and between populations (Hobcraft,1997).

Studies in Bangladesh, Bolivia, Ethiopia, Malawi, Thailand and elsewhere consistently have shown a higher risk for short interval births (Alam, 1995; Forste, 1994; Haaga, 1995; Rahman et al., 1996 and Shahidullah, 1994). Analysis of DHS data shows that, on average, the risk of death is twice as high for infants conceived less than two years after the mother's previous birth than for those conceived after a larger interval (Bicego and Ahmed, 1996 and Shane, 1997). When births are closely spaced, the next older sibling is endangered as well as the younger child. Even if infants survive the first year of life, they are almost 1.5 times more likely to die before age five than if pregnancies are spaced at least two years apart (Shane, 1997).

A study from Matlab in Bangladesh showed that the level of maternal mortality among adolescent women was nearly double that of women aged 20-34 (Hobcraft, 1997). Other studies suggest that the risk of dying during pregnancy or delivery is 20 to 200 percent greater for

women aged 15-19 than it is for women aged 20-34 (Senderowitz, 1995).

Children born to mother's age less than 20 years often experience higher risks of death during the first five years of life. A recent comparative study using data from Demographic and Health Surveys in 20 countries showed that the risk of death by age five was 28 percent higher for children born to adolescent mothers than for those born to women age 20-30 (Bicego et al., 1996).

The education of women can make childbearing safer and improve the health of the entire family. In Zaire and Nigeria, for example, women with some formal education had a maternal mortality rate one fourth that of women with no formal education (Harrison, 1980). Education levels strongly influence adolescent childbearing. More than two-thirds of women with no education in the Dominican Republic, Ecuador, Mexico and most African countries give birth before age 20 (Senderowitz, 1995). Women with some secondary schooling, however, are less likely to give birth during adolescence (Singh, 1997). Research in Nigeria showed that only 7 percent of women with seven years of schooling gave birth before age 20, compared to 43 percent of women with no education. Similarly, in Pakistan only 16 percent of women with 7 years of education gave birth before age 20 compared to 54 percent of women with no education (Senderowitz, 1995).

Mother in rural Senegal have their next birth within a median of 15 months if their infant dies in the first month of life. If an infant dies before age one, mothers wait a median of 22 months before their next child. If a child dies between ages one and two, mothers wait a median age of 29 months; and when a child survives for two years, mothers wait a median of 33 months to have their next child (Ronsmans, 1998). Some couples unintentionally have their next child quickly because a child's early death ends breastfeeding and women return to menses and resume ovulation sooner (Grummer-Strawn et al., 1998). In Ghana, the median duration of postpartum amenorrhoea dropped from 12 months to 4 months among women whose child died early (Nyarko et al.,1999). Data from the DHS show that, on average, child survival increases the duration of postpartum amenorrhoea by 17.8 percent. When a child dies, the duration of postpartum sexual abstinence can fall by much as 47 percent, according to data from the DHS (Grummer-Strawn et al., 1998).

Young girls in traditional societies are often bound by cultural norms that equate marriage and motherhood with female status and worth. Even the youngest brides often face enormous pressure to prove their fecundity soon after marriage through the birth of a child (Sadik, 1997). In other cases, cultural traditions encourage young women to prove their fertility before marriage (Senderowitz, 1995).

Bangladesh has made substantial advances in social indicators including health and education that have contributed greatly in the reduction of fertility level. Fertility decline achieved by mid-nineties is

remarkable. Childbearing starts early and progresses fast in Bangladesh. Children born to teenage mothers (below 20 years) and to mothers over the age of 35 have a reduced change of surviving (Perkin, 1968). More than half (55 percent) of women aged 15-19 who have married have at least one child, although most of them have had only one. In Jamaica and Nigeria, it has been found that pregnant women under 15 are 4-8 times more likely to die during pregnancy and childbirth than those age 15-19 (Williams, 1973 and Harrison et al., 1985). In the United States of America in 1981, the maternal death rate among mothers under 15 was 2.5 times higher than the among mothers aged 20-24 (Royston and Armston, 1989). Women in Algeria, Bangladesh, Ethiopia, Indonesia and Nigeria, who became pregnant when aged 15-19 ran a greater risk-sometimes twice as high of dying from pregnancy related causes than pregnant women in their twenties and early thirties (Liskin et al., 1985).

In Bangladesh, still children are born in a "too short" interval (less than 24 months). Nearly one in six children (16 percent) are born in a "too short" interval (less than 24 months) (Mitra et al., 2000). Younger women have shorter birth intervals for women age 15-19 is 24 months, compared with 44 months for women over 40. A shorter median interval also prevails for children whose preceding sibling has died, compared with those whose prior sibling is alive. This pattern presumably reflects a shortened breastfeeding period due to the death of the prior sibling, as well as minimal use of contraception (BDHS, 1996-97).

In Bangladesh, birth-intervals are five months shorter among rural women than among urban women. The longest birth intervals are found among women in Khulna Division and the shortest are among women is Sylhet Division. There is a tendency for birth intervals to increase with education. Mothers with some secondary education have a median birth interval that is six months longer than the interval for uneducated mothers (Mitra et al., 2000).

Variables such as age at marriage, current age of mother, women's occupation, family income and place of residence have profound effects on variation of early childbearing (Park et al., 1994).While it is difficult to separate education from other aspects of socio-economic status, it is clear that women with education are more likely to marry later, delay childbearing, use family planning and seek prenatal care (Harrisin, 1980; London et al., 1985; Monteith et al., 1987 and Potter, 1985). Educated women also are more likely to use obstetric services and avoid harmful traditional practices regarding pregnancy and childbearing.

Early childbearing is linked to the age at which women are married, their education levels and cultural norms related to women's social status and roles. The highest levels of adolescent childbearing work-wide occur in sub-Sahara Africa, where most of them aged 20-24 have given birth before 20 and in Latin America and the Caribbean, where about one third of them have given birth before age 20 (Hobcraft, 1997). Although not all childbearing occurs within marriage, age at marriage is closely linked to first birth due to cultural norms and expectations and

due to the fact that contraception is less commonly used to delay first births than it is to delay later births (McDevitt et al., 19960. Where women marry later, they have more time to complete their education, learn about reproduction and contraceptive methods and develop marketable skills. Moreover, delayed marriage and first birth means fewer years spent in childbearing and are often linked to lower fertility.

From the above discussion it can be concluded that early childbearing of women might be classified as those occur before the age of 20 years (early childbearing), then of them the age 10-16 termed as high risk and of them the age 17-19 termed as low risk childbearing. A part from this terms of birth interval childbearing with less than 24 months and childbearing after parity 3 can be termed as high-risk childbearing and beyond those is the low-risk childbearing. The review further indicates that so many factors affect such early childbearing in its own way. Some of such factors are education, religion, place of residence, women working status, age at marriage, age first birth and so on and shows how they affect the early childbearing of the Bangladeshi women.

## 1.4 Perspectives of the study

Early childbearing means the early growth that is the growth capacity of teen ages women. It is apparent that early childbearing vary with the varying demographic and socio-economic variables. Very little attention is given as to how capture the pattern of early childbearing with respect to age, age at marriage, duration of marriage, children ever born as well with varying socio-economic situation like education of women, education of husband and working status of women and so on. Among the studies available, this study mostly focuses mostly on the consequence for developed countries. Since relatively lower attention has been given to one of the major influential factors of fertility decline in Bangladesh, the early childbearing, therefore it may essential to know the pattern as well as the inherent peculiarities of early childbearing in Bangladesh.

## 1.5 Objectives of the study

The overall objective of this study is to examine the pattern of early childbearing of rural and urban community in Bangladesh.The specific objectives of this study are as follows:

1) to evaluate the observed child spacing patterns and trends.
2) to investigate the demographic pattern of early childbearing.
3) to examine the socio-cultural trends in early childbearing.
4) to determine the associated factors significantly affect early childbearing.

## 1.6 Organization of the Thesis

This study has organized in seven chapters, including the introductory one. In the first chapter we present the background of the study, review of literature, perspectives of the study and objectives of the study. Data source, sampling design, evaluation of data, selected influential variables and methods of analysis are given in chapter two. Chapter three presents the analysis of early childbearing pattern in Bangladesh. While chapter four shows the determinants of early childbearing. To estimate the intensity of the effect of factors of early childbearing by discriminant and logistic regression analysis are given in chapter five. Chapter six presents early childbearing pattern by different divisions: discriminant analysis. Finally, chapter seven presents summary and findings of the study, policy implications and recommendation of the study.

# *CHAPTER TWO*

# DATA AND METHODOLOGY

CHAPTER OUTLINE

# *CHAPTER TWO*

# DATA AND METHODOLOGY

## 2.1 Introduction

The main purpose of the present research is to investigate the pattern of early childbearing of Bangladeshi women. Therefore, in order to see the aspects of early childbearing first we need to examine the fertility schedules to shed some light on the age pattern of high-risk and low-risk childbearing. Here, by early childbearing we mean reproductive performance of women through the childbearing ages. Having some knowledge on such aforesaid aspect of age pattern of early childbearing, we have to investigate the pattern of high-risk and low-risk childbearing by age, birth interval on individual level having such data for every woman. Pregnancy of younger mothers (below 20 years) and close birth interval of below twenty-four months are likely to early child to mother and child life (Perkin, 1968).

In this chapter, we have discussed about nature and type of data needed to fulfill our objectives cited earlier and sources of data we have taken to undertake such research.

## 2.2 Sources of Data

The data used in this study have been collected from the 2003-2004 Bangladesh Demographic and Health Survey (BDHS). The survey was conducted under the authority of the National Institute for Population Research and Training (NIPORT) of the Ministry of Health and Family Welfare, Bangladesh. The survey was implemented by Mitra and Associates, a Bangladeshi research firm located in Dhaka.

## 2.3 Sample Design

The sample for the 2004 BDHS covered the entire population residing in private dwellings units in the country. Administratively, Bangladesh is divided into six divisions. In turn, each division is divided into zilas, and in turn each zila into upazilas. Each urban area in the upazila is divided into wards, and into mahallas within the ward; each rural area in the upazila is divided into union parishads (UP) and into mouzas within the Ups. The urban areas were stratified into three groups, 1) Standard metropolitan areas, 2) Municipality areas, and 3) Other urban areas. These divisions allow the country as a whole to be easily separated into rural and urban areas.

For the 2001 census, subdivisions called enumeration areas (EAs) were created based on a convenient number of dwellings units. Because aketch maps of EAs were accessible, EAs were considered suitable to use as primary sampling units (PSUs) for the 2004 BDHS. In each division, the list of EAs constituted the sampling frame for the 2004

BDHS survey. A target number of completed interviews with eligible women for the 2004 BDHS was set at 10,000, based on information from the 1999-2000 BDHS. The 2004 BDHS sample is a stratified, a multistage cluster sample consisting of 361 PSUs, 122 in the urban area and 239 in the rural area. After the target sample was allocated to each group area according to urban and rural areas, the number of PSUs was calculated in terms of an average of 28 completed interviews of eligible women per PSU (or an average of 30 selected households per PSU).

Mitra and Associates conducted a household listing operation in all the sample points from 3 October 2003 to 15 December 2003. A systematic sample of 10,811 households was then selected from these lists. All ever-married women age 10-49 in the selected households were eligible respondents for the women's questionnaire. For the men;s survey, 50 percent of the selected households were chosen through systematic sampling. Interviewers interviewed one randomly selected man, regardless of marital status, in the age group 15-54, from each of the selected households. It was expected that the sample would yield interviews with approximately 10,000 ever-married women age 10-49 and 4,400 men age 15-54.

## 2.4 Evaluation of Data: Indexes of Age Preference

In place of sample reinterview studies, various arithmetic devices have been developed for measuring heaping on individual ages or terminated digits. These devices depend on some assumption regarding the form of the true distribution of population by age over a part or all of the age range. On this basis an estimate of the true number or numbers is developed and this is again compared with the reported number or numbers. Whipple's Index and Myer's Index have been applied to estimate the extent of inaccuracy of the incidence of age heaping and digit preferences.

***Whipple's Index:*** Whipple's Index have been developed to reflect preference for or avoidance of a particular terminal digit or of each terminal digit. For example, employing again the assumption of rectangularity in a 10- year range, heaping on terminal digit "0" in the range 10 to 49 may be measured by comparing the sum of the populations of the ages ending in "0" in the range with one-tenth of the total population in the range:

$$\frac{\Sigma (P_{10} + P_{20} + P_{30} + P_{40})}{1/10\ \Sigma (P_{10} + P_{11} + P_{12} + \ldots\ldots\ldots + P_{48} + P_{49})}$$

$$= 97.378$$

Similarly, employing either the assumption of rectangularity or of linearity in a 5- year range heaping on multiples of five (terminal digits "0" and "5" combined) in the range 10 to 49 may be measured by comparing the sum of the populations of the ages in this range ending in "0" and one-fifth of the total population in the range:

$$\frac{\Sigma (P_{15} + P_{25} + P_{35} + P_{45})}{1/5\ \Sigma (P_{10} + P_{11} + P_{12} + \ldots\ldots\ldots + P_{48} + P_{49})}$$

$$= 53.278$$

We know that the Whipple's index varies between 100, representing no preference for "0" or "5", and 500, indicating that only digits "0" or "5" were reported. Here we observed that the calculated value of Whipple's index is approximately 100 using both formulas. So the data representing no preference for "0" or "5", and hence the quality of data is good.

***Myer's Index:*** Myer's has developed a blended method to avoid the bias in indexes computed in the way just described that is due to the fact that numbers ending in "0" would normally be larger than the following numbers ending in "1" to "9" because of the effect of mortality. The principle employed is to begin the count at each of the 10 digits in turn and then to average the results. Specifically, the method involves determining the proportion, which the population ending in a given digit

is of the total population 10 times, by varying the particular starting age for any 10- year age group. Table 2.1 shows the calculation of the indexes of preference for terminal digits in the age range 10 to 49 for data BDHS- 2004. In this particular case, the first starting age was 10, then 11, and so on, to 19. The abbreviation procedure of calculation calls for the following steps:

Step (1): Sum the populations ending in each digit over the whole range starting with the lower limit of the range (e.g., 10, 20, 30, 40; 21, 21, 31, 41).

Step (2): Ascertain the sum excluding the first population combined in step (1) (e.g., 20, 30, 40; 21, 31, 41).

Step (3): Weight the sums in steps (1) and (2) and add the results to obtain a blended population (e.g., weights 1 and 9 for the 0 digit; weights 2 and 8 for 1 digit).

Step (4): Convert the distribution in step (3) into percents.

Step (5): Take the deviation of each percent in step (4) from 10, the expected value for each percent.

**Table 2.1: Calculation of preference indexes for terminal digits by Myer's Blended Method for BDHS- 2004.**

| Terminal digit | Population with digit | | Weights for | | Blended population | | Deviation of percent from 10; (6)-10 |
|---|---|---|---|---|---|---|---|
| | Starting at age 10 (1) | Start. at age 20 (2) | Col. 1 (3) | Col. 2 (4) | Number (1)x(3) +(2)x4 | Per. Distrib. (6) | |
| 0 | 1114 | 1114 | 1 | 9 | 11140 | 10.037 | 0.037 |
| 1 | 1000 | 1000 | 2 | 8 | 10000 | 9.019 | 0.981 |
| 2 | 1063 | 1063 | 3 | 7 | 10630 | 9.578 | 0.422 |
| 3 | 1047 | 1010 | 4 | 6 | 10248 | 9.233 | 0.767 |
| 4 | 1086 | 983 | 5 | 5 | 10345 | 9.321 | 0.679 |
| 5 | 1201 | 999 | 6 | 4 | 11202 | 10.093 | 0.093 |
| 6 | 1229 | 956 | 7 | 3 | 11471 | 10.335 | 0.335 |
| 7 | 1205 | 854 | 8 | 2 | 11348 | 10.224 | 0.224 |
| 8 | 1251 | 906 | 9 | 1 | 12165 | 10.961 | 0.961 |
| 9 | 1244 | 852 | 10 | 0 | 12440 | 11.208 | 1.208 |
| Total | (x) | (x) | (x) | (x) | 110989 | 100.0 | 5.707 |
| Age pre. Tot./2 | (x) | (x) | (x) | (x) | (x) | (x) | 2.85 |

We know the theoretical range of Myer's index is 0, representing no heaping. From table 2.1, we observed that the calculated value of Myer's index is approximately 0. So we can say that the quality of data is very good.

## 2.5 Response Rates

Table 2.2 shows response and non-response rates for the household and individual in the survey. A total of 10,811 households were selected for the sample; 10,523 were occupied of which 10,500 were successfully interviewed. The shortfall is primarily due to dwellings that were vacant or destroyed or in which the inhabitants had left for an extended period at the time the interviewing teams visited them. Of the households occupied, 99.8% were successfully interviewed. In these households, 11,601 women were identified as eligible for the individual interview (i.e, ever-married and age 10-49) and interviews were completed for 11,440 or 98.6% of them. For women in households that selected for inclusion in the man's survey, 4,490 eligible men of age 15-54 were identified, of which 4,297 or 95.7% were interviewed.

The principal reason for non-response among eligible women and men was the failure to find them at home despite repeated visits to the household. The non-response rates for the 2004 survey were lower than those for the 1999-2000 survey.

**Table- 2.2: Results of the household and individual interviews**

| BDHS | 2004 | | | 1999-2000 | | |
|---|---|---|---|---|---|---|
| Results | Residence | | Total | Residence | | Total |
| | Urban | Rural | | Urban | Rural | |
| **Household interviews** | | | | | | |
| Household sampled | 3,646 | 7,165 | 10,811 | 2,997 | 7,271 | 10,268 |
| Household occupied | 3,522 | 7,001 | 10,523 | 2,891 | 7,039 | 9,922 |
| Households interviewed | 3,513 | 6,987 | 10,500 | 2,857 | 6,997 | 9,854 |
| Household response rate | 99.7 | 99.8 | 99.8 | 98.8 | 99.5 | 99.3 |
| Household non-response rate | .3 | .2 | .2 | 1.2 | .5 | .7 |
| **Individual interviews: Women** | | | | | | |
| Eligible women | 3,973 | 7,628 | 11,601 | 3,274 | 7,611 | 10,885 |
| Eligible women interviewed | 3,904 | 7,536 | 11,440 | 3,150 | 7,394 | 10,544 |
| Eligible women response rate | 98.3 | 98.8 | 98.6 | 96.2 | 97.1 | 96.9 |
| Eligible women non-response rate | 1.7 | 1.2 | 1.4 | 3.8 | 2.9 | 3.1 |
| **Individual interviews: Men** | | | | | | |
| Eligible men | 1,583 | 2,907 | 4,490 | 851 | 1,966 | 2,817 |
| Eligible men interviewed | 1,514 | 2,783 | 4,297 | 771 | 1784 | 2555 |
| Eligible men response rate | 95.6 | 95.7 | 95.7 | 90.6 | 90.8 | 90.7 |
| Eligible men non-response rate | 4.4 | 4.3 | 4.3 | 9.4 | 9.2 | 9.3 |

Source: BDHS- 2004 and 1999-2000, Table 1.1 Results of the household and individual interviews.

## 2.6 Selected Influential Variables of Childbearing

There are three types of variables, which play the role on early childbearing as follows:

i) Demographic variables

ii) Socio-economic variables and

iii) Cultural variables

### i) Demographic variables

The explanatory variables that summarize the demographic behavior of the respondents are considered as demographic variables.

Four demographic variables are examined in the analysis:

1. Current age of women,
2. Age at first marriage,
3. Marital duration,
4. Total children ever born (CEB) and

Here we observed that, the demographic variables are quantitative. In order to perform the analysis, it is required to make these variables into categorical variables.

**ii) Socio-economic variables**

The variables, which reflect the social and economical status of any community, are known as socio-economic variables. These variables are important in any demographic studies.

Four socio-economic variables are considered in the analysis:

1. Mother's education
2. Father's education
3. Women work status and
4. Husband occupation.

**iii) Cultural variables:**

The cultural variables exert important influences on reproductive behavior.

Three cultural-variables are investigated in the present study:

1. Religion and
2. Residence of women
3. Contraceptive use.

**Table-2.3: Variables considered for Analysis** (Variable number, Question number in BDHS 2004)

| Variable name | Variable number as indicated in BDHS, 2004 | Question number as indicated in BDHS, 2004 |
|---|---|---|
| Current age of women $(X_1)$ | V012 | Q106 |
| Age at first marriage $(X_2)$ | V511 | Q106A |
| Marital duration $(X_3)$ | V513 | Q307 |
| Children ever born $(X_4)$ | V201 | Q201 |
| Mother's education $(X_5)$ | V106 | Q108 |
| Father's education $(X_6)$ | V701 | Q804 |
| Women work status $(X_7)$ | V714 | Q807 |
| Religion $(X_8)$ | V130 | Q115 |
| Residence of women $(X_9)$ | V102 | Q104 |
| Contraceptive use $(X_{10})$ | V302 | Q304 |
| Occupation of husband $(X_{11})$ | V704 | Q806 |

Source: BDHS, 2004.

## 2.7 Analytical Methods

The methods of analysis of the data is based on

2.7.1 Percent Distribution

2.7.2 Contingency and Association Analysis

2.7.3 Discriminant Analysis

2.7.4 Logistic Regression Analysis

### 2.7.1) Percent Distribution

Percent distribution of women is provided in early childbearing in relation to various demographic, socio-economic and cultural variable by their hierarchy.

### 2.7.2) Contingency and Association Analysis

Several 2×2 contingency tables are prepared considering the childbearing of women as an attribute with two levels. The purpose of contingency and association analysis is to look at the independency criterion childbearing pattern of various demographic, socio-economic and cultural attributes.

**2.7.3) Discriminant Analysis:** Discriminant analysis is a statistical technique used to distinguish between two or more groups or cases. In our analysis we have considered more groups. Let us say few words about discriminant analysis. Discriminant analysis is a broad term that refers to several closely related statistical activities. A researcher is engaged in interpretation when studying the ways in which groups

differ, that is, is one able to "discriminate" between the groups on the basis of some set of characteristics, how well do they discriminate, and which characteristics are the most powerful discriminator? The characteristics used to distinguish among the groups are called "discriminating variables". These variables must be measured at the interval or ratio level of measurement, so that means and variances can be calculated and so that they can be legitimately employed in mathematical equation.

**2.7.4) Logistic Regression Analysis:** To examine the relative importance of all the variables simultaneously, In this thesis some multivariate techniques have been adopted. Multiple regression analysis is one of such technique. However, this technique poses difficulty when dependent variable can have two or more. To overcome these problem, the linear logistic regression is used. This model required far fewer assumptions than discriminant analysis be satisfied; logistic regression still performs well (Hosmer er.,1989)

The logistic regression model can be used not only to identify factors but also predict the probability of success. The general logistic model expresses a qualitative and quantitative. Before beginning a study of logistic regression qualitative dependent variable as a function of several independent variables, both, it is important to understand that the goal of an analysis using this method is the same as that of any model building the technique used in statistics.

# *CHAPTER THREE*

# OVERVIEW OF CHILDBEARING PATTERN

CHAPTER OUTLINE

# *CHAPTER THREE*

# OVERVIEW OF CHILDBEARING PATTERN

## 3.1 Introduction

The focus on fertility in this research is due to its important role in determining population growth rate and its impact on economic development. A major objective of this study is to examine fertility levels, patterns, and differentials in Bangladesh.

Most of the fertility measures are based on the birth histories collected from ever-married women age 15-49 interviewed during the survey. Each woman was asked a series of questions to give a retrospective history of all of her births. To encourage complete reporting, the interviewer asked the respondent about the number of sons and daughters living with her, the number living elsewhere, and the number who had died.

This chapter presents a description of childbearing pattern, age specific fertility rate, age at first birth, and reproductive behavior of adolescents.

## 3.2 The Phenomena of Childbearing Pattern

The most widely used measures of childbearing pattern are the total fertility rate (TFR) and its component age specific fertility rates (ASFRs). The TFR has declined dramatically from 6.3 children per women in 1971-1975 to 3.0 in 2001-2004, a decline of percent over a 25 years period (Figure 1.1) that represents the trends in TFR during 1971-2004 periods showed the pace of fertility decline. The pace of fertility decline in the most recent period compared to the exceptionally rapid decline during the late 1980s and early 1990s. The total fertility rate dropped almost imperceptibly from 3.3 for the period 1994-1996 to 3.3 in 1997-1999 and then remained 3.0 in 2001-2003 (see table 3.1).

**Table 3.1: Age-specific fertility rates (per 1,000 women) and total fertility rates (TFRs) among women age 15-49, selected sources, Bangladesh, 1975-2004**

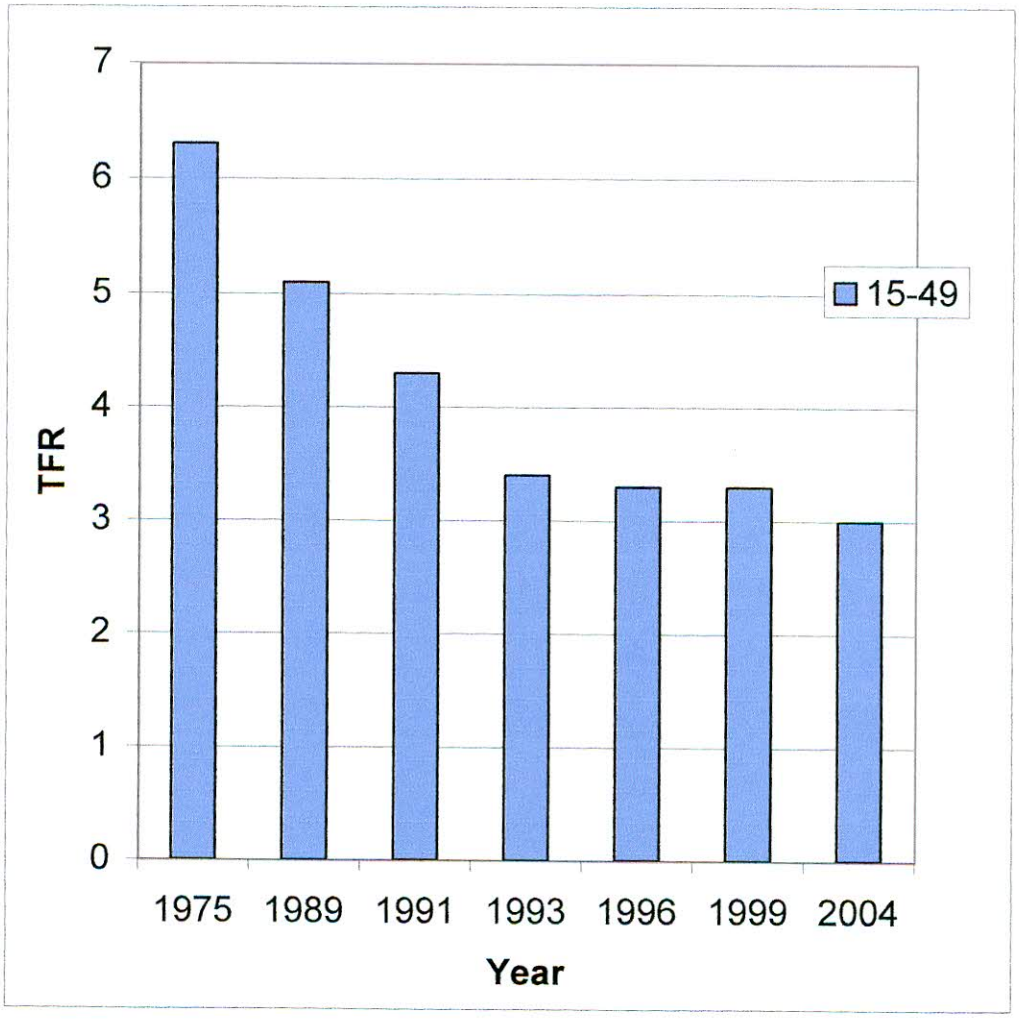
| Age group | Survey and approximate time period | | | | | | |
|---|---|---|---|---|---|---|---|
| | 1975 BFS 1971 - 1975 | 1989 BFS 1984-1988 | 1991 CPS 1989 - 1991 | 1993-1994 BDHS 1991-1993 | 1996-1997 BDHS 1994-1996 | 1999-2000 BDHS 1997-1999 | 2004 BDHS 2001-2003 |
| 15-19 | 109 | 182 | 179 | 140 | 147 | 144 | 135 |
| 20-24 | 289 | 260 | 230 | 196 | 192 | 188 | 192 |
| 25-29 | 291 | 225 | 188 | 158 | 150 | 165 | 135 |
| 30-34 | 250 | 169 | 129 | 105 | 96 | 99 | 83 |
| 35-39 | 185 | 114 | 78 | 56 | 44 | 44 | 41 |
| 40-44 | 107 | 56 | 36 | 19 | 18 | 18 | 16 |
| 45-49 | 35 | 18 | 13 | 14 | 6 | 3 | 3 |
| TFR | 6.3 | 5.1 | 4.3 | 3.4 | 3.3 | 3.3 | 3.0 |

Note: For the 1975 Bangladesh Fertility Survey (BFS) and 1989 BFS, the rates refer to the five-year period preceding the survey; for the other surveys, the rates refer to the three-year period preceding the survey. The BFS and Bangladesh Demographic and Health Survey (BDHS) utilized full birth histories, while the 1991 Contraceptive Prevalence Survey (CPS) used an eight-year truncated birth history.

Sources: 1975 BFS (MHPC, 1978: 73), 1989 BFS (Huq and Cleland, 1990: 103), 1991 CPS (Mitra et al., 1993: 34), 1993-1994 BDHS (Mitra et al., 1994: 24), 1996-1997 BDHS (Mitra et al., 1997: 30), and 1999-2000 BDHS (NIPORT et al., 2001: 34).

The age specific fertility rates (ASFRs) covering the age range of 15 to 50 years in quinquonnial age group from the year 1971 to 2003 from the basis of the analysis of the characteristic features of fertility of Bangladeshi women The graphical presentation of ASFRs showing the pattern as well as the level of fertility for some selected years is shown in Figure 3.1.1. The graph shows that the childbearing pattern of Bangladeshi women remains more or less same with a little exception in one or two cases but the level of reproductive performance has slower down (reduced) to a mark extent. However, prolong reproductive span still persists. Age specific fertility rates and the total fertility rates show decreasing trend in the level of childbearing pattern over time with some distortions noticed in ASFRs at young and middle ages of reproduction, i.e., the decline since the mid-1980s has been fairly uniform over all age groups of women except those age 25-29 (Figure 3.1.1).

**Figure 3.1.1: Trend in Total Fertility Rates (1971-2003)**



### 3.2.1 CEB from 1975-2004

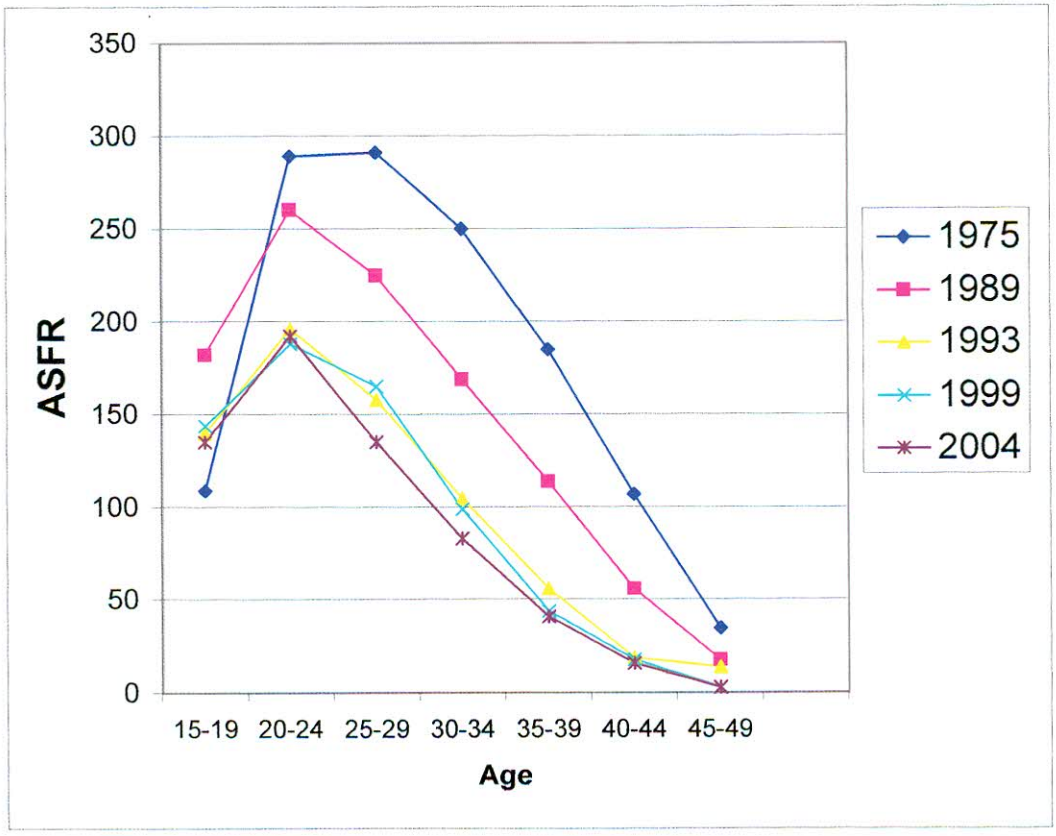
The life course fertility is also measure by children ever born (CEB) by mothers who had at least one live birth. It is a measure of cumulative cohort fertility. While cumulative current fertility measured from the age specific fertility rates reflects the current status of reproduction of women after certain age, the mean births per women or the mean number of children ever born measured the cumulative cohort fertility. Such mean number of births is provided in Table 3.2 by age groups for the ten different time points from 1975 to 2004. The data show a decreasing tendency of mean births per women over time at every age group with marked exception for teenagers where mean births per adolescent mother remain almost constant over the period under study. Between 1985 and 1989, the decline in mean number of children ever born was substantial in all but the youngest and oldest age groups. Although there was little change between 1989 and 1991, the rates against decline considerably between 1991 and 1993-1994, especially among women age 25 and above, and show further decline between 1993-1994 and 1999-2000 at all ages except 15-19 (Table 3.2).

**Table 3.2: Mean number of children ever born by age groups, selected sources, Bangladesh, 1975-2004**

| Age group | 1975 BFS | 1981 CPS | 1983 CPS | 1985 CPS | 1989 BFS | 1991 BDHS | 1993-1994 BDHS | 1996-1997 BDHS | 1999-2000 BDHS | 2004 BDHS |
|---|---|---|---|---|---|---|---|---|---|---|
| 15-19 | 0.6 | 0.5 | 0.6 | 0.4 | 0.4 | 0.4 | 0.3 | 0.4 | 0.4 | 0.4 |
| 20-24 | 2.3 | 2.0 | 2.2 | 2.0 | 1.7 | 1.7 | 1.6 | 1.5 | 1.4 | 1.4 |
| 25-29 | 4.2 | 3.7 | 3.8 | 3.6 | 3.1 | 3.2 | 2.9 | 2.8 | 2.6 | 2.6 |
| 30-34 | 5.7 | 5.4 | 5.5 | 5.1 | 4.7 | 4.5 | 4.1 | 3.9 | 3.6 | 3.4 |
| 35-39 | 6.7 | 6.4 | 6.5 | 6.5 | 5.9 | 5.7 | 5.2 | 5.8 | 4.3 | 4.1 |
| 40-44 | 7.1 | 7.3 | 7.4 | 7.4 | 6.6 | 6.7 | 6.4 | 5.6 | 5.1 | 4.7 |
| 45-49 | 6.7 | 7.6 | 7.5 | 7.2 | 7.3 | 7.4 | 6.9 | 6.4 | 6.1 | 5.6 |

Sources: 1975 Bangladesh Fertility Survey (BFS), 1983 and 1985 CPSs (Kantner and Frankenberg 1988:21); 1991 CPS (Mitra et al., 1993: 31); 1993-1994 BDHS (Mitra et al., 1994: 33); 1996-1997 BDHS (Mitra et al., 1997: 36); 1999-2000 BDHS (NIPORT ET AL., 2001: 39) all others (Cleland et al., 1994: 11).

**Figure 3.1.2: Age Specific Fertility rates (1971-2004)**



### 3.2.2 Distribution of women who had a child by specified ages

The proportion of all women in different age cohorts who had a child by a given age during childbearing period indicates a high incidence of very early childbearing in Bangladesh (Table 3.3). In most cases, the first birth occurs between ages 15 and 17; the median age at first births is 17-18 for all women aged 20 and older. There is an indication that the median age at first birth has increasing slightly from about 17 for older women to about 19 for women in their early twenties. This slight change to later age at first birth is reflected in the smaller proportion of younger women whose first birth occurred before age 15; about 18% of women in their forties report having had their first birth before age 15, compared with only 7% of women age 15-19.

**Table 3.3: Percent of women in different age cohorts who had a child by specified ages, Bangladesh 2004**

| Current Age | Had a child by age | | | | | | |
|---|---|---|---|---|---|---|---|
| | < 15 | 15-17 | 18-19 | 20-21 | 22-24 | 24+ | Median age at first birth |
| 15-19 | 6.5 | 20.3 | 3.0 | - | - | - | - |
| 20-24 | 10.1 | 33.5 | 17.7 | 8.3 | 3.0 | - | 18.7 |
| 25-29 | 10.1 | 37.6 | 18.7 | 12.4 | 9.4 | 3.2 | 18.2 |
| 30-34 | 11.3 | 39.1 | 21.4 | 12.3 | 8.0 | 4.6 | 18.0 |
| 35-39 | 11.1 | 38.1 | 20.6 | 12.1 | 9.0 | 6.5 | 18.1 |
| 40-44 | 16.6 | 41.9 | 17.6 | 8.3 | 8.1 | 5.2 | 17.2 |
| 45-49 | 17.8 | 48.3 | 16.7 | 7.1 | 5.1 | 3.2 | 16.9 |

Sources: 2004 BDHS.

Table 3.4 shows the percentage distribution of non-first births that occurred in the years before the 2004 BDHS by the number of months since the previous birth. The results indicate that adolescent mothers (less than 20) have, on average, shorter birth intervals than their adults' counterparts. Nearly one in six children (16%) are born a "too short" interval (less than 24 months). More than half (57%) of non-first births occur three or more years after the previous birth, while 26 percent of births take place 24-35 months after the previous birth. The median birth interval is 39 months. This is slightly longer than the median birth interval of 35 months reported in the 1993-1994 BDHS survey and 37

months in the 1996-1997 BDHS survey (Mitra et al., 1993: 34; Mitra et al., 1997: 38). As accepted, younger women have shorter birth intervals than older women presumably because they are more fecund and want to build their families. The median birth interval for women having parity 2-3 is 40 months compared with 37 months for women having 7 or more parity. Married adolescents may have higher fertility desire and a lower contraceptive use rate.

**Table 3.4: Percentage Distribution of subsequent births (non-first births) in the five years preceding the survey by number of months since previous birth, according to parity of mothers, BDHS- 2004**

| Number of months since previous birth | Parity of Mother | | | Total |
|---|---|---|---|---|
| | 2-3 | 4-6 | 7+ | |
| 7-17 | 6.0 | 6.9 | 8.1 | 6.5 |
| 18-23 | 9.4 | 10.2 | 12.8 | 9.9 |
| 24-35 | 24.6 | 26.9 | 27.4 | 25.5 |
| 36-47 | 21.9 | 20.7 | 19.6 | 21.4 |
| 48+ | 38.0 | 35.3 | 32.0 | 36.7 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 |
| Median number of months | 40.3 | 38.5 | 36.7 | 39.3 |

Table 3.5 shows the percent distribution of non-first births that occurred in the five years before the 2004 BDHS by the number of months since the previous birth. The results indicate that adolescent mothers (less than 20) have, on average, shorter birth intervals than their adults' counterparts. Nearly one in six children (16%) are born a "too short" interval (less than 24 months). More than half (57%) of non-first births occur three or more years after the previous birth, while 26 percent of births take place 24-35 months after the previous birth. The median birth interval is 39 months. As expected, younger women have shorter birth intervals than older women, presumably because they are more fecund and want to build their families. The median birth interval for women age 15-19 is 26 months, compared with 52 months for women over age 40. The median birth interval is slightly shorter if the previous child was a girl than if it was a boy. Birth intervals are much shorter if the previous child died (28 months) than if the previous child survived (40 months). In part, this reflects the shortening of postpartum amenorrhea that occurs when the preceding child dies in infancy and breastfeeding stops prematurely. Women are also less likely if the previous child died and they want to replace the dead chidden. There is a tendency for birth intervals to increase with education. Mothers with some secondary education have a median birth interval that is six months longer than the interval for uneducated mothers.

**Table 3.5: Percentage Distribution of subsequent births (non-first births) in the five years preceding the survey by number of months since previous birth, according to age of mothers, BDHS- 2004**

| Number of months since previous birth | Age of Mother | | | | Total |
|---|---|---|---|---|---|
| | 15-19 | 20-29 | 30-39 | 40+ | |
| 7-17 | 14.5 | 6.9 | 4.6 | 4.0 | 6.5 |
| 18-23 | 20.0 | 10.1 | 8.4 | 8.1 | 9.9 |
| 24-35 | 40.6 | 27.4 | 20.7 | 17.7 | 25.5 |
| 36-47 | 21.0 | 23.1 | 18.9 | 14.1 | 21.4 |
| 48+ | 3.9 | 32.5 | 47.4 | 56.1 | 36.7 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| Median number of months | 26.3 | 37.8 | 46.0 | 52.2 | 39.3 |

Table 3.6 presents the percentage distribution of all women and currently married women aged 15-49 by number of children ever born. Among the currently married women, 17.6 percent had one child and 21 percent had two children. The corresponding figures for all women are 14.7 and 17.3 percent, respectively. The proportion decreases with the number of children ever born. The mean number of children ever born to currently married women is 2.59, while it is 2.15 for all women aged 15-49.

It has been observed that only 9.7 percent of the currently married women did not have any child at the time of survey. This may be due to the fact that most of them were newly married, and or had short exposure to childbearing. Some of them were pregnant and some were using contraception. To some extent, women sub-fecundity, rather than infertility, may be responsible for not having any child during adolescence. The percentage of women in their forties who have never had children provides an indicator of the level of primary infertility the proportion of women who are unable to bear children at all. Since voluntary childlessness is rare in Bangladesh, it is likely that married women with no births are unable to bear children.

**Table 3.6: Percentage distribution of all women and currently married women ages 15-49 by number of children ever born (CEB) and mean number of children ever born, BDHS-2004**

| Children ever born | All women | Currently married women |
|---|---|---|
| 0 | 25.0 | 9.7 |
| 1 | 14.7 | 17.6 |
| 2 | 17.3 | 21.0 |
| 3 | 14.3 | 17.3 |
| 4 | 10.8 | 12.9 |
| 5 | 6.8 | 8.3 |
| 6 | 4.5 | 5.3 |
| 7 | 3.0 | 3.5 |
| 8 | 1.8 | 2.1 |
| 9 | 1.0 | 1.2 |
| 10+ | 0.9 | 1.1 |
| Mean number of children ever born | 2.15 | 2.59 |

### 3.2.3 Distribution of Teenage Women (by current age and birth interval)

In the analysis of early childbearing in Bangladesh, we consider the ever-married women of the age less than or equal to twenty years. Total surveyed population was 11440, and the study (≤20) population is 1703.

**Table 3.7: Distribution of Teenage Women by Current Age and Birth interval**

| Current Age (≤20 years) | Birth Interval | | Total |
|---|---|---|---|
| | <24 months | 24+ months | |
| <15 | 137 | 3 | 140 |
| 15 | 129 | 73 | 202 |
| 16 | 155 | 118 | 273 |
| 17 | 136 | 215 | 251 |
| 18 | 105 | 240 | 345 |
| 19 | 84 | 308 | 392 |
| Total | 746 | 957 | 1703 |

The number of women of age ≤ 20 years by their birth interval is presented in Table 3.7. From Table 3.7, we observed that the number of women whose age <15 with her <24 months birth interval is 137 and 24+ months birth interval is only 3. Again the women of ages 15, 16, 17, 18, 19, 20 years with less than 24 months birth interval are 129, 155, 136, 105, 84 and 24+ months birth interval are 73, 118, 215, 240, 308

respectively. Here it is observed that the number of women of the birth interval of less than 24 months is higher for <15, 15 and 16 years age of women than those have the birth interval above 24 months. Again it is observed that for the age of 17 to 19 years, the number of women is higher for 24+ months than <24 months birth interval. This indicates that younger women were shorter birth intervals then older women, this may be due to want to build their family as well as younger women are more fecund then older women.

### 3.2.4 Distribution of Teenage Women (by current age and birth interval)

We construct the another table for the distribution of teenage women where birth intervals was taken by <10, 10-14, 15-19, 20-24, 24+ months by current age of less than or equal to twenty.

**Table 3.8: Current age of women (≤20 years) by Birth intervals**

| Current Age (≤20) | Birth Interval (months) | | | | | Total |
|---|---|---|---|---|---|---|
| | <10 | 10-14 | 15-19 | 20-24 | 25+ | |
| <15 | 95 | 42 | - | | 3 | 140 |
| 15 | 77 | 52 | - | 39 | 34 | 202 |
| 16 | 83 | 69 | 3 | 37 | 81 | 273 |
| 17 | 55 | 74 | 7 | 65 | 150 | 351 |
| 18 | 54 | 43 | 5 | 55 | 188 | 345 |
| 19 | 32 | 40 | 10 | 46 | 264 | 392 |
| Total | 396 | 320 | 25 | 242 | 720 | 1703 |

The number of women of age ≤ 20 years by their birth interval is presented in Table 3.8. From Table 3.8, we observed that the number of women with <10 months birth interval is 396, 10-14 months birth interval is 320, 15-19 months birth interval is only 25, 20-24 months birth interval is 242 and 25+ months birth interval is 720. Again the number of women with current age <15 years is 140, 15 years is 202 and current ages 16, 17, 18, and 19 are 273, 351, 345 and 392 respectively.

# *CHAPTER FOUR*

# DETERMINANTS OF EARLY CHILDBEARING

CHAPTER OUTLINE

# *CHAPTER FOUR*

# DETERMINANTS OF EARLY CHILDBEARING

## 4.1 Introduction

Before proceeding towards detail analysis of early childbearing patterns and their associated factors, it is felt necessary to investigate the background characteristics of the women under study. BDHS 2004 collected information on various aspects of socio-economic, demographic and cultural characteristics of the women. It is well known that women with different socio-economic, cultural and demographic status have different childbearing pattern. A few of them are education of women and of their husbands, women's working status, occupation of husbands, religion, place of residence, current age, age at first marriage, duration of marriage and total children ever born. From numerous studies it is quite evident that early childbearing performance varies greatly with differences in religion (such as Muslim and non-Muslim), residential status (such as rural and urban), working status (such as working and not working) etc. It is well known that all these aforesaid characteristics affect the early childbearing performance of women directly.

## 4.2 Variables Included in the Analysis

In the 2004 BDHS, a number of demographic, socio-economic and cultural variables are available. Among them, nine variables are taken into consideration to compute discrimination the early childbearing of variables considered the socio-economic variables are respondent's education, women work status, while the demographic variables regarded in this study are age of women, age at first marriage, marital duration and total children ever born and cultural variables are religion and place of residence. Classifications of each variable are made in the following way:

**Table 4.1: Classification of Variables**

| Variable | Category | |
|---|---|---|
| Current age of women | Less than 16 years | 16 or more |
| Age at first marriage | Less than 16 years | 16 or more |
| Marital duration | 0-4 years | 5-9 years |
| Total children ever born | Less than 2 | 2 or more |
| Mother's education | No education | Primary or more |
| Father's education | No education | Primary or more |
| Women work status | Never working | Ever working |
| Religion | Muslim | Non-Muslim |
| Place of residence | Urban | Rural |
| Contraceptive use | Ever use | Never use |
| Occupation of husband | Employed | Unemployed |

Percent distribution of women according to the variables under study with their classifications is shown in Table 4.2. It is well recognized that women with different demographic, socio-economic and cultural status have different early childbearing patterns. It is observed from the table that early childbearing performance varies greatly by the demographic, socio-economic and cultural variables:

**Table 4.2: Percent distribution of women possessing different background characteristics of the study population, BDHS-2004**

| Background characteristics | N | % |
|---|---|---|
| Age of women | | |
| Less than 16 years | 1088 | 63.9 |
| 16 or more | 615 | 36.1 |
| Total | 1703 | 100 |
| Age at first marriage | | |
| Less than 16 years | 1503 | 88.3 |
| 16 or more | 200 | 11.7 |
| Total | 1703 | 100 |
| Marital duration | | |
| 0-4 years | 1477 | 86.7 |
| 4-5 years | 225 | 13.2 |
| Total | 1703 | 100 |
| Children ever born | | |
| Less than 2 | 1689 | 99.2 |

| | | |
|---|---|---|
| 2 or more | 14 | .8 |
| Total | 1703 | 100 |
| Mother's education | | |
| No education | 249 | 14.6 |
| Primary or more | 1454 | 85.4 |
| Total | 1703 | 100 |
| Father's education | | |
| No education | 479 | 28.1 |
| Primary or more | 1224 | 71.9 |
| Total | 1703 | 100 |
| Women work status | | |
| Never working | 1541 | 90.5 |
| Ever working | 162 | 9.5 |
| Total | 1703 | 100 |
| Religion | | |
| Muslim | 131 | 92.3 |
| Others | 1572 | 7.7 |
| Total | 1703 | 100 |
| Place of residence | | |
| Urban | 1205 | 29.2 |
| Rural | 498 | 70.8 |
| Total | 1703 | 100 |

| | | |
|---|---|---|
| Contraceptive use | | |
| Ever use | 585 | 34.4 |
| Never use | 1118 | 65.6 |
| Total | 1703 | 100 |
| Occupation of husband | | |
| Manual | 1035 | 61.8 |
| Non-manual | 668 | 39.2 |
| Total | 1703 | 100 |

### 4.2.1 Demographic Variables

It is well known that women with different demographic status have different childbearing patterns. From numerous studies, it is quite evident that early childbearing performance varies greatly with differences in current age, age at first marriage, duration of marriage and so on.

#### Current Age of Women

It is a common belief that low age of women is inversely related to fertility. While early age of women has been conducive to high fertility (Osborn, 1958), large age is argued to have a fertility-reducing effect (Coale, 1975). In the survey to assess the respondent's age, they were asked two questions in the individual interview: "In what year and what month were you born? and "How old were you at your first birthday?" When respondents did not know their age or date of birth, interviewers recorded their best estimate of the respondent's age.

From the table 4.2 we observed that the respondent women of age less than 16 years are 63.9 percent and the remaining 36.1 percent respondent ages are 16 or more years.

**Age at First Marriage**

It is a common belief that age at first marriage is inversely related to fertility. While early marriage of women has been conducive to high fertility (Osborn, 1958), late marriage is argued to have a fertility-reducing effect (Coale, 1975). Delayed marriage (other things being equal) shortens the period between generations and hence puts an independent brake on long range population growth (Davies and Blake, 1956). In Mysore, it has been shown that a rise in the age at marriage of women from under 15 years to 16-18 years has produced an appreciable decline in fertility (UN, 1961). Agarwala (1967) estimated that an increase in average age at marriage from the existing 15.6 years to 19 or 20 would lead to decline of birth rate by 29% in India. The potential impact of age at first marriage is especially high in countries were there is little voluntary control of fertility (Yaukey and Thorsen, 1972).

Table 4.2 provides data relating to age at first marriage. About 88.3 percent of women are married when they were of age less than 16 years and the rest 11.7 percent of women are married when they were aged 16 or more years.

**Marital Duration**

Marital duration is another important variable. Time between current age and age at marriage is marital duration. It may have a strong positive relationship with birth intervals. In the present study the variable is categorized in to 0-4, 5-9, 10-14, 15-19, 20-24, 25-29 and above 30 years.

Table 4.2 also provides that about 86.7 percent of married women have duration of marriage below 4 years and 13.2 percent having 4 or more.

**Total children ever born**

How many live births are produced by a women in her reproductive age or at the date of interviewed is the number of total children ever born.

From the table 4.2 we observed that the 99.2 percent women has less than 2 children and the rest 0.8 percent women has 2 or more children.

### 4.2.2 Socio-economic Variables

It is well known that women with different socio-economic status have different childbearing patterns. From numerous studies, it is quite evident that early childbearing performance varies greatly with differences in mother's education, father's education and women work status and so on.

**Mother's education**

Education is one of the key determinants of life style for improving the status of women (Widayatum 1991; DHS, 1996-97). In almost all countries, women's education is strongly related to their domestic economic power. Female education has a very significant effect on fertility as well as early childbearing. Education is the factor, which regulates the income, occupation, family status, Sex preference, knowledge and practice of contraception.

Table 4.2 shows that 14.6 percent of women have no education and the rest 85.4 percent had primary or higher education.

**Father's education**

Father's education is very important factor in socio-economic analysis. Father's education mainly related to income of family and family status. This variable included in the analysis is categorizing into no education and primary or more.

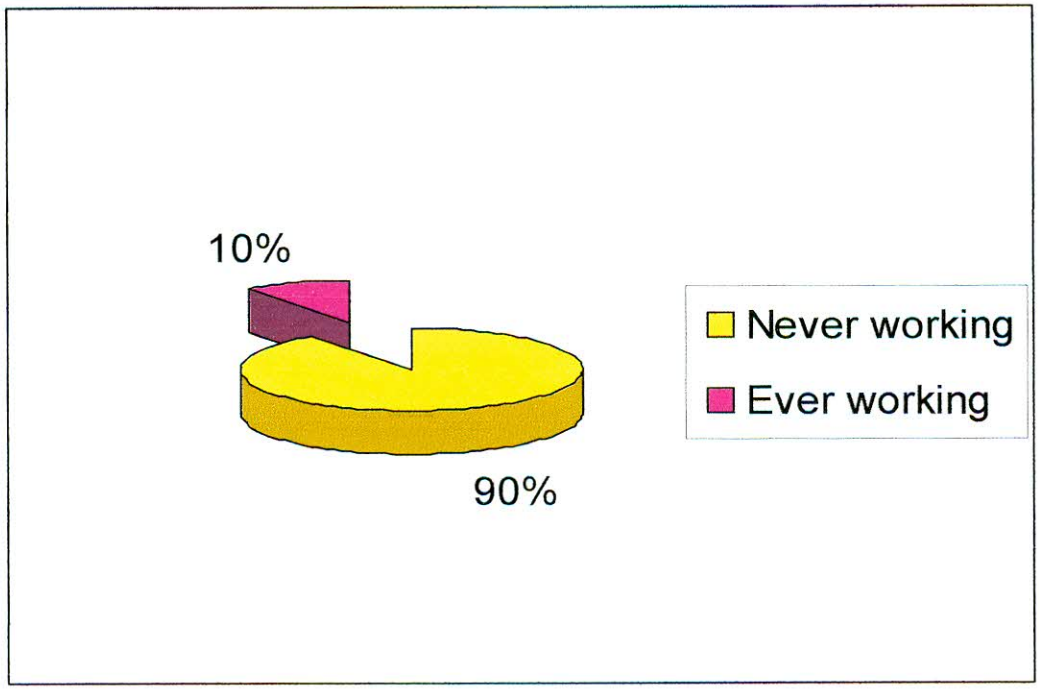
Table 4.2 provides data relating to education of husbands of rural women. From the table, it appears that about 28.1 percent of husbands have no education and the rest 71.9 percent of husbands had primary or higher education.

**Women work status**

Women work status may have a significant effect on the early childbearing. Here we considered that the early childbearing may vary from working mother to non-working mother. It is a dichotomous variable categorized into working and not working.

From the table 4.2, it appears that the majority of women (90.5 percent) are currently not working. Only 9.5 percent of women are working out side of home.

**Figure: 4.1.1 Percent distribution of women work status**



**Husband's occupation**

In developing countries like Bangladesh, the husband's occupation is closely related to the social status of the women. It is expected that wives whose husbands have professional, administrative and technical jobs would have higher age at marriage

From the table 4.2, it is observed that 39.2 percent of husbands are engaged in non-manual occupation and majority of the husband is engaged in the (61.8 percent) manual occupation.

### 4.2.3 Cultural Variables

It is well known that women with different cultural status have different childbearing patterns. From numerous studies, it is quite evident that early childbearing performance varies greatly with differences in religion and place of residence and so on.

**Religion**

Religion is certainly a significant explanatory variable. Most studies indicate that Muslims often have higher fertility than non-Muslims. Islam is the dominant religion in Bangladesh. Majority persons of this country are Muslims.

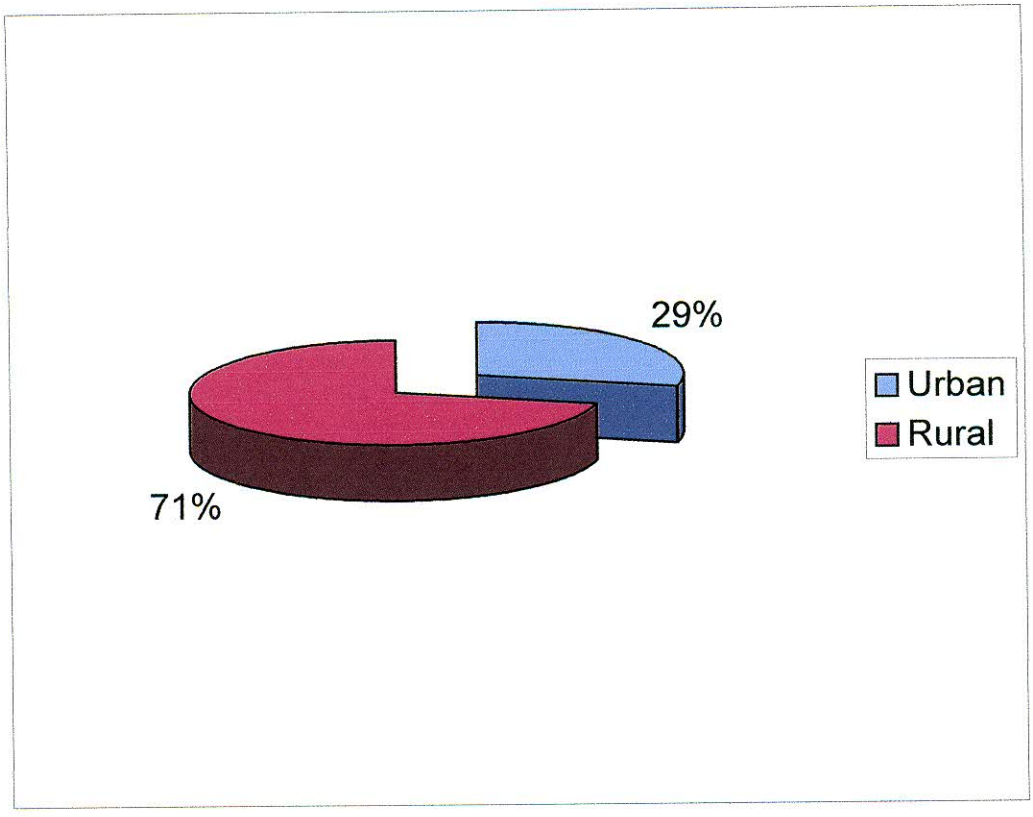
From the religious status, it appears that 92.3 percent of the respondents are Muslim and only 7.7 percent are non-Muslim. A vast majority of the respondents are Muslim. Rob (1988) found that Islam is opposed to birth control and that Muslim religious leaders are against family planning.

**Residence of women**

The variable residence of women has an important impact on the length of birth interval. This variable has been categorized as 'urban and rural' types depending on whether the respondent belongs to the urban or rural area of the country.

Data of urban-rural residence for Bangladesh are presented in Table 4.2. It is observed that only 29.2 percent of the respondents live in urban areas against 70.8 percent of women in rural areas. In our study, it is observed that majority of the women live in rural areas.

**Figure: 4.1.2 Percent distribution of place of residence**

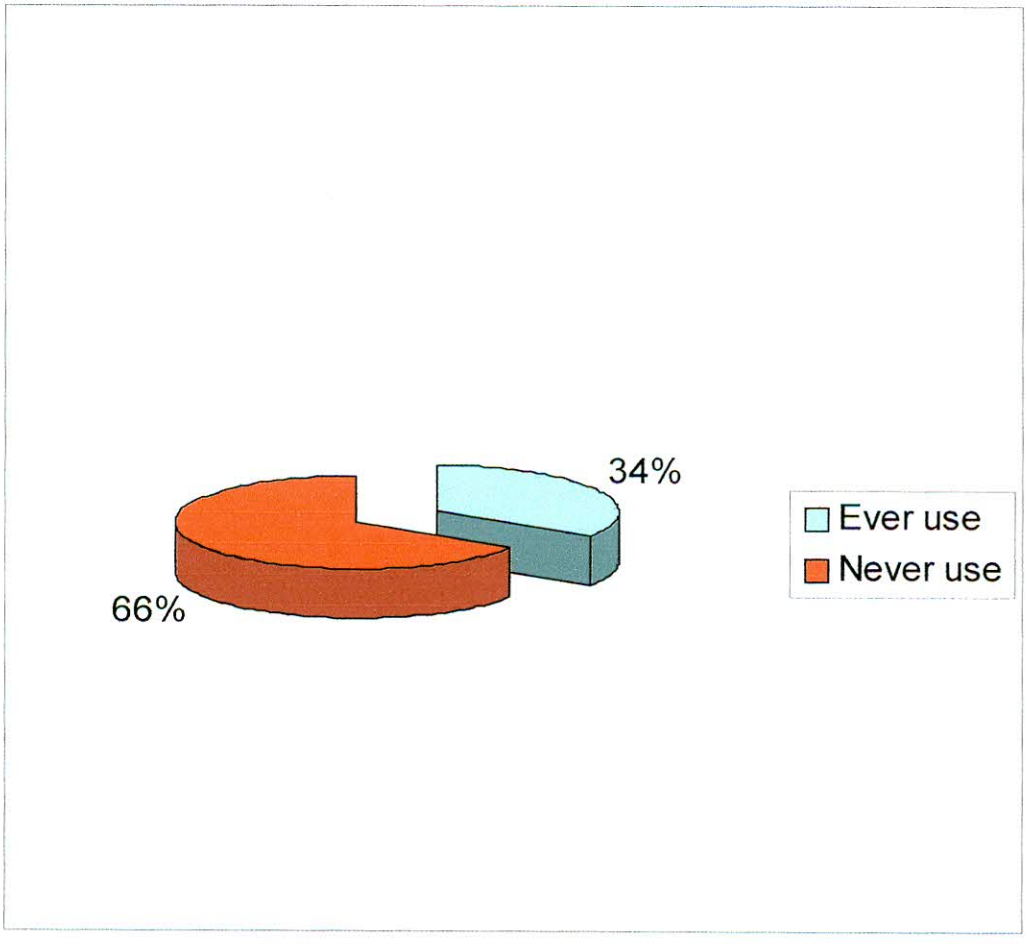



**Contraceptive use**

Family planning can effectively reduce maternal and infant mortality rates by decreasing the early pregnancies. Social and economic development as well as more widely diffused family planning services will contribute to a higher level of contraceptive use.

From Table 4.2 we observed that only 34.4 percent of women are currently using contraception and remaining 65.6 percent of women are not using family planning methods.

**Figure: 4.1.3 Percent distribution of contraceptive use**



# *CHAPTER FIVE*

# MULTIVARIATE ANALYSIS OF EARLY CHILBEARING

CHAPTER OUTLINE

# *CHAPTER FIVE*

# MULTIVARIATE ANALYSIS OF EARLY CHILDBEARING

## 5.1 Introduction

The early childbearing patterns are observed to vary with varying levels of socio-economic, demographic and cultural variables as can be found in chapter four. Now, can we assess the early childbearing performance? Also we isolate the factors that significantly affect the early childbearing. To identify the association between the selected variables and early childbearing concerned with age, chi-square test was performed. However, in such analysis, it is difficult to identify the relative impact of the explanatory variables on the dependent variable. Hence, in this chapter, the multivariate technique is employed to isolate the impact of selected socio-economic, demographic and cultural variables that affect early childbearing. For this purpose, discriminant analysis is used to discriminate the early childbearing patterns in the context of age.

Again in order to identify the factors that influence the early childbearing, a well known logistic regression analysis also has been employed in this chapter. The methods has been discussed in the following section. Table 5.1 gives a detailed description of the variables.

**Table 5.1 Variables considered for Analysis (Codes & Categories)**

| Characteristics | Variable Level | Codes and Categories |
|---|---|---|
| Current age of women | $X_1$ | 0 = Less than 16 years<br>1 = 16 or more |
| Age at first marriage | $X_2$ | 0 = Less than 16 years<br>1 = 16 or more |
| Duration of marriage | $X_3$ | 0 = 0-4 years<br>1 = 5-9 years |
| Total children ever born | $X_4$ | 0 = Less than 2<br>1 = 2 or more |
| Mother's education | $X_5$ | 0 = No education<br>1 = Primary or more |
| Father's education | $X_6$ | 0 = No education<br>1 = Primary or more |
| Women work status | $X_7$ | 0 = Never working<br>1 = Ever working |
| Religion | $X_8$ | 0 = Non-Muslim<br>1 = Muslim |
| Place of residence | $X_9$ | 0 = Rural<br>1 = Urban |
| Contraceptive use | $X_{10}$ | 0 = Never use<br>1 = Ever use |
| Occupation of husband | $X_{11}$ | 0 = Unemployed<br>1 = Employed |

## 5.2 Methods of Analysis

### 5.2.1 Discriminant Analysis

Discriminant analysis is a statistical technique used to distinguish between two or more groups or cases. Discriminant analysis seems to be originated from the study of inter group distance. The idea of inter group distance index has been presented extensively by G. M. Morant in the 1920s and by P. C. Mahalanobis in 1930s. The multivariate inter group distance has been developed by R. A. Fisher in the 1930s to discriminate between-groups. The discrimination has been done by linear composites where each composite is linear combination of variables.

There are two major objectives in separation of groups: (i) Description of group separation, in which linear functions (Discriminant functions) of the variables are used to describe or elucidate the differences between two or more groups. The goals of discriminant analysis include identifying the relative contribution of variables to separation of the groups and finding the optimal plane on which the points can be projected to best illustrate the configuration of the groups. (ii) Prediction or allocation, in which linear or quadratic functions (classification functions) of the variables are employed to assign an individual sampling unit to one of the groups.

To study the differences among groups linear combinations of predictor variables are formed. These linear combinations are used to identify the class of an object. Therefore, discriminant analysis helps us

to identify a class for an object by some apriori information. Sir R. A. Fisher has proposed first this statistical tool to classify the objects into mutually exclusive and exhaustive groups. But the analysis starts with the objects when their groups are known in advance. The purpose of the analysis is either to describe group differences or to predict group membership on the basis of response variable measures.

The predict or identification of group membership is done on the basis of one or more predictor or explanatory variables along with one criterion variable. The explanatory variable is catagorical in nature and measured in nominal scale. Sometimes it is dichotomous and sometimes it is polytomous. The discriminant analysis with polytomous categorical criterion is sometimes known as predictive discriminant analysis and prediction is done by a linear combination of predictors. There are as many linear combinations as there are groups and the prediction rule enables to determine the group with which an object is identified. The group membership should be predicted accurately as per as possible.

The characteristics used to distinguish the high-risk and low-risk childbearing are called "discriminant variables". These variables must be measured at the interval or ratio level of measurement, so that means and variances can be legitimately employed in mathematical equations. In general, there is no limit on the number of discriminating variables as long as the total number of cases exceeds the number of variables by more than two. There are, however, some limits on the statistical properties, which the discriminating variables are allowed to have. For

one thing, no variable may be a linear combination of other discriminating variables. Another is two variables which are perfectly correlated cannot be used at the same time in the analysis.

### 5.2.1(a) Scope of Discriminant Analysis

The objective of discriminant analysis is to classify the sample objects into two or more groups. This is done with the help of linear combination of predictor or explanatory variables. The basic principle to determine the group with which an object is identified is that the misclassification error of that object is minimum. Under this assumption the between-group variance will be approximately zero if the error in classification is less or the classification is exact. The increase in error of classification leads to increase the amount of variance of any variable and the ratio of within-group sum of squares to total sum of squares will be maximum. This ratio is measured by Wilk's Lambda.

If the group means of different groups are equal. A will be 1. this implies that within-group variance and total variance are equal and the error in classification is more. Again, A = 0 implies that between-group variance and total variance are equal and error in classification is less. In such a situation the discriminant analysis provides a linear combination of explanatory variables so that it discriminates between pre-identified groups with less error. This linear combination can be represented by

$$D = b'X$$

where $D$ is the discriminant score of order $(1 \times n)$.

$b$ is a $(p \times 1)$-vector of discriminant weight and

$X$ is the $(n \times p)$ data matrix.

In two groups of discriminant problem the sample objects are classified with the help of a binary or indicator variable with values zero or one. One group of objects are identified by zero value of binary variable and another group of objects are identified by the value one of binary variable. Now, corresponding to this binary variable the discriminant score $D = b'X$ is calculated using the data matrix X. This calculated discriminant score looks like the fitted multiple regression line when the binary variable is considered as dependent one. In such a situation

$Y = b'X$ is the linear probability model where $Y$ is the binary variable and $X$ is the matrix of explanatory variables.

### 5.2.1(b) Assumption Underlying Discriminant Analysis

It has already been mentioned that the objective of the discriminant analysis is to classify the sample objects accurately on the basis of a linear combination of predictor variables. The optimality of classification depends on the assumptions of data. The assumptions are:

(i) the predictor variables follow multivariate normal distribution,

(ii) the covariate matrices of different groups of data are homogeneous.

### 5.2.1(c) Form of Discriminant analysis

To distinguish between the high-risk and low-risk of early childbearing, the following mathematical form is used:

$$f_{km} = u_0 + u_1 X_{1km} + u_2 X_{2km} + u_3 X_{3km} + \ldots\ldots\ldots + u_p X_{pkm} \quad \text{--------- (i)}$$

Where, $f_{km}$ = the value (score) on the canonical discriminant function for case m in the group k.

$X_{ikm}$ = the value on discriminant variable $X_i$ for case m in group k; and

$X_{ik.}$ = mean value of variable i for those cases in group k.

$X_{i..}$ = mean value of variable i for all cases (grand or total mean)

$u_i$ = coefficients which produce the desired characteristics in the function.

Using pooled within group's correlation matrix, correlation between independents is not perfect correlation. It is obvious, one or more of the variables may be poor discriminators, because the group means are not very different on those variables. It may happen that some of the variables have no significant contribution on early childbearing. A forward stepwise procedure has been considered to select the individual variable, which provides the greatest univariate discrimination of early childbearing.

Stepwise procedures must employ some measures of discrimination as the criterion for selection. In this analysis, we used Maximize-minimum Mahalanobis (1963) distance (D square) between the pairs of groups' centroids. Minimum tolerance value has been considered 0.001. Maximum significance of F to enter has been considered 0.05 to continue stepwise procedure of Mahalanobis distance D-square. F to remove is also a partial multivariate F statistic, but it tests the significance of the decrease in discrimination when that variable is removed from the list of variables already selected. Minimum significance of F to remove has been considered as 0.1. in stepwise method. Maximum significance of Wilk's Lambda has been considered as 1.00 and prior probability of each group is 0.5. Finally, to test the significance of high-risk and low-risk childbearing, we used the Statistical Package for Social Science (SPSS).

Another way to judge the substantive of a discriminate function is by examining the canonical correlation. This correlation is a measure of association which summaries the degree of relatedness early childbearing and the discriminate function. A value of zero denotes no relationship at all, but larger numbers (always-positive) represent increasing degree of association with 1 being the maximum. The value of overall $\chi^2$ indicates that ultimately discriminatory variables of early childbearing are significant. Using stepwise procedure coefficients of Fisher's linear discriminating variables for early childbearing are found.

When Fisher's approach is used, it turns out that it may be possible to determine several linear combinations for early childbearing.

### 5.2.2 Logistic Regression Analysis

The linear discriminate analysis classifies an individual into one of two populations. Risk factors can be identified as independent variables that provide maximal discriminatory power. However, this technique is based on the assumption that the independent variables are normally distributed with equal variances. In most practical situation, some of the variables are qualitative or measured in nominal or ordinal scales and often the assumption of normality is violated. A practical method that does not require any assumption is Cox's (1970) linear logistic regression analytical method. This method required far fewer assumptions than discriminate analytical method and is more flexible since the distribution of the predictor variables do not have to be normally distributed, linearly related or of equal variance within each group. Logistic regression analysis especially useful when the distribution of the responses on the dependent variable is expected to be non-linear with one or more of the independent variables.

Suppose that there in individual, some of them are called "success" and others are "failure". Let $y_i$ denote the dependent variable for i-th observation and $Y_i = 1$ if the i-th individual as a success and $Y_i = 0$ if the i-th individual is a failure. Consider a collection of p independent variables which will be denoted by the vector $X' = (x_1, x_2, x_3, \ldots x_n)$

and the vector of the coefficients of X is $\beta' = (\beta_1, \beta_2, \beta_3, \ldots\ldots\beta_p)$. These variables are either qualitative, such as religious, service, family type, and residence or quantitative, such as age, income, age at marriage etc. For the moment we will assume that each of these variables is at least interval scaled. Let the conditional probability that the outcome is present be denoted by $(Y_i = 1/X_{i1}, X_{i2}, X_{i3}, \ldots\ldots X_{ip}) = P_i$. Then the logit of the multiple logistic regression models is given by the equation

$$g(X) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots\ldots\ldots\ldots \beta_p X_p \quad \text{---------- (i)}$$

In which case

$$P_i = \frac{e^{g(x)}}{1+e^{g(x)}} \quad \text{---------- (ii)}$$

$$\text{And } 1 - P_i = \Pr(Y_1 = 0 / X_{i1}, X_{i2}, X_{i3}, \ldots\ldots X_{ip}) = \frac{e^{g(x)}}{1+e^{g(x)}} \quad \text{----- (iii)}$$

Equations (ii) and (iii) look complicated, however, the logarithm of the ratio of $P_i$ and $1 - P_i$ is a simple linear function of $X_{ij}$.

$$\text{Let } \lambda_i = \log_e \frac{\pi(Y)}{1-\pi(Y)} = \beta' X \quad \text{---------- (iv)}$$

Which express the log odds of occurrence on an event (i.e. independent variable) as a linear function of the independent variables.

The logit is thus the logarithm of the odds of success, that is, the logarithm of the ratio of the probability of success to the probability of failure. It is also called the logit transformation of $P_i$ and equation (iv) is linear logistic model. It has several nice properties; $P_i$ is bounded only between 0 and 1. If $\pi(Y) < 0.5$, logit $P_i$ is negative; while if $P_i > 0.5$, logit $P_i$ is positive.

In logistic regression, the parameters of the modes are estimated by maximum likelihood method. That is, the coefficient that makes our observed results most "likely" is selected. The contribution of individual variables in logistic regression dependent on the other individual variables and the interpretation is difficult when are highly correlated. In logistic regression, just as linear regression, the codes for the independent variables must be meaningful. We must decode the values of the independent variables by creating a new set of variables that correspond, in someway, the original categories.

When we have a variance with more than two categories, we must create a new variable to represent the categories. The number of new variables required to represent a categorical variables is one less than the number of categories. For example, if instead of the actual values for education of the respondents, we had values of 0, 1 depending on whether the value was 'no education', and 'some education'. The value "no education" would be represented by codes of 0 and it is called reference category. If we use indicator variable for coding, the

coefficient for the new variables represent the effect of each category compared to a reference category. The coefficient for 'some education' is the change in log odds when the lower primary compared to no education. The coefficients for no education is necessarily zero, since it does not differ from itself. The logistic regression procedure will automatically create new variables for categorical variables.

### 5.2.2(a) Estimation Technique

The most common method used to estimate unknown parameters in linear regression is least squares. Under usual assumptions, least squares estimators have some desirable properties. But when least squares method is applied to estimate a model with dichotomous outcome the estimators no longer have these same properties. In such situations, the general method for estimating the parameters of logistic regression models is the method of maximum likelihood.

In logistic regression, the likelihood equation is non-linear and explicit function of unknown parameters. Therefore, we use a very effective and well-known iterative method, Newton-Raphson method.

Now, let us consider a single regression model as

$Y_i = \beta_0 + \beta_1 X_i + \varepsilon_i$ ; (i = 1, 2, ....., n.) -- -- -- -- -- - (i)

Where $Y_i$ is a dichotomous variable, it takes two values 0 and 1.

So, $Y_i$ is a Bernoulli random variable. So, the p.d.f. of $Y_i$ is given by

$$f_i(Y_i) = p_i^{Y_i}(1-p_i)^{1-Y_i} \quad ; \quad (Y_i = 0 \text{ or } 1) \quad \text{- - ------- (ii)}$$

$$i = 1, 2, \ldots\ldots, n$$

Where $p_i$ is a probability that define as

$$p_i = \frac{e^{\beta_0+\beta_1 x}}{1+e^{\beta_0+\beta_1 x}}$$

$$\therefore \frac{p_i}{1-p_i} = e^{\beta_0+\beta_1 X} \quad -- \quad -- \quad -- \quad \text{(iii)}$$

Implies, $\log_e\left(\frac{p_i}{1-p_j}\right) = \log_e\left(e^{\beta_0+\beta_1 X}\right)$

Since those are assumed to be independent, the joint probability density function is

$$g(Y_1, Y_2, \ldots\ldots, Y_n) = \prod_{i=1}^{n} f_i(Yi)$$

$$= \prod_{i=1}^{n} p_i^{Y_i}(1-p_i)^{1-Y_i} \quad -- \quad -- \quad -- \quad \text{(iv)}$$

Since the logarithm is a monotonic function, so, taking logarithm on (iv), we get

$$\log_e [\ g(Y_1, Y_2, \ldots\ldots, Y_n)\ ] = \log_e \left( \prod_{i=1}^{n} p_i^{Y_i}(1-p_i)^{1-Y_i} \right)$$

$$= \sum_{i=1}^{n}[Yi \log_e p_i + (1-Y_i)\log_e(1-p_i)]$$

$$\log_e [\ g(Y_1, Y_2, \ldots\ldots, Y_n)\ ] = \sum[Y_i\{\log_e p_i - \log_e(1-p_i)\} + \log_e(1-p_i)]$$

$$= \sum_{i=1}^{n}\left[Y_i \log\left(\frac{p_i}{1-p_i}\right) + \log(1-p_i)\right]$$

$$= \sum[Y_i(\beta_0+\beta_1 X_i) + \log\left(\frac{1}{1+e^{(\beta_0+\beta_1 X_i)}}\right)]$$

$$I_i \text{ (say)} = \sum_{i=1}^{n}\left[Y_i(\beta_0+\beta_1 X_i) - \log\{1+e^{(\beta_0+\beta_1 X_i)}\}\right]$$

$$= \sum Y_i(\beta_0 + \beta_1 X_i) - \sum \log\{1 + e^{(\beta_0 + \beta_1 X_i)}\} \quad - - - - \quad \text{--(v)}$$

Now, differentiating eq.(v) with respect to $\beta_0$ and $\beta_1$ respectively,

$$\frac{\delta I_i}{\delta \beta_0} = \sum_{i=1}^{n} Y_i - \sum \left[ \frac{e^{\beta_0 + \beta_1 X_i}}{1 + e^{\beta_0 + \beta_1 X_i}} \right]$$

or, $$\frac{\delta I_i}{\delta \beta_0} = \sum_{i=1}^{n} Y_i - \sum_{i=1}^{n} p_i$$

and

$$\frac{\delta I_i}{\delta \beta_1} = \sum_{i=1}^{n} X_i Y_i - \sum_{i=1}^{n} \left[ \frac{X_i e^{(\beta_0 + \beta_1 X_i)}}{1 + e^{(\beta_0 + \beta_1 X_i)}} \right]$$

or, $$\frac{\delta I_i}{\delta \beta_1} = \sum_{i=1}^{n} X_i Y_i - \sum_{i=1}^{n} X_i p_i$$

$$\frac{\delta I_i}{\delta \beta} = \begin{pmatrix} \frac{\delta I_i}{\delta \beta_0} \\ \frac{\delta I_i}{\delta \beta_1} \end{pmatrix} = \begin{pmatrix} \sum_{i=1}^{n} Y_i - \sum_{i=1}^{n} p_i \\ \sum_{i=1}^{n} X_i Y_i - \sum_{i=1}^{n} X_i p_i \end{pmatrix}$$

$$= X^T Y - X^T p$$

$$= X^T (Y - p) \quad - - - - - - - - \qquad \text{(vi)}$$

Where,

$$X = \begin{pmatrix} 1 & X_1 \\ 1 & X_2 \\ \vdots & \vdots \\ 1 & X_n \end{pmatrix}, \qquad Y = \begin{pmatrix} Y_1 \\ Y_2 \\ \vdots \\ Y_n \end{pmatrix}, \qquad p = \begin{pmatrix} p_1 \\ p_2 \\ \vdots \\ p_n \end{pmatrix}$$

Now, we put $\frac{\delta I_i}{\delta \beta} = 0$, then we get

$$x^T(Y-p) = 0 \quad \text{- - - -- - - - - - - -- - -} \quad \text{(vii)}$$

or, $X^TY = X^Tp$

or, $\hat{Y} = \hat{p}$,

The solution to eq$^n$. (vii) will satisfy

$$X^T(Y-\hat{Y}) = 0 \quad \text{- - - - -- - - - - - - - - - -} \quad \text{- - (viii)}$$

Equation (viii) is generally solved by using Newton-Raphson method. This entailes first determining,

$$\frac{\delta}{\delta\beta}(X^TY - Y^Tp) = \frac{\delta}{\delta\beta}\{X^T(Y-p)\} = -\frac{\delta}{\delta\beta}X^Tp = -\left[\frac{\delta}{\delta\beta}p\right]X$$

But we have,

$$p_i = \frac{e^{(\beta_0+\beta_1X_i)}}{1+e^{(\beta_0+\beta_1X_i)}}$$

$$\frac{\delta p_i}{\delta \beta_0} = \frac{\{1+e^{(\beta_0+\beta_1X_i)}\}e^{(\beta_0+\beta_1X_i)} - e^{(\beta_0+\beta_1X_i)}e^{(\beta_0+\beta_1X_i)}}{\{1+e^{(\beta_0+\beta_1X_i)}\}^2}$$

$$= \frac{e^{(\beta_0+\beta_1X_i)}}{\{1+e^{\beta_0+\beta_1X_i}\}} \times \frac{1}{e^{(\beta_0+\beta_1X_i)}}$$

$$= p_i(1-p_i)$$

$$\therefore \quad \frac{\delta p_i}{\delta \beta_i} = \frac{\{X_ie^{(\beta_0+\beta_1X_i)}\}}{\{1+e^{(\beta_0+\beta_1X_i)}\}^2}$$

$$= X_ip_i(1-p_i)$$

$$\therefore \quad \frac{\delta p}{\delta \beta} = X^TW$$

Where, W= diag.

And $X^T = \begin{pmatrix} 11\cdots\cdots\cdots 1 \\ X_1 X_2 \cdots X_n \end{pmatrix}$

$\therefore \quad \frac{\delta p}{\delta \beta} X = X^T W X$

Iterative estimates of β are then obtained as

$$\hat{\beta} = \left(X^T W X\right)^{-1}\left(X^T W Z\right) \qquad \text{- - - - - -} \qquad \text{- - (ix)}$$

With Z playing the role of Y in this iteratively reweighted least squares approach. Specifically,

$$Z_i = \hat{\eta} + \frac{Y_i + \hat{p}_i}{\hat{p}_i(1-\hat{p}_i)}$$

With $\eta_i = \log_e\left(\frac{p_i}{1-p_i}\right)$. Notice that $\hat{\eta}_i$ plays an important role of $Y_i$ and $\frac{(Y_i - \hat{p}_i)}{\hat{p}_i(1-p_i)}$ is the residual corresponding to $Y_i$ divided by the estimated variance of $Y_i$.

If we wish to write eq$^n$. (ix) in an equivalent form that shows the updating of $\hat{\beta}$, we may write Z as:

$$Z = X\hat{\beta}^{(i)} + W^{-1}e$$

with $e = Y - \hat{p}_i$, we then obtain

$$\hat{\beta}^{(i+1)} = \left(X^T W X\right)^{-1} X^T W\left(X\hat{\beta}^{(i)} + W^{-1}e\right)$$

$$= \hat{\beta}^{(i)} + \left(X^T W X\right)^{-1} X^T e \qquad \text{- - - -} \qquad \text{- - - -} \qquad \text{- - (x)}$$

The updating formula given by eq$^n$. (x) is used until the estimates converge.

The first step is to obtain the initial estimates; $\beta^{(0)}$. Various approaches are used to obtain these. As originally derived by Lachebrunch (1975) and displayed by Hosmer and Lemeshow (1989), the initial estimates obtained using the discriminant function are given by

$$\hat{\beta}^{(0)} = \begin{pmatrix} \hat{\beta}_0^{(0)} \\ \hat{\beta}_1^{(0)} \end{pmatrix} = \begin{pmatrix} \log_e\left(\frac{\hat{\Theta}_1}{\hat{\Theta}_0}\right) - 0.5\left(\hat{\mu}_1^{\,2} - \hat{\mu}_0^{\,2}\right) \div \hat{\sigma}^2 \\ \frac{\hat{\mu}_1 - \hat{\mu}_0}{\hat{\sigma}^2} \end{pmatrix}$$

Here, $\hat{\mu}_0 = \overline{X}_0$ and $\hat{\mu}_1 = \overline{X}_1$, where $\overline{X}_0$ and $\overline{X}_1$ are the average of the n-values when Y=0 and Y=1 respectively. And $\hat{\Theta}_1 = \overline{Y}$ and $\hat{\Theta}_0 = 1 - \hat{\Theta}_1$

And $\hat{\sigma}^2 = \frac{(n_0 - 1)s_0^{\,2} + (n_1 - 1)s_1^{\,2}}{n_0 + n_1 - 2}$,

Where $s_0^{\,2}$ and $s_1^{\,2}$ are the usual sample variances computed using Y= 0 and Y = 1 respectively, and $n_0$ and $n_1$ are the corresponding sample sizes.

### 5.2.2(b) Testing the significance of the coefficients

To assess the effect of independent variables on the dependent variable, we have to follow some procedures incorporated with logistic regression model, such as

(1) Likelihood ratio test.

(2) Wald test.

(3) Score test.

We have used Wald test to test our hypothesis

$H_0$ : The contribution of the covariates in the model is equal to zero.

vs. $H_1$ : At least one of them is non zero.

**Wald Test:**

The Wald test statistic is an alternative test which is used to test the significance of individual logistic regression coefficients for each independent variable that is, to test the null hypothesis in logistic regression that a particular logit (effect) coefficient is zero. For dichotomous independents, the Wald statistic is the squared ratio of the unstandardized logit coefficient to its standard error.

When the overall null hypothesis $H_0 : \beta_1 = \beta_2 = \text{---- - - - } = \beta_p = 0$ , is rejected we may decide that at least one $\beta_i$ is non-zero. Then to identify significant coefficient, we have to perform the test procedures for any specific parameter and Wald test plays this role. This test procedure is known after the name of Wald who has given this test procedure in 1943. The assumption of this test is the same as those of the likelihood ratio test. The test statistic is obtained by comparing the maximum likelihood estimate of any slope parameter to be estimate of its standard error.

Let us set the null hypothesis

$$H_0 : \beta_j = 0$$

vs, $$H_1 : \beta_j \neq 0 \quad \text{for } j = 1, 2, 3, ...., p$$

Then the univariate Wald statistic is defined as

$$W_j = \frac{\hat{\beta}_j}{SE(\hat{\beta}_j)}$$

where $\hat{\beta}_j$ is the M.L.E. of $j^{th}$ coefficient and S.E. $(\hat{\beta}_j)$ denote the standard error of $\hat{\beta}_j$. Under the null hypothesis that the slope parameter is zero, this statistic follows a standard distribution. Let, $\alpha$ be the level of significance and $Z_{\alpha/2}$ be the critical value of standard normal distribution. Then we accept the null hypothesis if $-Z_{\alpha/2} < Z_j < Z_{\alpha/2}$ ; otherwise it will be rejected at $\alpha$% level of significance.

The multivariate analogue of the Wald test can be expressed as

$$W = \hat{\beta}^T \left[\text{var}(\hat{\beta})\right]^{-1}$$
$$= \beta(X^T W X)\beta$$

Which is distributed as chi-square with (p+1) degrees of freedom under the hypothesis that each of the (p+1) coefficients is zero. Since we are interested only in the slope coefficient, the multivariate Wald test for the slope coefficients can be obtained by eliminating $\beta_0$ and $\beta$ and the corresponding first row and first column from $(X^T WX)$.

## 5.2.2(c) Interpretation of Parameters

Interpretation of parameters in logistic regression model is not so straightforward as in linear regression model. So it is relevant to present a little discussion about it. Since the logit transformation of g(x) is linear in parameters, we can interpret the parameters using the arguments of linear regression. Thus the interpretation may be described as follows:

We know that the logit transformation of a logistic regression model is

$$p(x) = \frac{e^{(\beta_0 + \beta_1 x_1 + \cdots + \beta_p x_p)}}{1 + e^{(\beta_0 + \beta_1 x_1 + \cdots + \beta_p x_p)}}$$ is linear in parameters.

That is,

$$g(x) = \log_e\left[\frac{p(x)}{1-p(x)}\right]$$

$$= \beta_0 + \beta_1 x_1 + \ldots\ldots\ldots\ldots + \beta_p x_p$$

So, arguing analogously as in the case of linear regression model, we can say that $\beta_j$ (j= 1, 2, 3, ....., p) represents the rate of change in $\log_e\left[\frac{p(x)}{1-p(x)}\right]$ for one unit change in $X_j$ (other variables remaining).

The interpretation of parameters in logistic regression has another interesting aspect. In fact, this is the proper interpretation. To describe this, we first consider that the independent variables ($X_j$) are dichotomous. This case is not only simplest but also it gives the conceptual foundation for all other saturations. The description is as the following:

### 5.2.2(d) Interpretation of Parameters in terms of Odds Ratio

We begin our consideration of the interpretation of logistic regression coefficients with the situation where the independent variable is nominal scale and dichotomous (that is, measured at two levels). This case provides the conceptual foundation for all the other situations.

We assume that the independent variable, x, is coded as either zero or one.

The difference in the logit for a subject with x=0 and x=1 is

$$g(1)\text{-}g(0) = \{\beta_0+\beta_1\}\text{-}\{\beta_0\} = \beta_1$$

The algebra shown in this equation is straightforward. We present it in this level of detail to emphasize that the first step in interpreting the effect of a covariate in a model is to express the desired logit difference is equal to $\beta_1$ in order to interpret this result; we need to introduce and discuss a measure of association termed the odds ratio.

The possible values of the logistic probabilities may be conveniently displayed in a 2×2 table as shown in table 6.2 (e). The odds of the outcome being present among individuals with X = 0 is defined as $\frac{p(0)}{1-p(0)}$, similarly the odds of the outcome being present among individuals with X = 1 is defined as $\frac{p(1)}{1-p(1)}$. The odds ratio, denoted O, is defined as the ratio of the odds for X =0 to the odds for X = 1, and given by the equation-

$$O = \frac{\frac{p(1)}{1-p(1)}}{\frac{p(0)}{1-p(0)}}$$

Substitution the expressions for the logistic regression model shown in table 6.2 (e), below:

**Table 5.2.2(d) Value of the Logistic Regression Model when the variable is Dichotomous**

| Outcome variable (Y) | Independent Variables (X) | |
|---|---|---|
| | X = 1 | X = 0 |
| Y = 1 | $p(1) = \frac{e^{(\beta_0+\beta_1)}}{1+e^{(\beta_0+\beta_1)}}$ | $p(0) = \frac{e^{\beta_0}}{1+e^{\beta_0}}$ |
| Y = 0 | $1\text{-}p(1) = \frac{1}{1+e^{(\beta_0+\beta_1)}}$ | $1\text{-}p(0) = \frac{1}{1+e^{\beta_0}}$ |
| Total | 1.0 | 1.0 |

$$O = \frac{\left[\frac{e^{(\beta_0+\beta_1)}}{1+e^{(\beta_0+\beta_1)}}\right]}{\left[\frac{e^{\beta_0}}{1+e^{\beta_0}}\right]} \times \frac{\left[\frac{1}{1+e^{\beta_0}}\right]}{\left[\frac{1}{1+e^{(\beta_0+\beta_1)}}\right]}$$

$$= \frac{e^{(\beta_0+\beta_1)}}{e^{\beta_0}}$$

$$= e^{\beta_1}$$

Hence, for logistic regression with dichotomous (also with polychotomous) independent variables coded 0 or 1 (or 1, 2, 3 etc.), the relation between the odds ratio and the regression coefficient is

$$O = e^{\beta_1} \quad \text{- - - - - - ----------} \quad (5)$$

This simple relationship between the coefficient and the odds ratio is the fundamental reason why logistic regression has proven to be such a powerful analytical research tool.

The odds ratio is a measure of association which has found wide use, especially in epidemiology, as it approximates how much more likely (or unlikely) is for the outcome to be present among those with x = 1 (or

2 , or 3), then among those with x= 0. For example, if y denotes the presence or absence of lung cancer and if x denotes whether the person is a smoker, then O = 2, estimate that lung cancer is twice more likely to occur among smokers than non-smokers in the study population. As an another example, suppose y denotes the presence or absence of heart disease and x denotes whether or not the person engage in regular strenuous physical exercise. If the estimated odds ratio is O = 0.5, then occurrence of heart disease is one half as likely to occur among those who exercise than among those who do not in the study population.

The interpretation give for the odds ratio is based on the fact that in many instances it approximates a quantity called the relative risk. The parameter is equal to the ratio p(1)/p(0). It follows from Table 5.2.2(d) that the odds ration approximates the relative risk if [1-p(0)]/[1-p(1)]≈ 1. This holds when p(x) is small for both 1 and 0.

## 5.3 Results and Discussion

### 5.3.1 Results of Discriminant Analysis

The result of discriminant analysis is shown in Table 5.3. Out of eleven variables seven are discriminating high-risk from low-risk early childbearing corresponding to age of women. The third and fifth columns show the Wilk's lamda and minimum Mahalanobis distance D Square of the Table 5.3. For example, most significant discriminating variable is duration of marriage, as it discriminates high-risk early childbearing from low-risk early childbearing with maximum significance of Wilk's lamda (0.984) and minimum Mahalanobis distance (0.349). The next significant discriminating factor is contraceptive use, as it discriminates high-risk early childbearing from low-risk early childbearing with maximum significance of Wilk's lamda (0.978) and minimum Mahalanobis distance (0.354). The other significant variables which discriminate high-risk early childbearing pattern from low-risk early childbearing pattern are mother's education, age at marriage, religion, place of residence and women work status.

**Table 5.3 Significant Discriminate Variables of Early Childbearing Patterns**

| Step | Name of Variables | Wilk's lamda | Sig. | Minimum D square | Sig. | Between groups |
|---|---|---|---|---|---|---|
| 1 | Marital duration | 0.984 | .000 | 0.349 | .000 | High-risk and Low risk |
| 2 | Contraceptive use | 0.978 | .000 | 0.354 | .000 | High-risk and Low risk |
| 3 | Mother's education | 0.943 | .000 | 0.378 | .000 | High-risk and Low risk |
| 4 | Age at marriage | 0.921 | .000 | 0.388 | .000 | High-risk and Low risk |
| 5 | Religion | 0.881 | .000 | 0.432 | .000 | High-risk and Low risk |
| 6 | Place of residence | 0.834 | .000 | 0.435 | .000 | High-risk and Low risk |
| 7 | Women work status | 0.802 | .000 | 0.449 | .000 | High-risk and Low risk |

The size of eigen value (0.650) is related to the discriminating power of the function. This value shows that discrimination of two groups of variables is present. Another way to judge the substantive utility of a discriminate function is by examining the canonical correlation coefficient (0.570). This correlation is a measure of association, which summaries the degree of relatedness between high-risk and low-risk mothers and the diecriminate function. A value of zero denotes no discrimination at all, but large numbers (always positive) represent increasing degrees of association with 1 being the maximum. The value of overall Chi-square is 665.537, which indicates those ultimately discriminatory variables of high-risk and low-risk early childbearing is significant.

| Eigenvalue | Canonical correlation | Willk's lamda | Chi-square | d.f | Significance |
|---|---|---|---|---|---|
| 0.650 | 0.570 | 0.810 | 665.537 | 7 | .000 |

Using stepwise procedure coefficients of Fisher's linear discriminating variables are shown in Table 5.4.

**Table 5.4: Coefficients of (Fisher's linear) Discriminating Variables of high-risk and Low-risk early Childbearing according to age of Women**

| Variable | Coefficients of High-risk mother | Coefficients of Low-risk mother |
|---|---|---|
| Marrital duration $(X_3)$ | 1.991 | 0.577 |
| Mother's education $(X_5)$ | 0.861 | 0.570 |
| Age at marriage $(X_2)$ | 2.243 | 2.206 |
| Religion $(X_8)$ | 12.784 | 13.367 |
| Place of residence $(X_9)$ | 3.664 | 3.912 |
| Contraceptive use $(X_{10})$ | 0.210 | 0.112 |
| Women work status $(X_7)$ | 0.282 | 0.466 |
| Constant | -17.285 | -20.103 |

When Fisher's approach is used, it turns out that it may be possible to determine several linear combinations for low-risk and high-risk mothers. Mathematical form of two groups are given below:

$$\lambda_0 = -17.285 + 2.243X_2 + 1.991X_3 + 0.861X_5 + 0.282X_7 + 12.784X_8 + 3.664X_9 + 0.210\,X_{10}$$

$$\lambda_1 = -20.103 + 2.206\,X_2 + 0.577\,X_3 + 0.570\,X_5 + 0.466\,X_7 + 13.367\,X_8 + 3.912\,X_9 + 0.112\,X_{10}$$

### 5.3.2 Results of Logistic Regression Analysis

The result of logistic regression analysis is shown in Table 5.5. The regression coefficients in the model are also shown in the table. The variables education of women ($x_5$), religion ($x_8$) and age at first marriage ($x_2$) are significant at 1% level, the variables place of residence ($x_9$), marital duration ($X_3$) and contraceptive use ($X_{10}$) are significant at 5% level and the variables father's education ($X_6$) and women's work status ($x_7$) are significant at 10% level. The sixth column of the Table 5.5 shows the odds ratios. For example, the odds ratio of mother's education ($X_5$) is 1.116 indicates that the early childbearing will be 1.116 times higher for those mothers who have no education than those mothers who have education. Also, the odds ratio of place of residence ($X_9$) is 1.355 indicates that the early childbearing will be

1.355 times higher for those mothers who lives in rural area than those mothers who lives in urban area. The odds ratio of religion ($x_8$) is 1.934 indicates that the early childbearing will be 1.934 times higher for those mothers whose religion Muslim than those mothers whose religion non-Muslim. The odds ratio of age at first marriage ($x_2$) is 1.235 indicates that the early childbearing will be 1.235 times higher for those mothers whose age at first marriage is less than 16 years than those mothers whose age at first marriage is 16 or more years. Similarly the variables fathers education ($X_6$) is 0.769 times higher, women work status ($x_7$) is 2.964 times higher, marital duration ($X_3$) is 0.241 times higher and the variable contraceptive use ($X_{10}$) is 0.711 times higher for their categories. Therefore, the most important significant variables that influence early childbearing mothers are place of residence, religion, age at first marriage, women work status, mothers education, fathers education, contraceptive use and marital duration. The most significant variable is education and the next significant variable is place of residence and so on.

**Table 5.5: Results of Logistic Regression analysis for Early Childbearing patterns**

| Variables | Coeff. | S.E | Sign. | Wald statistic | Odds ratio |
|---|---|---|---|---|---|
| Education of women ($x_5$)<br>No education<br>Primary or more | 0.110 | 0.194 | 0.000 | 0.323 | 1.116 |
| Place of residence ($x_9$)<br>Rural<br>Urban | 0.304 | 0.140 | 0.030 | 4.709 | 1.355 |
| Religion ($x_8$)<br>Non-Muslim<br>Muslim | 0.660 | 0.253 | 0.009 | 6.779 | 1.934 |
| Father's education($X_6$)<br>No education<br>Primary or more | 0.214 | 0.148 | 0.075 | 3.174 | 0.769 |
| Age at first marriage($x_2$)<br>Less than 16 years<br>16 or more | 0.132 | 0.196 | 0.006 | 61.241 | 1.235 |
| Women work status ($x_7$)<br>Never working<br>Ever working | 0.483 | 0.052 | 0.059 | 6.489 | 2.964 |
| Marital duration ($X_3$)<br>0-4 years<br>5-9 years | 6.552 | 0.231 | 0.023 | 1.226 | 0.241 |
| Contraceptive use ($X_{10}$)<br>Never use<br>Ever use | -0.342 | 0.138 | 0.014 | 6.097 | 0.711 |
| Constant | 2.077 | 0.470 | 0.000 | 19.562 | 7.983 |

The logistic regression equations for early childbearing are given below:

$$Z_0 = 2.077 + 0.132X_2 + 6.552\ X_3 + 0.110X_5 + 0.483X_7 + 0.660X_8 + 0.340X_9 - 0.342\ X_{10}$$

## 5.4 Model Validation

To check how much those methods are highly significant, the cross validity prediction power (CVPP), $\rho^2_{cv}$, is applied.

Here $\rho^2_{cv} = 1 - \frac{(n-1)(n-2)(n+1)}{n(n-k-1)(n-k-2)}(1 - R^2)$. Where, $n$ is the sample size or number of cases, $k$ is the number of predictors in the methods and the cross-validated $R$ is the correlation between observed and predicted values of the dependent variable. Using the above statistics, it can be concluded that if the prediction equation is applied to many other samples from the same population, then ($\rho^2_{cv} \times 100$)% of the variance on the predicted variable would be explained by the methods (Stevens 1996).

**Table 5.6: Estimated Cross Validity Prediction Power, $\rho_{cv}^2$ of the Predicted Methods of Early Childbearing**

| Methods | $n$ | $k$ | $R^2$ | $\rho_{cv}^2$ |
|---|---|---|---|---|
| Logistic Regression | 1703 | 10 | 0.492 | 0.4857 |
| Discriminant | 1703 | 10 | 0.570 | 0.5646 |

The estimated CVPP, $\rho_{cv}^2$, corresponding to their $R^2$ is shown in table 5.6. From this table we see that the value of cross validity prediction power for the methods of logistic regression is 0.4857 and discriminant is 0.5646. So it implies that the method of discriminant analysis is highly cross-validated, for the analysis of early childbearing.

## 5.5 Conclusion

The discriminant analysis extracted seven variables concerned with age. The most important significant variables that discriminate the early childbearing are marital duration, age at first marriage, education of women, women work status, religion and place of residence. The variables that significantly discriminate the high-risk childbearing from low-risk childbearing corresponding to age of women. The most important significant discriminating variables concerned with marital duration, age at marriage and mothers education. The most important significant variables that influence the early childbearing corresponding to age of women. The variables that influence the early childbearing concerned with mother's education, place of residence and religion. In this chapter we used two methods and among them the method of discriminant is highly cross validated.

# *CHAPTER SIX*

# EARLY CHILDBEARING PATTERN OF DIFFERENT DIVISIONS: DISCRIMINANT ANALYSIS

CHAPTER OUTLINE

# *CHAPTER SIX*

# EARLY CHILDBEARING PATTERN OF DIFFERENT DIVISIONS: DISCRIMINANT ANALYSIS

## 6.1 Introduction

Early childbearing is one of the most important components of population composition. Data on early childbearing distribution describe the behavior of a population in the formation and dissolution of marital unions. In this chapter, we discuss and compare the different characteristics of early childbearing among different divisions using discriminant analysis.

In earlier chapter we have seen that discriminant analysis is better than logistic regression analysis for the analysis of the covariates of early childbearing. So, therefore the discriminant analysis is employed to study the pattern and influences of the covariates of early childbearing for different divisions. Initially, we considered eleven variables for the analysis but seven variables are found to be significantly discriminant for the covariates of overall Bangladesh. But for the division-wise analysis we observed only four or five variables are significantly discriminant.

There are six divisions in Bangladesh. So, the analysis is based on Dhaka, Rajshahi, Barisal, Khulna, Chittagong and Sylhet division.

In this chapter a preliminary analysis of different divisions is under taken with a view to shed light on the inherent peculiarities of the early childbearing pattern in the country. The main purpose of this chapter is to evaluate the covariates of early childbearing pattern of different divisions.

## 6.2 Total Number and Percentage Distribution of Women in Different Divisions by Age

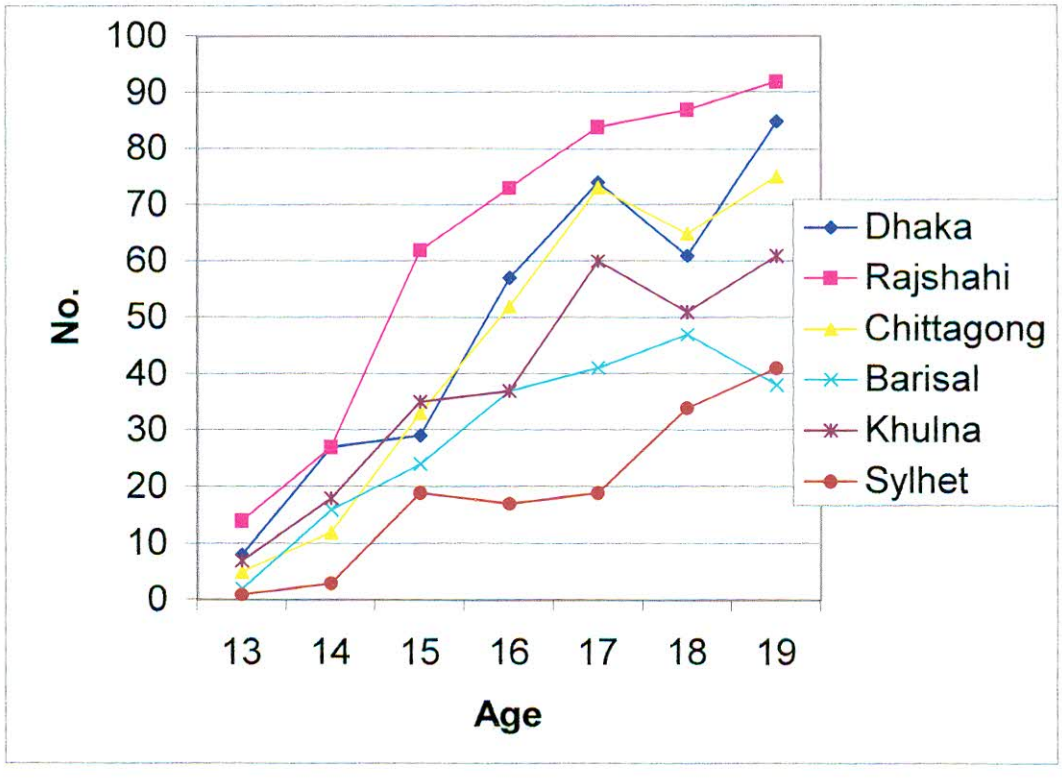
Our study population is 1703 (discuss in chapter one), where 314 are in Dhaka division, 439 are in Rajshahi division, 315 are in Chittagong division, 205 are in Barisal division, 269 are in Khulna division and 134 are in Sylhet division respectively.

## 6.1 Total number and percentage distribution of women in different divisions by age

| Age | Dhaka | | Rajshahi | | Chittagong | | Barisal | | Khulna | | Sylhet | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | N | % | N | % | N | % | N | % | N | % | N | % |
| 13 | 8 | 2.3 | 14 | 3.2 | 5 | 1.6 | 2 | 1.0 | 7 | 2.6 | 1 | 0.7 |
| 14 | 27 | 7.9 | 27 | 6.2 | 12 | 3.8 | 16 | 7.8 | 18 | 6.7 | 3 | 2.2 |
| 15 | 29 | 8.5 | 62 | 14.1 | 33 | 10.5 | 24 | 11.7 | 35 | 13.0 | 19 | 14.2 |
| 16 | 57 | 16.7 | 73 | 16.6 | 52 | 16.5 | 37 | 18.0 | 37 | 13.8 | 17 | 12.7 |
| 17 | 74 | 21.7 | 84 | 19.1 | 73 | 23.2 | 41 | 20.0 | 60 | 22.3 | 19 | 14.2 |
| 18 | 61 | 17.9 | 87 | 19.8 | 65 | 20.6 | 47 | 22.9 | 51 | 19.0 | 34 | 25.4 |
| 19 | 85 | 24.9 | 92 | 21.0 | 75 | 23.8 | 38 | 18.5 | 61 | 22.7 | 41 | 30.6 |
| Total | 314 | 100 | 439 | 100 | 315 | 100 | 205 | 100 | 269 | 100 | 134 | 100 |

The number of women of age ≤ 20 years by different division is presented in Table 6.1. From Table 6.1, we observed that the number of women in Dhaka division with age 13, 14, 15, 16, 17, 18 and 19 are 8, 27, 29, 57, 74, 61 and 85 respectively. Similarly the number of women in Rajshahi, Chittagong, Barisal, Khulna and Selhet with age 13, 14, 15, 16, 17, 18 and 19 are 14, 27, 62, 73, 84, 87 and 92; 5, 12, 33, 52, 73, 65 and 75; 2, 16, 24, 37, 41, 47 and 38; 7, 18, 35, 37, 60, 51 and 61; 1, 3, 19, 17, 19, 34 and 41 respectively.

**Figure 6.1.1: Number of women in different divisions with different age**



## 6.3 Discriminant Analysis of Early Childbearing: Dhaka Division

The result of discriminant analysis of early childbearing for Dhaka division is shown in Table 6.2. Out of eleven variables four are discriminating high-risk from low-risk early childbearing corresponding to age of women. The third and fifth columns of the table 6.2 show the Wilk's lamda and minimum Mahalanobis distance D Square. The most significant discriminating variable is duration of marriage, it discriminates high-risk early childbearing from low-risk early childbearing with maximum significance of Wilk's lamda (0.912) and minimum Mahalanobis distance (0.214). The next significant discriminating factor is age at first marriage, as it discriminates high-risk early childbearing from low-risk early childbearing with maximum significance of Wilk's lamda (0.890) and minimum Mahalanobis distance (0.397). The other significant variables which discriminate high-risk early childbearing pattern from low-risk early childbearing pattern are contraceptive use and place of residence.

**Table 6.2: Significant Discriminate Variables of Early Childbearing Patterns in Dhaka Division**

| Step | Name of Variables | Wilk's lamda | Sig. | Minimum D square | Sig. | Between groups |
|---|---|---|---|---|---|---|
| 1 | Marital duration | 0.912 | .000 | 0.214 | .000 | High-risk and Low risk |
| 2 | Age at marriage | 0.890 | .000 | 0.397 | .000 | High-risk and Low risk |
| 3 | Contraceptive use | 0.831 | .000 | 0.453 | .000 | High-risk and Low risk |
| 4 | Place of residence | 0.802 | .000 | 0.498 | .000 | High-risk and Low risk |

The size of eigen value (0.631) is related to the discriminating power of the function. This value shows that discrimination of two groups of variables is present. Another way to judge the substantive utility of a discriminate function is by examining the canonical correlation coefficient (0.589). This correlation is a measure of association, which summaries the degree of relatedness between high-risk and low-risk mothers and the diecriminate function. A value of zero denotes no discrimination at all, but large numbers (always positive) represent increasing degrees of association with 1 being the maximum. The value of overall Chi-square is 143.560, which indicates those ultimately discriminatory variables of high-risk and low-risk early childbearing is significant.

| Eigenvalue | Canonical correlation | Willk's lamda | Chi-square | d.f | Significance |
|---|---|---|---|---|---|
| 0.631 | 0.589 | 0.653 | 143.560 | 4 | .000 |

## 6.4 Discriminant Analysis of Early Childbearing: Rajshahi Division

The result of discriminant analysis of early childbearing for Rajshahi Division is shown in Table 6.3. Out of eleven variables five are discriminating high-risk from low-risk early childbearing corresponding to age of women. The third and fifth columns of the table 6.3 show the Wilk's lamda and minimum Mahalanobis distance D Square. The most significant discriminating variable is duration of marriage, it discriminates high-risk early childbearing from low-risk early childbearing with maximum significance of Wilk's lamda (0.882) and minimum Mahalanobis distance (0.306). The next significant discriminating factor is age at first marriage, as it discriminates high-risk early childbearing from low-risk early childbearing with maximum significance of Wilk's lamda (0.852) and minimum Mahalanobis distance (0.391). The other significant variables which discriminate high-risk early childbearing pattern from low-risk early childbearing pattern are contraceptive use, women work status and place of residence.

**Table 6.3: Significant Discriminate Variables of Early Childbearing Patterns in Rajshahi Division**

| Step | Name of Variables | Wilk's lamda | Sig. | Minimum D square | Sig. | Between groups |
|---|---|---|---|---|---|---|
| 1 | Marital duration | 0.882 | .000 | 0.306 | .000 | High-risk and Low risk |
| 2 | Age at marriage | 0.852 | .000 | 0.391 | .000 | High-risk and Low risk |
| 3 | Contraceptive use | 0.752 | .000 | 0.410 | .000 | High-risk and Low risk |
| 4 | Women work status | 0.749 | | 0.488 | .000 | High-risk and Low risk |
| 5 | Mother's education | 0.724 | .000 | 0.513 | .000 | High-risk and Low risk |

The size of eigen value (0.363) is related to the discriminating power of the function. This value shows that discrimination of two groups of variables is present. Another way to judge the substantive utility of a discriminate function is by examining the canonical correlation coefficient (0.516). This correlation is a measure of association, which summaries the degree of relatedness between high-risk and low-risk mothers and the diecriminate function. A value of zero denotes no discrimination at all, but large numbers (always positive) represent increasing degrees of association with 1 being the maximum. The value

of overall Chi-square is 134.779, which indicates those ultimately discriminatory variables of high-risk and low-risk early childbearing is significant.

| Eigenvalue | Canonical correlation | Willk's lamda | Chi-square | d.f | Significance |
|---|---|---|---|---|---|
| 0.363 | 0.516 | 0.734 | 134.779 | 5 | .000 |

## 6.5 Discriminant Analysis of Early Childbearing: Khulna Division

The result of discriminant analysis of early childbearing for Khulna Division is shown in Table 6.4. Out of eleven variables four are discriminating high-risk from low-risk early childbearing corresponding to age of women. The third and fifth columns of the table 6.4 show the Wilk's lamda and minimum Mahalanobis distance D Square. The most significant discriminating variable is duration of marriage, it discriminates high-risk early childbearing from low-risk early childbearing with maximum significance of Wilk's lamda (0.935) and minimum Mahalanobis distance (0.239). The next significant discriminating factor is age at first marriage, as it discriminates high-risk early childbearing from low-risk early childbearing with maximum significance of Wilk's lamda (0.878) and minimum Mahalanobis distance (0.301). The other significant variables which discriminate high-risk early childbearing pattern from low-risk early childbearing pattern are contraceptive use and religion.

**Table 6.4: Significant Discriminate Variables of Early Childbearing Patterns in Khulna Division**

| Step | Name of Variables | Wilk's lamda | Sig. | Minimum D square | Sig. | Between groups |
|---|---|---|---|---|---|---|
| 1 | Marital duration | 0.935 | .000 | 0.239 | .000 | High-risk and Low risk |
| 2 | Age at marriage | 0.878 | .000 | 0.301 | .000 | High-risk and Low risk |
| 3 | Contraceptive use | 0.856 | .000 | 0.470 | .000 | High-risk and Low risk |
| 4 | Religion | 0.824 | .000 | 0.499 | .000 | High-risk and Low risk |

The size of eigen value (0.240) is related to the discriminating power of the function. This value shows that discrimination of two groups of variables is present. Another way to judge the substantive utility of a discriminate function is by examining the canonical correlation coefficient (0.538). This correlation is a measure of association, which summaries the degree of relatedness between high-risk and low-risk mothers and the diecriminate function. A value of zero denotes no discrimination at all, but large numbers (always positive) represent increasing degrees of association with 1 being the maximum. The value of overall Chi-square is 57.092, which indicates those ultimately discriminatory variables of high-risk and low-risk early childbearing is significant.

| Eigenvalue | Canonical correlation | Willk's lamda | Chi-square | d.f | Significance |
|---|---|---|---|---|---|
| 0.240 | 0.538 | 0.807 | 57.092 | 4 | .000 |

## 6.6 Discriminant Analysis of Early Childbearing: Barisal Division

The result of discriminant analysis of early childbearing for Barisal Division is shown in Table 6.5. Out of eleven variables four are discriminating high-risk from low-risk early childbearing corresponding to age of women. The third and fifth columns of the table 6.5 show the Wilk's lamda and minimum Mahalanobis distance D Square. The most significant discriminating variable is age at first marriage, as it discriminates high-risk early childbearing from low-risk early childbearing with maximum significance of Wilk's lamda (0.903) and minimum Mahalanobis distance (0.385). The next significant discriminating factor is duration of marriage, as it discriminates high-risk early childbearing from low-risk early childbearing with maximum significance of Wilk's lamda (0.892) and minimum Mahalanobis distance (0.423). The other significant variables which discriminate high-risk early childbearing pattern from low-risk early childbearing pattern are husband occupation and religion.

**Table 6.5: Significant Discriminate Variables of Early Childbearing Patterns in Barisal Division**

| Step | Name of Variables | Wilk's lamda | Sig. | Minimum D square | Sig. | Between groups |
|---|---|---|---|---|---|---|
| 1 | Age at marriage | 0.892 | .000 | 0.385 | .000 | High-risk and Low risk |
| 2 | Marital duration | 0.903 | .000 | 0.423 | .000 | High-risk and Low risk |
| 3 | Husband occupation | 0.856 | .000 | 0.476 | .000 | High-risk and Low risk |
| 4 | Religion | 0.803 | .000 | 0.492 | .000 | High-risk and Low risk |

The size of eigen value (0.271) is related to the discriminating power of the function. This value shows that discrimination of two groups of variables is present. Another way to judge the substantive utility of a discriminate function is by examining the canonical correlation coefficient (0.591). This correlation is a measure of association, which summaries the degree of relatedness between high-risk and low-risk mothers and the diecriminate function. A value of zero denotes no discrimination at all, but large numbers (always positive) represent increasing degrees of association with 1 being the maximum. The value of overall Chi-square is 48.384, which indicates those ultimately

discriminatory variables of high-risk and low-risk early childbearing is significant.

| Eigenvalue | Canonical correlation | Willk's lamda | Chi-square | d.f | Significance |
|---|---|---|---|---|---|
| 0.271 | 0.591 | 0.787 | 48.384 | 4 | .000 |

## 6.7 Discriminant Analysis of Early Childbearing: Chittagong Division

The result of discriminant analysis of early childbearing for Chittagong Division is shown in Table 6.6. Out of eleven variables four are discriminating high-risk from low-risk early childbearing corresponding to age of women. The third and fifth columns of the table 6.6 show the Wilk's lamda and minimum Mahalanobis distance D Square. The most significant discriminating variable is age at first marriage, as it discriminates high-risk early childbearing from low-risk early childbearing with maximum significance of Wilk's lamda (0.909) and minimum Mahalanobis distance (0.315). The next significant discriminating factor is duration of marriage, as it discriminates high-risk early childbearing from low-risk early childbearing with maximum significance of Wilk's lamda (0.906) and minimum Mahalanobis distance (0.338). The other significant variables which discriminate

high-risk early childbearing pattern from low-risk early childbearing pattern are religion father's education and women work status.

**Table 6.6: Significant Discriminate Variables of Early Childbearing Patterns in Chittagong Division**

| Step | Name of Variables | Wilk's lamda | Sig. | Minimum D square | Sig. | Between groups |
|---|---|---|---|---|---|---|
| 1 | Age at marriage | 0.909 | .000 | 0.315 | .000 | High-risk and Low risk |
| 2 | Marital duration | 0.906 | .000 | 0.338 | .000 | High-risk and Low risk |
| 3 | Religion | 0.845 | | 0.482 | .000 | High-risk and Low risk |
| 4 | Father's education | 0.842 | .000 | 0.499 | .000 | High-risk and Low risk |
| 5 | Women work status | 0.813 | .000 | 0.537 | .000 | High-risk and Low risk |

The size of eigen value (0.203) is related to the discriminating power of the function. This value shows that discrimination of two groups of variables is present. Another way to judge the substantive utility of a discriminate function is by examining the canonical correlation coefficient (0.578). This correlation is a measure of association, which summaries the degree of relatedness between high-risk and low-risk

mothers and the diecriminate function. A value of zero denotes no discrimination at all, but large numbers (always positive) represent increasing degrees of association with 1 being the maximum. The value of overall Chi-square is 57.471, which indicates those ultimately discriminatory variables of high-risk and low-risk early childbearing is significant.

| Eigenvalue | Canonical correlation | Willk's lamda | Chi-square | d.f | Significance |
|---|---|---|---|---|---|
| 0.203 | 0.578 | 0.831 | 57.471 | 5 | .000 |

## 6.8 Discriminant Analysis of Early Childbearing: Sylhet Division

The result of discriminant analysis of early childbearing for Sylhet Division is shown in Table 6.7. Out of eleven variables four are discriminating high-risk from low-risk early childbearing corresponding to age of women. The third and fifth columns of the table 6.7 show the Wilk's lamda and minimum Mahalanobis distance D Square. The most significant discriminating variable is age at first marriage, as it discriminates high-risk early childbearing from low-risk early childbearing with maximum significance of Wilk's lamda (0.917) and minimum Mahalanobis distance (0.252). The next significant discriminating factor is duration of marriage, as it discriminates high-risk early childbearing from low-risk early childbearing with maximum significance of Wilk's lamda (0.845) and minimum Mahalanobis

distance (0.390). The other significant variables which discriminate high-risk early childbearing pattern from low-risk early childbearing pattern are contraceptive use and.

**Table 6.7: Significant Discriminate Variables of Early Childbearing Patterns in Sylhet Division**

| Step | Name of Variables | Wilk's lamda | Sig. | Minimum D square | Sig. | Between groups |
|---|---|---|---|---|---|---|
| 1 | Age at marriage | 0.917 | .000 | 0.252 | .000 | High-risk and Low risk |
| 2 | Marital duration | 0.845 | .000 | 0.390 | .000 | High-risk and Low risk |
| 3 | Contraceptive use | 0.790 | | 0.417 | .000 | High-risk and Low risk |
| 4 | Religion | 0.705 | | 0.485 | .000 | High-risk and Low risk |

The size of eigen value (0.330) is related to the discriminating power of the function. This value shows that discrimination of two groups of variables is present. Another way to judge the substantive utility of a discriminate function is by examining the canonical correlation coefficient (0.574). This correlation is a measure of association, which summaries the degree of relatedness between high-risk and low-risk mothers and the diecriminate function. A value of zero denotes no

discrimination at all, but large numbers (always positive) represent increasing degrees of association with 1 being the maximum. The value of overall Chi-square is 36.615, which indicates those ultimately discriminatory variables of high-risk and low-risk early childbearing is significant.

| Eigenvalue | Canonical correlation | Willk's lamda | Chi-square | d.f | Significance |
|---|---|---|---|---|---|
| 0.330 | 0.574 | 0.752 | 36.615 | 4 | .000 |

## 6.9 Discriminant Analysis of Early Childbearing: Compare with Overall analysis and Division-wise Analysis

The result of discriminant analysis is shown table 6.9. Table 6.9, out of eleven variables seven are discriminating high-risk from low-risk early childbearing (when overall analysis), but when division-wise analysis we observed that four variables are discriminating high-risk from low-risk early childbearing in Dhaka, Barisal, Khulna and Selhet division, five variables are discriminating high-risk from low-risk early childbearing in Rajshahi and Chittagong division. This table shows that for overall analysis, most significant discriminating variable is marital duration but for division-wise analysis, most significant discriminating variable is marital duration in Dhaka, Rajshahi and Khulna division and most significant discriminating variable is age at first marriage in Chittagong, barisal and Selhet division.

**Table 6.8: Significant Discriminate Variables of Early Childbearing Patterns (compare with overall analysis and division-wise analysis)**

| Name of variables | Overall Analysis | | Division-wise Analysis | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Dhaka | | Rajshahi | | Barisal | | Khulna | | Chittag. | | Selhet | |
| | W Lam | M D | W Lam | M D | W lam | M D | W lam | M D | W lam | M D | W lam | M D | W lam | M D |
| Marital duration | 0.984 | 0.349 | 0.912 | 0.214 | 0.882 | 0.306 | 0.903 | 0.423 | 0.935 | 0.239 | 0.906 | 0.338 | 0.845 | 0.390 |
| Contraceptive use | 0.978 | 0.354 | 0.831 | 0.453 | 0.752 | 0.410 | | | 0.856 | 0.470 | | | 0.790 | 0.417 |
| Mother's education | 0.943 | 0.378 | | | 0.724 | 0.513 | | | | | | | | |
| Age at marriage | 0.921 | 0.388 | 0.890 | 0.397 | 0.852 | 0.391 | 0.892 | 0.385 | 0.878 | 0.301 | 0.909 | 0.315 | 0.917 | 0.252 |
| Religion | 0.881 | 0.432 | | | | | 0.803 | 0.492 | 0.824 | 0.499 | 0.845 | 0.482 | 0.705 | 0.485 |
| Place of residence | 0.834 | 0.435 | 0.802 | 0.498 | | | | | | | | | | |
| Women work status | 0.802 | 0.449 | | | 0.749 | 0.488 | | | | | 0.813 | 0.537 | | |
| Husband occupation | | | | | | | 0.856 | 0.476 | | | | | | |
| Father's education | | | | | | | | | | | 0.842 | 0.499 | | |

Where, W→Wilk's, Lam→Lamda, M→Minimum, D→D-square

## 6.10 Conclusion

In the above tables we observed that the five discriminating significant variables are in Rajshahi and Chittagong division but there are four discriminating significant variables are in other divisions. The most discriminating significant variable is duration of marriage in Dhaka, Rajshahi and Khulna division. The next discriminating significant variables are at first marriage, contraceptive use, place of residence, religion, women work status, mother's education and husband occupation. The most discriminating significant variable is age at first marriage in Barisal, Chittagong and Sylhet divosion. The next discriminating significant variables are duration of marriage, contraceptive use, place of residence, religion, women work status, mother's education and husband occupation. In this chapter we see that the canonical correlation is high (above 0.5) in each division. So we say that this variables are highly correlated for early childbearing in Bangladesh.

# *CHAPTER SEVEN*

# SUMMARY AND CONCLUSION

CHAPTER OUTLINE

# *CHAPTER SEVEN*

# SUMMARY AND CONCLUSION

## 6.1 Summary and Findings

1. The present study under the title "Covariates of Early Childbearing in Bangladesh" is undertaken with an aim to investigate the reproductive behavior of the women in Bangladesh. Of course the early childbearing are age, women education and place of residence dependent and there are so many demographic, socio-economic and cultural as well as biological factors that affect the early childbearing. In fact, the early childbearing in a sense are respectively the early plus delayed fertility and the on-time fertility while age is concerned. However, the study is undertaken with respect to age, women education and place of residence. The objectives of the study have been

   (i) to evaluate the observed child spacing patterns and trends.

   (ii) to investigate the demographic pattern of early childbearing.

   (iii) to examine the socio-cultural trends in early childbearing.

   (iv) to determine the associated factors significantly affect early childbearing

2. The study uses BDHS, 2004 data and also data obtained from several other sources. To look at the early childbearing with respect to age at an aggregate level several fertility schedules are used. At the individual level relevant data made available from BDHS, 2004. Apart from age, education and place of residence, the demographic, socio-economic and cultural variables that are considered in the analysis are age at marriage of women, duration of marriage, children ever born, place of residence, education of women, education of husbands, women working status, religion. In all, the analysis considered nine variables. For all 9 variables, data are taken from 11,440 women as recorded in BDHS 2004. With regard to quality of data used in the analysis no screening procedure is adopted admitting the fact that BDHS data are assume to be of good quality and are widely used and well accepted worldwide. So the analysis are performed using data as they are recorded in BDHS. For the sake of analysis, some classifications/hierarchy are made whenever necessary.

3. In our study, 1088 women are at high-risk early childbearing and the rest 615 are of low-risk early childbearing in the context of age of women. About 249 women according to the education of mother early childbearing of high-risk and the rest 1454 are low-risk early childbearing. According to the place of residence, early childbearing of 1205 women is of high-risk and the rest 498 women of low-risk early childbearing.

4. Apart from percent distribution of women possessing various background characteristics, the study uses Chi-square analysis to investigate the significance of association early childbearing with the demographic, socio-economic and cultural traits. Recourse of discriminate and multiple logistic techniques are made to isolate the significant factor (s) that discriminate the early childbearing as well as to evaluate the factors that significantly affect the early childbearing.

5. Childbearing begins early in Bangladesh with large majority of women becoming mothers before they reach age of 20. It indicates a high incidence of very early childbearing in Bangladesh. In most cases, the first birth occurs between ages 15 and 17; the median age at first birth is 17-18 for all women ages 20 and older. The median birth interval for women age 15-19 is 27 months compared with 48 months for women over age 40. Married adolescents aged 15-19 may have higher fertility desire. Being low age at marriage if Bangladeshi women and in compliance with cultural and social view, a newly married women gives birth as soon as possible after marriage and takes one or two births before the age of 20. These births may happen with too shorter birth interval.

6. About 14.6 percent of women are illiterate and the rest 85.4 percent had primary or higher education. It is observed that only 29.2 percent of women live in urban areas against 70.8 percent in rural areas. From the religious status, it appears that majority of women (92.3%) are Muslim. It also appears that majority of women (90.5%) are currently not working. About 86.7 percent of married women have duration of marriage 0-4 years and the rest 13.3 percent of married women have duration of marriage 5-9 years

7. The variables education of women, working status of women, duration of marriage, children ever born, age at first marriage, religion and place of residence are significantly associated with age of women.

8. Also some demographic socio-economic and cultural variables are studied to isolate those that discriminate high-risk from low-risk childbearing in the context of age. Out of nine variables, duration of marriage, mother's education, age at marriage, religion, residence and place of residence are the factors that significantly discriminating high-risk childbearing from low-risk childbearing.

9. From logistic regression analysis, it is revealed that the most significant variables that influence early childbearing are education, place of residence and age at marriage.

## 6.2 Policy Implications of the Study

Early childbearing in Bangladesh is characterized by early start of motherhood, quick progress till the peak age of reproduction and slow progress till the end of childbearing period. Also it is a matter of fact that women have less capability to decide how many children they want, when to have them and whether they use contraception or not to avoid or terminate pregnancy. Motherhood is often forced by depriving young women of adequate birth spacing and spacing and contraceptive information. Due to traditional customs and norms and societal pressure an adolescent girl is forced to marry early and take birth in quick succession. Early sexual experience combined with a lack of information and services related to reproduction increases the risk of unwanted or unintended and too early pregnancy. At some older ages of reproduction Bangladeshi women are found to be reluctant to stop taking more births than they already have creating some hazards to reproductive performance. Now, the question is-can we bring the women belonging to the early childbearing.

No doubt that a considerable number of women give birth with high-risk and they belong to lower age (<20) spectrum of reproduction. These women have low age of marriage (63.9% have age of marriage of <16 years), no level education (14.6% of no education) and no work

experience (90.5%). On the other hand, women with early childbearing, more than 88.3% have age of marriage of less than 16 years, 92.3% have education at primary or more and about 9.5% are working. Though the stipulated age if Bangladeshi women is 18 years but average age of marriage is currently around 16 years. Government should increase the stipulated age of marriage from 18-20 years. Since, in our country no birth occurs beyond marriage, increasing age of marriage will result avoiding high-risk childbearing in the context of age. Such increase in age of marriage also reduces the length of childbearing span. Another way of avoiding high-risk childbearing to women of lower age spectrum is not to take first birth before the age of 20. This is possible by increasing the age of marriage to 20 years as well as using contraception at least by those who get marry before the age of 20. Increase in the level of education as well as creating job opportunities for the adolescents may help increase in the age of marriage. After marriage (before the age of 20) use of contraception is the only way to avoid children before the age of 20.

A considerable number of women are in the category of early childbearing according to age. Percentages of such early childbearing vary according to varying demographic, socio-economic and cultural variables of women. One of the ways to reduce the number of such women is to make them aware about the boon of taking marry children. Uptil now we have stressed and try to give some policy implications for women who are in early childbearing category. No doubt age is the most important attributes that clearly differentiate high-risk and low-risk

categories while birth interval is not. Women of high-risk childbearing category may have children having successive birth interval of more than 2 or 3 years or even more. Contrary to that, women belonging to low-risk childbearing category might have children having successive births at interval of less than 24 months. Thus, measure should be taken not only to bring high-risk childbearing women into low-risk childbearing category but also bring all women irrespective of age and birth interval to keep the limit of birth at some replacement level (TFR =2.13) and space births in planned way to reach the limit. The limit may be 2 or 3 births.

## 6.3 Recommendations

The following recommendations are made for consideration:

1. Increase the age of marriage of females from 18 years to 20 years. This might be possible by increasing the level of education of adolescent girls providing jobs to those adolescent girls who will not marry before the age of 20.

2. In the case of formidable socio-cultural and economic constraints improve has been made in some demographic areas particularly in the areas of early marriage and early childbearing of population of Bangladesh. Significant studies have been made in the areas of population policies and programs including the family planning activities. It is suggested that greater participation of women in development activities might create conditions favorable to the

pursuit of population goals. To avoid high-risk pregnancies, emphasis should be given to create job opportunities and improve the status of women through education while formulating population policies and programs.

3. Higher socio-economic status of women will contribute to change the pattern of early childbearing. Education of women and employment opportunities, particularly in rural areas will contribute to depress the level of early childbearing performance.

4. Education may provide better employment opportunities outside home and providing education to females, especially at the secondary and higher levels can increase age at marriage and age at first birth. Delaying the start of childbearing at young ages would save many women's lives.

## 6.4 Conclusion

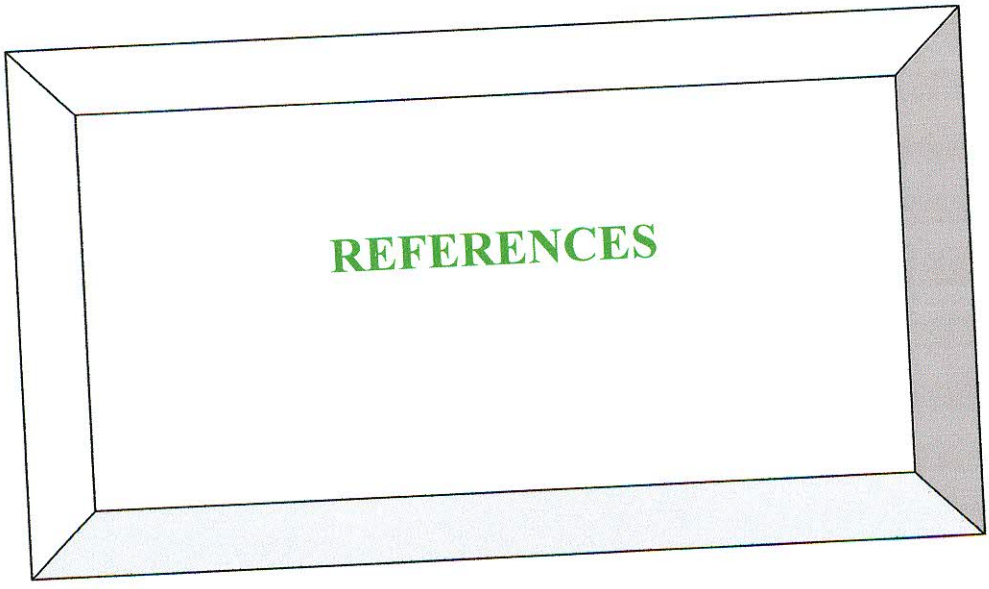
1. Early pregnancy is a critical issue in safe motherhood. To ensure safe motherhood, mothers should avoid early pregnancy. That is, a woman can participate in childbearing after age of 20 years. Delaying the start of childbearing at young ages would save many women's lives. Women aged less than 20 years face higher risk of dying from pregnancy and children.

2. To ensure save motherhood, the 1994 International Conference on Population and Development encourages high-risk women to have access to safe, effective, affordable and acceptable methods of family planning of their choice,..... and the right of access to appropriate health care services that will enable women to go safely through pregnancy and children (ICPD, 1994).

3. Family planning can be an effective way to avoid early pregnancies. While healthy needs vary in different areas, family planning is one service that is appropriate and beneficial in almost all settings. At the Alma Ata conference family planning was listed as one of the basic components of primary health care (WHO, 1978). In 1984, the United Nations Children's Emergency fund (UNICEF) endorsed family planning as on of high-priority techniques for improving child health, along with breastfeeding, immunization, family education and growth monitoring. The government of Bangladesh has undertaken an extensive family planning program to reduce population growth in the country. Improvement of health and nutritional status of children as well as creation of job opportunities particularly for women and increasing the education level of women may have decrease early childbearing and changing the pattern of childbearing. To achieve these, integrated poverty alleviation programs need to be strengthened.

4. Bangladesh is tried hard to accelerate its momentum towards achieving the Mid-Decade and World Summit for Children Goals and Millennium Development Goals regarding health of both mothers and children. Already much has been accomplished and is on target to achieve the goals, with the exception of the one for malnutrition.

5. The present study is a modest attempt to categorize the variables into two ways and to analyze the early childbearing pattern in context of prevailing socio-economic conditions. There is no doubt about the contributions of early childbearing pattern in regulating population growth of the country. Reasonably and hopefully it is believed that in the light of findings of the study, policy makers and planners will show a congenial and judicious path for the development of Bangladesh.


REFERENCES

# REFERENCES


Abedin, S. (2000). "Dynamics of Childbearing Pattern in Bangladesh". A thesis Submitted to the University of Rajshahi, in partial fulfillment for the degree of Master of Science in the Department of Population Science and Human Resource Development.

Abouzahr, C. and E. Royston, (1991). "Maternal mortality: A global factbook," Geneva, World Health Organization, 606 p.

Alam, N. (1995). "Birth spacing and infant and early childhood mortality in a high Fertility area of Bangladesh: Age dependent and interactive effects". Journal of Biosocial Science, 27 (4): 393-404.

Alan Guttmacher Institute (AGI), (1998). "Into a new world: Young women's sexual and reproductive lives". New York, AGI, 56 p.

Amin, R., J. Chowdhury, A. U. Ahmed, R. B. Idyll and M. Kabir (1993) "Reproduc change in Bangladesh: evidence from recent data", Asia-Pacific PopulationJournal, 8 (4): 39-58.

Amin, R., J. Chowdhury, A. U. Ahmed, R. B. Hill and M. Kabir (1993). "Reproductive change in Bangladesh: evidence from recent data, "Asia-Pacific population Journal, 8 (4): 39-58.

Amin, R.B. Hill and Y. Li., (1995). "Poor Women's Participation in Cridit-Based Self-Employment". The Impact on their Empowerment, Fertility, Contraceptive Use and fertility Desire in Rural Bangladesh. Pakistan Development Review, 34 (2): 93-119

Amin, S. Becker and J. Chowdhury (1990). "Recent evidence on trends and differentials in Bangladesh fertility," Journal of Bio-social Science, 22: 225-230.

Aziz, K.M. A. and C. Maloney (1985). Life Stage, Gender and fertility in Bangladesh (Dhaka, International Centre for Diarrhoeal Disease Research, Bangladesh).

Bankole, A. and C.F. Westoff, (1995). "Childbearing Attitudes and Intentions". Demographic and Health Surveys Comparative Studies, No. 17, Macro International, Calverton, MD, Table 5.2, p. 17.

Barkat-e-Khuda; A. Barkat, (1992). "Female education scholarship program: an impact study". Report prepared for the Wolrd Bank, Dhaka, and University Research Corporation (Bangladesh).

Barker, G.k. and S. Rich (1992). "Influences on adolescent sexuality in Nigeria and Kenya: Findings from recent focus-group discussions". Studies in Family Planning, 23 (3): 199-210.

Barua, A., B.B Barua, M.S. Ahmed, (1980). "Characteristics of abortion cases admitted in Sylhet Medical College Hospital in 1980". BFRB Report (1980), 357-369.

BBS, (1993). "Bangladesh Population Census, 1991". Dhaka, Bangladesh Bureau of Statistics, Statistics Division, Ministry of Planning, 1993.

BBS, (2003). "Bangladesh Population Census, 2001". Dhaka, Bangladesh Bureau of Statistics, Statistics Division, Ministry of Planning, 2003.

BDHS, (1993-1994). Bangladesh Demographic and Health Survey 1993-1994. National Institute for Population Research and Training. Dhaka, Bangladesh. Mitra and Associate and Macro International Inc. Calverton, Maryland, USA, 1993.

BDHS, (1996-1997). Bangladesh Demographic and Health Survey 1996-1997. National Institute for Population Research and Training. Dhaka, Bangladesh. Mitra and Associate and Macro International Inc. Calverton, Maryland, USA, 1996.

BDHS, (1999-2000). Bangladesh Demographic and Health Survey 1999-2000. National Institute for Population Research and Training. Dhaka, Bangladesh. Mitra and Associate and Macro International Inc. Calverton, Maryland, USA, 1999.

BFS, (1975). "Bangladesh Fertility Survey, 1975". Secondary Analysis, National Institute of Population Research and Training, Dhaka, Bangladesh.

BFS, (1989). "Bangladesh Fertility Survey, 1989". Secondary Analysis, National Institute of Population Research and Training, Dhaka, Bangladesh.

Bicego, G. and Ahmad, O.B. (1996). "Infant and child mortality". Calverton, Maryland, Macro International.

Bongaarts, J. (1978). "A framework for analyzing the proximate determinants of fertility in sub-Sahara Africa". Population and Development Review, 10 (3): 511-537.

Bongaarts, J. and R. Potter, (1983). "Fertility, biology, and behavior: An analysis of the proximate determinants". New York, Academic Press, 230 p.

Brittain, A.W., (1992). "Birth Spacing and child mortality in a Caribbean population". Human Foundation to Delhi, 4(2): 220-241.

Bulatao, R.A. (1979). "On the nature of the transition in the value of children". Working paper, No. 60A, Honolulu: East-West Population Institute.

Castro-Martin, T. (1995). "Women's education and fertility: Results from 26 Demographic and Health Survey," Studies in Family Planning, 26(4): 187-202.

Chakraborty, N., S. Sharmin and M.A. Islam (1998). "Differential pattern of birth intervals in Bangladesh", Asia-Pacific Population Journal, Vol. 11(4): 73-86.

Chardran, P.E. (1989). "Biological influence of infant death on fertility". Journal of Biosocial Science, 21(2): 217-221.

Chen, L.C., S. Ahmed, G. Melita and W.H. Mosley (1974). "A prospective study of birth interval dynamics in rural Bangladesh", Population Studies, 28: 277-397.

Chen, M.C. Gesche, S. Ahmed, A.I. Chowdhury and W.H. Mosley (1974), "Maternal mortality in rural Bangladesh". Studies in Family planning, 5(11): 334-341.

Chowdhury, A.I., A. de Francisco and K.M.A. Aziz (1994). "Infant and child mortality among high and low-risk Bangladeshi mothers in relation to some socio-economic variables". Bio-statistical Aspects of Health, (16), 199-215.

Cleland, J, J.F. Phillips, S. Amin and G.M. Kamal (1994). "The determinants of reproductive change in Bangladesh: Success in a childbearing environment", Washington, D.C., World Bank.

Cleland, J, J.F. Phillips, S. Amin and G.M. Kamal (1993). "Equality, security and fertility: a reduction to Thomas, Population Studies, 47(2):345-352.

Cnattingius, S, M.R. Forman, H.W. Berendes, and L. Isotalor, (1992). "Delayed childbearing and risk of adverse perinatal outcome". A population based study. Journal of the American Medical Association, 268(7): 886-890.

Cochrane, S.E., (1979). "Fertility and Education: what do we really know? World Bank Staff Occasional Paper, No.26 (Baltimore: The John Hopkins University Press, 1979).

Davis, K. and J. Blake (1956). "Social structure and fertility: an analytical framework", Economic Development ant cultural Change", 4(3): 211-235.

Dodge, C.P. (1992), "Meena her perspective on EPI Plus". Integration (32): 12-15.

Duza, M.B., (1990). "Population Issues and Strategies in Bangladesh". South Asian Study of Population Policy and Programs: Bangladesh, United Nation Population Fund-Dhaka 1990.

Eckholm, E. and K. Newland (1977). "Health: the family planning factor". Population Reports, Series J, No. 14. Washington, D.C., George Washington University Medical Certer, Population Information Program, 11P.

Fisher, R. A. (1940). The precision of discriminant functions. Annuals of Eugenics, 10, 422-429.

Forste, R. (1994). "The effects of breastfeeding and birth spacing on infant and child mortality in Bolivia". Population Studies, 48 (3): 497-511.

Fretts, R. C. and R. H. Usher, (1997). "Causes of fetal death in woman of advanced maternal age". Obstetrics and Gynaecology 89 (1): 40-45.

Gall, M. D., Borg, W. R., & Gall, J. P. (1996). Educational research: an introduction (6th ed.). New York: Longman Publishers USA.

Gertler, P. J. and J. W. Molyneaux (1994). "How economic development and family planning programs combined to reduce Indonesian fertility", Demography, 31(1): 33-63.

Girummer-Strawn, L. M., P. W. Stupp, and Z. Mei (1984). "Effect of a child's death on birth spacing: A cross-national analysis", In: Montgomey, M. R. and Chohen, B., Eds. From Death to Birth: Mortality decline and reproductive change. Washington, D. C., National Academy Press, P. 39-73.

Grant, J. P (1984). "The State of the world's Children 1984". New York, United Nations Children's Fund (UNICEF), p. 42.

Gubhaju, B., K. Streatfield and A. K. Majumder (1991). "Socio-economic, demographic and environmental determinants of infants mortality in Nepal". Journal of Biosocial Science, 23(4): 425-435.

Gyimah, S. O. (2002). "Lagged effect of childhood mortality on reproductive behavior in Ghana and Kenya". London, Canada, Population Studies Centre, University of Western Ontario, 23 p.

Haaga, J. (1989). "Mechanisms for the Association of Maternal Age, Parity and Birth Spacing with Infant Health", in A. M. Pamell, ed., Contraceptive Use and Controlled Fertility: Health Issues for Women and Children", National Academy Press, Washington, D. C.

Haoga, J. G. (1995). "Family planning as a promoter of child survival and growth". In: Pinstrup- Andersen, P., Pelletier. D., and Alderman, H. child growth and nutrition in developing countries: Priorities for action. Ithaca, New York, Cornell University Press, p. 176-198.

Harrison, K. A., (1980). "Approaches to reducing maternal and perinatal mortality in Africa". In: Philpott, R. H., ed. Maternity services in the developing world- What the community needs. Collage of Obstetricians and Gynaecologists, London, Rayal.

Hay, S. and H. Barbano, (1972). "Independent effects of maternal age and birth order on the incidence of selected congenital malformations". Teratology 6(3): 271-280.

Heaton, T. B. and R. Forste (1998). "Education as policy: The impact of education on marriage, contraception and fertility in Colombia, Peru, and Bolivia". Social Biology, 45(3-4): 194-213.

Henry, L. (1953). "Fonderments theoriquesdes measures dela fecondite natural Revue de I' Institute International de Statistique", 21: 135-151.

Henshaw, S. K. (1990). "Induced abortion: A word review, 1990". Family Planning Perspectives, 22(2): 76-89.

Hoa, H. T., N. V. Toan, A. Johansson, V. T. Hoa, B. Hojer and L. A. Person (1996). "Child spacing and two-child policy in practice in rural Veitnam: Cross sectionalsurvey. British Medical Journal, (Clinical Research Ed)".313 (7065): 1113-1116.

Hobcraft, J. (1987). "Does Family planning save chidren's lives?" 78 p.

Holaman, D. j., K. A. O'Conner, and J. W. Wood (1998). "Age and Female reproductive function: identifying the most biological determinants". In A. Hill and N. Naseic- Tailor (eds) Age: Between Nature and Culture. Oxford University Press, Forthcomng.

Hollos, M. and U. Larsen, (1992). "Fertility differentials among the Ijo in southern Nigeria: does urban residence make a difference?" Social Science and Medicine, 35(9): 1199-1210.

Hook, E.B. (1976). "Estimates of maternal age specific risks of a Down-syndrome birth in women aged 34-41". Lancet 2 (1975): 33-34.

House, W. J. (1998). "Prospects for Demographic Change in Vanuatu: Results of a KAP Survey", UNFPA Country Support Team for the South Pacific, Discussion Paper No. 17.

House, W. J. and N. Ibrahim (1999). "Childbearing by older women a forgotten issue?" Reflections, UNFPA, Suva.

ICPD, (1994). "International Conference on Population and Development, 1994". ICDP Programme of Action, Principle 4 and para. 7.2. Cairo.

Islam, M. A., Chakraborty, N., and Sharmin, S. (1996). "Differential Pattern of Birth Intervals in Bangladesh". Asia-Pacific Population Journal, Vol. 11(4): 73-86.

Islam, M. M., (1999). "Adolescent Childbearing in Bangladesh". Asia-Pacific Population Journal, Vol. 14, No. 3: 73-87.

Islam, M. M. and Mamun Mahmud (1996). "Marriage patterns and some issues related to adolescent marriage in Bangladesh", Asia-Pacific Population Journal, 11(3): 27-42.

Islam, A. A. Mamun and R. Bairagi (1998). "Fertility and its proximate determinants in Bangladesh". Evidence from the 1993-94 Demographic and Health Survey, Asia- Pacific Population Journal, Vol. 13, No. 3.

Islam, M. N. and M. M. Islam (1991). "On predicting a menorrhea period from breastfeeding duration". Working paper, No. 5, Statistical Research Unit, Department of Statistics, Dhaka University, Dhaka.

Islam, N. (1996). "Trends and Correlates of Marriage and Fertility in Bangladesh". A thesis submitted to the University of Rajshahi in Fulfillment of the requirements for the Degree of Doctor of Philosophy in Statistics.

Islam, N. and S. Abedin (1996). "Some Observations on Marriage, Contraception and Fertility in Bangladesh". Genus. Vol. L-II. No. 1-2.

Islam, N. and S. Abedin (2001). "Effect of Education on age at marriage and fertility in Bangladesh". Man in India, 81(3&4), pp. 339-343.

Islam, S. M., H. T. Khan and H. M. Khan (1993). "Factors affecting fertility in a rural area of Bangladesh", Bangladesh Journal Sci Res, 11(1): 21-26.

Islam, S. M. S. and H. T. A. Khan (1995). "Influences of selected socio-economic and demographic variables on fertility in Bangladesh". Asia-Pacific Population Journal, Vol. 10. No. 2,pp. 51-63.

Isvan, N. A. (1991). "Productive and reproductive decisions in Turkey: The role of domestic bargaining". Journal of Marriage and the Family, 53(4): 1057-1070.

Jejeebhoy, S. J. (1992). "Women's education, fertility and the proximate determinants of fertility". Presented at the expert group meeting on Population and Women, Gabarone, Botswana, Un, 40 p.

Kabir, H. (2000). "Determinants of contraceptive Norms in Rural Bangladesh". A thesis submitted to the Jahangirnagar University in conformity with the Requirements for the degree of Doctor of Philosophy in Statistics.

Kabir, M. and R. I. Chowdhury, (1993). "Infant and child motality levels and trends in Bangladesh". Secondary Analysis of Bangladesh Fertility Survey, 1989. National Institute of Population Research and Training (NIPORT). Dhaka.

Kabir, M., U. Rob, K. S. Ahmed, U. R. Saha, (1996). "Difference Between Husbands and Wives in Attitudes toward Contraceptive use and Fertility preferences". In: Kanter Andrew; Ahmed Al-Sabir; Nitai Chakrabarty ed. BDHS 1993-94 Extended Analysis. Dhaka: NIPORT/EWC. 213-229.

Kamal, N. and Slogget, (1993). "The Influence of Religiosity High Mobility and Decision Making on Contraceptive Use". Secondary Analysis of Bangladesh Fertility Survey 1989, Dhaka, NIPORT, 1993: 87-132.

Kapoor, P. N., (1991). "Analytical Review of Couple Protection Rates (1990)". Ministry of Health and Family Welfare, Government of India, New Delhi, October 1991.

Khalifa, M. and A. Farhat, (1997). "Factors affecting the probability and timing of parity progression in Egypt". Egyptian Population and Family Planning Review, 27(1): 2-18.

Khan, H. T. and R. Raeside (1997). "Factors affecting the most recent fertility rates in urban-rural Bangladesh". Department of Mathematics, Napier University, Edinburgh, Scotland, U.K. Socsic Med, 1997 Feb; 44(3): 279-289.

Khan, S. M. Islam, H. M. Khan and R. Bari (1993). "Fertility differentials in rural Bangladesh", Dhaka University Stud, 4191): 83-89.

Kirk, D. and B. Pillet (1998). "Fertility levels, trends, and differentials in sub-Shara Africa in the 1980s and 1990s". Studies in Family Planning, 29(1): 1-22.

Knodel, J. (1993). "Natural fertility: age patterns, levels, and trends, in R. A. Bulatao and R. D. Lee (eds)". Determinants of fertility in developing countries, Vol. 1: Supply and Demand for Children. Academic Press, New York, 61-102.

Koenig, M. A., J.F. Phillips and R.S. Simmons (1987). "Trends in family size preference and contraceptive use in Matlab, Bangladesh". Studies in Family Planning, 18(3), pp. 117-127.

Koenig, M. A., J.F. Phillips, O.M. Campbell and S. D'Souza, (1990). "Birth intervals and childhood mortality in rural Bangladesh". Demography, Vol. 27(2): 251-265.

Koenig, M. A., V. Fauveau, A.I., Chowdhury, J. Chakrabarty and M. A. Khan (1980). "Maternal mortality in Matlab, Bangladesh: 1976-85. studies in Family Planning, 19(2): 69-80.

Kost, K. and S. Amin, (1988). "Testing for direct reproduction mediated effects of socio-economic determinants of child survival". Presected at

the Annual Meeting of the Population Association of American, New Orleans.

Krebs, J.R. and N.B. Dabies (1993). "An introduction to Behavioral Ecology", 3rd edition Oxford, Blackwell.

Lerman, C. (1992). "The effect of migration on contraceptive usage and service point choice in Indonesia". Boulder, Colorado, Westview Press, p. 137-154.

Levin, A., B.K. Caldwell, and Barkat-e-Khuda (1997). "Demand for family planning services in rural Bangladesh: effect of cash prices and asses". In reproductive health in rural Bangladesh: Policy and Programmatic implications. Vol. 2. Eds. Thomas T. Kane, Barkat-e-Khuda, and James F. Phillips, p. 245-288.

Liskin, L.S., N. Kak, A.H. Rutledge, L.C. Smit and L. Stewart, (1985). "Youth in the 1980s: Social and health concerns". Population Reports, Series M, No. 9. Baltimore, Johns Hopkins School of Public Health, Population Information Program, 40 p.

Luther, M.Y., S. Thapa, and S.B. Westhey (1999). Nepal Survey shows that "Family planning saves lives". Asia-Pacific Population and Policy, 49: 1-4.

Mahalanobis, P.C. (1963). "On the Generalized Distance in Statistics". Proceeding at the National Institute of Science, India. 12: 49-55.

Mahmud, M. and M. Mazharul Islam(1999). "Health status of adolescent mothers and their child: evidence from Bangladesh Fertility Survey 1989". Social Science Review 16(1).

Maine, D., L. Reedman, F. Shaheed, and S. Frautschi (1994). "Risk, reproduction, and rights: The uses of reproductive health data". In: Cassen, R., Compiler, Population and development: Old debates, new conclusions. New Brunswick, Transaction Publishers, p. 203-227, 238-240 (U.S. Third World Policy Perspectives, No. 19).

Mason, K.O. (1984). "The Status of women: A review of its relationships to fertility and mortality". Paper prepared for the Population Science Division of the Rockfeller Foundations, Population Studies Center, University of Michigan, p.6.

Mason, K.O. (1996). "Wives Economic Division-Making Power in the Family in Five Asian Countries". Population Series, No. 86, East-West Center Working Papers.

Mazharul, O.I. (1999). "Adolescent childbearing in Bangladesh: Asia-Pacific Population Journal, Vol. 14 No. 3, pp. 73-87.

McCauley, A.P. and C. Salter, (1995). "Meeting the needs of young adults". Population Reports, Series J, Number 41. Baltimore, Johns Hopkins School of Public Health, Health, Population Information Program, 44 p.

McDevitt, T.M., A. Adlakha, T.B. Fowler and K. Harris-Bourne (1996). "Trends in adolescent fertility and contraceptive use in the developing world". Washington, D.C., Bureau of the Census, 89 p.

Miller, J.E., J. Trussell, A.R. Pebley and B. Vaughan (1992). "Birth spacing and children Mortality in Bangladesh and the Phillipines". Demography, 29(2): 305-318.

Miller, M. K. and C. S. Stokes (1985). Teenage fertility, socio-economic status and infant mortality". Journal of Bio-social Science, 17(2): 147-155.

Millman, S. and P.H. Hendershott (1980). "Early fertility and lifetime fertility". Family Planning Perspectives, 12: 139-149.

Mitra, S.N., Ahmed Al-Sabir, A.R. Cross and K. Jamil (1997). Bangladesh Demography and Health Survey 1996-97 (Dhaka, Mitra and Associates).

Montgomery, M.R. and C.B. Lioyd (1996). "Fertility and maternal and child health in: Ahlburg, D.A., Kelly, A.C., and Mason, K.O., eds". The impact of population growth on well being in developing countries. New York, Springer-verlag, p. 37-65.

Mostafa, M.G., (1972). "Methods of Statistics".

Mturi, A.J. (1996). "Patterns of fertility and contraceptive use in Tanzania". Published Doctoral Thesis, Southampton, U.K., University of Southampton.

Mturi, A.J. (1997). "The determinants of birth intervals among non-contracepting Tangania women". Department of Statistics and Demography, National University of Lesotho, Roma.

Nair, N.K. and L. Smith (1984). "Reasons for not using contraceptives: An international comparison". Studies in Family Planning, Vol. 15.No.2.

Nancy, E.R. (1998). "Gender, Power and Population Change". Population Bulletin, 52, No.1 (Washington D.C; Population Reference Bureau, 1997).

Naquib, M., A.M. Mohamed, and H.O. Eljack (1995). "Life table analisis of birth interval, north Sudan 1989, p. 90". Cairo Demographic Centre Research Monograph Series, No. 24, p. 676-705.

Nath, D.C., C.L. Kenneth and L.L. Donna (2003). "Socio-economical and Demographic Correlates of the open birth interval in a traditional Indian Society".

Nath, D.C., K.C. Land and G. Goswami (1999). "Effects of the status of women on the first birth interval in India urban Society". Journal of Biosocial Science, 31(1): 55-69.

Nath, D.C., K.K. Singh, K.C. Land and Talukdar (1993). "Age at marriage and the length of the first birth interval in a traditional society". Life table and hazards model analysis". Human Biology, 65(5): 783-797.

National Research Council, (1989). "Contraception and reproduction, health consequences for women and children in the developing world". Washington, D.C., National Academy Press, p. 130.

Noble, J., J. Covert and M. Yanagishita (1996). The World's youth 1996 (Wall Chart) (Eng, Fre, Spa) Washington, D.C., Population Reference Bureau, 2 p.

Nur, O.E. (1982). "The effect of infant mortality on reproductive behavior: the experience of the Sudan". Draper Fund Report (11): 14-16.

Nyarko, P., N. Madise and I. Dianond (1999). "Infant mortality and the pace of childbearing in Ghana: Some evidence of son preference". Proceedings of the Third African Population conference: The African Population in the 21st Century,Durban, South Africa, Department of Welfare, Republic of South Africa, 619-644.

Obaidullah, M. and A.R. Khan, (1981). "Social Dynamics of Abortion Services in Rural Bangladesh". BFRP Sixth Contributes Conference, Dhaka, Bangladesh.

Okie, S. (1998). "Beyond the birds and bees: Teaching children to make responsible Decisions about sex". Washington, Post, p. 212.

Park, C.B., M.A. Islam, N. Chakraborty and A. Kantner (1998). "Partitioning the effect of infant and child death on subsequent fertility: An exploration in Bangladesh". Population Studies, 52(3): 345-356.

Perkin, G.W. (1968). "Assessment of reproductive risk in non pregnant women". American Journal of Obstetrics and Gynaecology, 101(5), 709-717.

Population Reports J. (1984). "Family Planning Programs". Population Information Program, John Hopkins University, Hampton House, 624 North Broadway, Baltimore, Maryland 21205, USA.

Prakasam, C.P., U.P. Sinha, A. G. Khan and H. Ready (1993). "Influence of loss of child on mother's reproduction". Bombay, India, International Institutes for Population Science (IIPS), Research Report Series No. 4, 65p.

Rahim, A. and B. Ram (1993). "The impact of adolescent childbearing on the risk of marital dissolution in Canada". Presented at the

International Population Conference, Montreal, Canada, Aug. 24 Sep. 1, 13p.

Rahman, M., (1984). "Breastfeeding Patterns and Birth Intervals in Bangladesh". Studies in African and Asian Demography, Cairo Demographic Center Research Monograph Series, 12.

Rahman, M., (1998). "The effect of child Mortality on Fertility regulation in rural Bangladesh". Studies in Family Planning, Vol. 29(3) pp. 268-281.

Rahman, M., M. Kabir and R. Amin, (1996). "Relationship between survival status of first child and subsequent child death". Journal of Biosocial Science, 28(2): 185-191.

Rao, K.V. and T.R. Balakrishnam (1988). "Age at first birth in Canada: a hazards model analysis". Genus, 44(1-2): 53-72.

Ren, X. S. (1995). "Birth spacing dynamics in china: the cases of Hebei and Shanxi provinces". Population Research and Policy Review, 14(4): 411-425.

Rindfuss, R.R. and C. John (1983). "Social Determinants of Age at first birth". Journal of Marriage and the Family, 45(3): 563-565.

Rinehart, W., and A. Kois (1984). "Healthier mothers and children through family planning". Population Reports, Series J, No. 27.

Baltimore, Johns Hopkins School of Public Health, Population Information Program, May-June. 38p.

Rob, U., (1981). "Regional Variation and Determinants of Fertility in Bangladesh". Unpublished Ph.D. Dissertation, Department of Population Planning and International Health, University of Michigan, U.S.A.

Rochat, R.W., (1981). "Maternal mortality in the United States of America". World Health Statistics Quarterly 34(1): 2-13.

Rochat, R.W., S. Jabeen, M. J. Rosenberg, A. R. Measham, A.R. Khan, M. Obidullah and P. Gould, (1981). "Maternal and abortion related deaths in Bangladesh 1978-1979". International Journal of Gynaecology and Obstetrics, 19(2): 155-164.

Rodriguez, G., J. Hobcraft, J. McDonal, J. Menken and J. Trussell (1984). "A comparative analysis of determinants of birth intervals". WFS Comparative Studies, No. 30.

Ronsmans, C. (1996). "Birth spacing and child survival in rural Senegal". International Journal of Epidemiology, 25(5): 989-997.

Ross, J.A. and E. Frankenberg, (1993). "Findings from two decades of family planning research". New York, Population Council, 107 p.

Royston, E. and A. D. Lopez, (1987). "On the assessment of maternal mortality". World Health Statistics Quarterly, 40(3): 214-224.

Royston, E. and S. Armstrong, (1989). "Preventing maternal deaths". Geneva, World Health Organization.

Sembajwa, I. S. (1981). "Fertility and infant mortality amongst the Yoruba in western Nigeria". Changing Africa Family Project Series Monograph No. 6. Australian National University Press, Canberra.

Senderowitz, J. (1995). "Adolescent health: reassessing the passage to adulthood". World Bank Discussion Papers. No. 272. Washington D. C., World Bank.

Shahidullah, M. (1980). "Differentials Nuptiality Patterns in Bangladesh". Published thesis for Master of Arts in Demography at the Australian National University Canberra.

Shahidullah, M. (1994). "Breastfeeding and child survival in Matlab, Bangladesh". Journal of Biosocial Science, 26(2): 143-154.

Shaikh, K., (1984). "Nuptiality Pattern in Rural Bangladesh". Demography India, 13,1.

Shane, B. (1997). "Family planning Saves lives". 3rd ed. Washington, D. C., Population Reference Bureau, 28 p.

Shapiro, D. and O. Tanbashe (1997). "Employment, education and fertility behavior in Kinshasa: Some preliminary evidence". Population Research and Policy Review, 16(3): 259-287.

Simmon, R. and R. Mita (1995). "Women's status and family planning in Bangladesh: An analysis of focus group data". Final report. (New York) Population Council, 80 p.

Simmon, R. and A. M. Young (1996). "Family planning programs and other interventions to assist women: The impact on demographic change and on the status of women". Program on Population East-West Center. Foreword by Karen Oppenheim Mason, Honolulu, Hawaii.

Singh, S. and D. Wulf (1990). "Today's adolescents, tomorrow's parents: A portrait of the American". New York, Alan Guttmacher Institute, p. 96.

Singh, S. and G. Sedgh, (1997). "The relationship of abortion to trends in contraception and fertility in Brazil, Colombia and Mexico". Internal Family Planning Perspectives, 23(1): 4-14.

Srinivasan, K., P. C. Sexena, and A. Pandey (1994). "Birth order and birth interval statistics: use in assessing levels and changes in fertility". Journal of Family Welfare, 40(1): 1-14.

Srivastava, J.N. (1990). "Impact of birth spacing on child survival in rural Utter Pradesh". Demography India, 19(1): 141-146.

Starrs, A (1997). "The safe motherhood action agenda: Priorities for the next decade". New York, Family Care International, 100 p.

Starrs, A. (1987). "Preventing the tragedy of maternal deaths: a report on the International Safe Motherhood Conference". Nairobi, World Bank, World Health Organization, United Nations Fund for Population Activities.

Sulliban, J.M., S. O. Rutstein and G. T. Bicego (1994). "Infant and child mortality". Calverton, Maryland, Macro International. 63 p.

Swenson, I. (1978). "Early Childhood survivorship related to the subsequent interpreg- nancy interval and outcome of the subsequent pregnancy". Tropical pediatrics and Environmental Child Health 24(3): 103-106.

Swenson, I. And N. M. Thang, (1993). "Determinants of birth intervals in Vietnam: a hazard model analysis". Journal Tropical Pediatrics, 39(3): 163-167.

Swenson, I. And P. A. Harper, (1979). "High-risk maternal factors related to fetal wastage in rural Bangladesh". Journal of Biosocial Science, 11(4): 465-471.

Tam, L., (1993). "Rural to urban migration in Bolivia and Peru: Associations with child mortality, breastfeeding cessation, maternal care

and contraception". Presented at the annual meeting of the American Public Health Association, San Francisco, 8 p.

Tan, J. P. and M. R. Haines, (1984). "Schooling and Demand for Children". Historical Perspectives. Washington, D. C: World Bank.

Taslim, I.J. (1990). "Factors affecting non-use of contraceptive in rural Bangladesh". M.Sc. Thesis, Department of Statistics, J.U., Savar, Dhaka.

Thapa, S. and R. D. Ratterford, (1984). "Infant mortality estimates based on the Nepal Fertility Survey". Population Studies, 36(1): 61-80.

Trussel, I. And A. R. Pebley (1984). "The impact of family planning programme, infant, child and maternal mortality". World Bank Staff Working Paper.

Trussel J. and J. Menken (1978). "Early childbearing and subsequent fertility". Family Planning Perspectives, 10(4): 209-218.

Trussel, J., L. G. Martin, R. Feldman, J. A. Palmore, M. Conception and Noor Laily Abu Bakar (1985). "Determinants of birth interval length in the Philippines, Malaysia, and Indonesia: a hazard-model analysis". Demography, 22(2): 145-168.

UN, (1981). "Selected Factors Affecting Fertility and Fertility Preferences in Developing Countries". In World Fertility Survey Conference 1980, Vol. 2, World Fertility Survey, London.

UN, (1983). "The Determinants and Consequences of Population Trends". New York. Vol. 12, 11.

UN, (1984). "Report of the International conference on population". New York: United Nations.

UN, (1985). "Fertility Preferences". Selected Findings From the World Fertility Survey Data, New York. Department of International Economic and Social Affairs, United Nations.

UN, (1994). "The health rationale for family planning: Timing of births and child survival". New York, UN, 119 p.

UN, (1995). "World Population Prospects". The 1994 Revision. Population Division, United Nations, New York.

UN, (1995). "Programme Of action of the International Conference on the Population and Development". New York, UN, 115 p.

UN, (1996). "World Population Prospects". The 1996 Revision, Population Division, United Nations, New York.

UN, (1997). "Family Building and Family Planning Evaluation". United Nations. New York, 1997, Department of Economic and Social Affairs Population Division.

UN, (1999). "World demographic trends: Reports of the Secretary-General". Geneva, UN, 17 p.

UNICEF, (1994). "The girl child an Investment in Future". New York, UNICEF.

United Nations Development Program (UNDP), (1994). "Human development report 1994". New York, Oxford University Press, 226 p.

United Nations Population Division (UNPD), (1995). "Women's education and fertility behavior". Recent evidence from the Demographic and Health Surveys. New York, UN, 113 p.

Westoff, C. F., A.K. Blanc and L. Nyblade (1994). "Marriage and entry into parenthood". Calverton, Maryland, Macro International, p. 42.

Widayatun, (1991). "Women's status and child survival in West Java, Indonesia". Asia-Pasific Population Journal, Vol. 6, No. 1.

Williams, L.L., (1973). "Some observations on maternal mortality in Jamaica". West India Medical Journal, 22(1): 1-14.

Wilson, C., J. Oeppen and M. Pardoe (1988). "What is fertility?" The modeling of a concept. Population Index, 54: 4-20.

Winikoff, B. and M. Sullivan (1987). "Assessing the role of family planning in reducing maternal mortality". Studies in Family Planning, 18(3): 128-143.

World Bank, (1993). "World Development Report 1993: investing in health". New York, Oxford University Press, 329 p.

World Health Organization (WHO), (1978). "Director-General and United Nations Children's Fund. Executive Director. "Primary health care (International Conference on Primary Health Care, Alma-Ata, USSR)", New York, WHO, P 49.

World Health Organization (WHO), (1996). "Revised 1990 estimates of maternal mortality: A new approach by WHO". Geneva, WHO, 16 p.

World Health Organization (WHO), (1987). "Infections, pregnancies and infertility: Perspectives on prevention". Fertility and Sterility, 47(6): 964-968.

Yamaguchi, K. and L. R. Ferguson (1995). "The stopping and spacing of childbirth and their birth-history predictors: Rational-choice theory and event-history analysis", American Sociology Review, 60: 272-298.

Zhu, B. P., R.T. Rolfs, B. E. Nangle and J.M. Horn (1999). "Effect of the interval between pregnancies on perinatal outcomes". New England Journal on Medicine, 340(8): 589-594.

K. C. Bhuyan. "Multivariate Analysis and its Applications"

# ABBREVIATIONS

| | |
|---|---|
| CECB | Covariates of Early Childbearing in Bangladesh |
| BDHS | Bangladesh Demographic and Health Survey |
| HR | High Risk |
| LR | Low Risk |
| BBS | Bangladesh Bureau of Statistics |
| WHO | World Health Organization |
| BI | Birth Interval |
| BPS | Bangladesh Population Census |
| GDP | Gross Domestic Product |
| WB | World Bank |
| BFS | Bangladesh Fertility Survey |
| UN | United Nations |
| CPR | Contraceptive Prevalence Rate |
| TFR | Total Fertility Rate |
| DDS | Demographic Surveillance System |
| UNICEF | United Nations International Children Emergency Fund |
| NIPORT | National Institute for Population Research and Training |
| UP | Union Parishads |
| PSU | Primary Sampling Unit |
| V | Variable |
| Q | Question |
| ASFR | Age Specific Fertility Rate |
| CEB | Children Ever Born |
| CVPP | Cross Validity Prediction Power |