

## Factors Affecting Age for First Birth: An Exploratory Analysis on Bangladeshi Women

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### ABSTRACT

The present study aims to examine the existing situation of age at first birth as well as to identify the factors associated behind the issue. A secondary analysis of Bangladesh Demographic and Health Survey (BDHS) data, 2011, has been performed. To measure the effect of the explanatory variables on age at first birth, we perform bivariate analysis. After performing bivariate analysis, a logistic regression analysis has been performed to assess the effect of the explanatory variables. Findings of the study revealed that educational level, household economic status, respondent's working status have significant contribution for age at first birth among the female in Bangladesh. From the study it can be concluded that husband's or partner's education level, age of marriage and socio-economic status of female make a significant contribution in age at first birth.

**Keywords:** Logistic regression; deviance; age at first birth, Bangladesh

### INTRODUCTION

Bangladesh is one of the world's densely populated countries which have a population of about 150 million, with a corresponding population density of more than 920 persons per square kilometer. Most of the people living here are poor. Bangladesh is lagging far behind neighboring countries with respect to its economic development. Over the last five decades, there have been major achievements in some areas of health development both globally and in the South-East Asia region. However, despite many major achievements in health, a large number of women in our region continue to die from preventable causes related to maternity. The maternal deaths in the South-East Asia region are among the highest in the world and nearly every 2 min a woman dies as a result of complications of pregnancy or childbirth. This accounts for 40% of all global maternal deaths.

Perceiving the importance of the maternal health, World Health Day has been observed

over the world with the slogan pregnancy is special, let's make it safe in 1998 and make every mother and child count in 2005. In spite of effective program every minute a mother dies from complications in pregnancy and childbirth. That means 1,400 mothers die every day more than half a million mothers die every year (WHO, 2004). The survival and well-being of mothers are not only important in their own right but are also central to solving much broader economic, social and developmental challenges.

When mothers die or are sick, their families, communities and nations suffer as well. Improving the survival and well-being of mothers will not only increase the health of societies, it will also decrease inequity and poverty.

Age at marriage may be effect on fertility. In some situations, age at marriage may have no effect on fertility. First, if women start having children no matter when they marry, then the effect of age at marriage on fertility may be

limited. Second, if fertility is controlled within marriage by using contraceptives or other means, age at marriage may not have much effect on fertility because couples may decide how many children they would like to have regardless of the age at marriage. Third, if the level and pattern of fecund ability depends upon marriage duration and little on age, fertility is likely to be affected little by age at marriage because a woman, whether she marries early or late will have the same fertility experience. Although, fecundity is related to the age of a woman, it does not depend on age at marriage.

Marriage is almost universal in Bangladesh and postponement of first marriage has been outlined as the main determinant of fertility decline observed (Cleland et al., 1994). Meanwhile, the mean age at first marriage for women has indicated 16.6 years in 1974 to 8.2 in 1991 and 21 in 2001 and men 23.9 in 1974 to 25.3 in 1991 and 26.5 in 2001 (BBS, 1993, 2001). Total Fertility rate is 4.2 in 1990 (Mitra et al., 1993) but at present total fertility rate is 2.9 (BBS, 2001). There has been a substantial decline in the crude birth rate in Bangladesh, it was 34.4 per thousand population in 1986, declined to 30.8 in 1992 but at present 25.5 in 2001 (BBS, 1993, 2001). Though the TFR has dropped significantly, the maternal mortality rate is 320 per 100,000 live births (Niport, 2005). A high proportion of such deaths are attributed to a lack of emergency obstetric services and trained personnel. Doctors, trained nurses or midwives assist the delivery of only 13% of births in Bangladesh (BDHS, 2004). Additionally, trained traditional birth attendants assist 14% of births. Maternal mortality has come down 6 deaths per thousand live births to roughly 5 per thousand live births (BBS, 1993). This small but important decline is mainly attributed to increased availability of family planning and immunization services and a reduction in the number of births to high-risk mothers. In this context, age at first marriage to be a major proximate determinant of fertility. These facts have been the major motive of conducting the current research on age at first birth in Bangladesh.

## METHODS

### Data Source

This study uses the data from Bangladesh Demographic and Health Survey (BDHS), 2011

intends to serve as a source of population and health data for policy makers and the research community. In general, the objectives of the BDHS are to:

- Assess the overall demographic situation in Bangladesh.
- Assist in the evaluation of the population and the health programs in Bangladesh
- Advance survey methodology

### Description of Variables

The main concern of this study is to determine the factors effecting age at first birth. So we have to deal with a large number of variables associated with age at first birth. For the suitability of this study some variables are recorded and at the same time new variables created by combining information of some variables instead of the variables with their original codes.

Age of a woman at the birth of her first child is dependent variable in this study. Independent variables are age at first sexual intercourse, age at first marriage, place of residence, religion, husband's / partner's education level, respondent's education level, respondent working status and wealth index.

### Age at First Sexual Intercourse

Even with the onset of puberty, child bearing cannot take place unless one engages in sexual activities that eventually lead to pregnancy. Age at first sexual intercourse is an important variable of age of a woman at the birth of her first child.

### Age at First Marriage

In Bangladesh, marriage marks the point in a women's life when childbearing becomes socially acceptable. Age at first marriage has a major effect on age of mothers at first birth because women who marry early have, on average a lower age at first birth.

Mothers working status is also related in the birth of children. Working before marriage whether at home or outside is a strong factor in postponing the first birth.

### Place of Residence

Urbanization and its concomitant modernizing effects are believed to have a depressing effect on age at first motherhood. It was expected that women in rural areas would have a lower age at

first birth than their urban sisters for the following reasons: Urban women are more likely to practice contraception than their rural counterparts as shown earlier. Furthermore, the values and attitudes of the educated urban women have been modified through modernization. Rural women on the other hand still adhere to the traditional norms, values, beliefs and practices, which attach a lot of importance to marriage and reproduction. They will therefore start child bearing early so as to meet societal expectations.

### Religion

Religion is believed to play a part in shaping the views, norms, belief attitudes and practices of the people. These will in turn govern the reproductive behavior, and subsequently fertility. There are variations in values regarding marriage, marital dissolution and contraception among the different religions. Religion is coded into two categories – Muslims and Non-Muslims. In this study Non-Muslims category includes Hindus, Christians and Buddhists.

### Respondent's Education Level

Education, particularly women's education, has a significant interaction effect on fertility. It is believed that lower education leads to higher fertility, and likewise early fertility means lower education. With education, new values, aspirations, and a new outlook on life as well as skills for taking advantage of new opportunities come along. Advancement in women's education increases the potential for participation in a paid labor force in the modern sector of the economy. This in turn increases the opportunity cost of child bearing and creates trade-offs between child bearing and participation in the paid labor force. Education will keep women in the schools for longer years, thus delaying birth.

### Husband's Education Level

An educated married man is more concerned about the early age pregnancy related complications. So husband's education level plays an important role delaying the first birth.

### Wealth Index

An important factor for age at first birth is wealth index. This is because the poor cannot manage the television for watching and even they hardly manage to use contraceptive

methods. Wealth index is categorized into solvent and insolvent.

### Regression Analysis

Regression analysis is a conceptually simple method for investigating functional relationships among variables. A real estate appraiser may wish to relate the sale price of a home from selected physical characteristics of the building and taxes (local, school, county) paid on the building. We may wish to examine whether cigarette consumption is related to various socio-economic and demographic variables such as age, education, income, and price of cigarettes. The relationship is expressed in the form of an equation or a model connecting the response or dependent variable and one or more explanatory or predictor variables. In the cigarette consumption example, the response variable is cigarette consumption (measured by the number of packs of cigarette sold in a given state on a per capita basis during a given year) and the explanatory or predictor variables are the various socio-economic and demographic variables. In the real estate appraisal example, the response variable is the price of a home and the explanatory or predictor variables are the characteristics of the building and taxes paid on the building.

We denote the response variable by  $Y$  and the set of predictor variables by  $X_1, X_2, \dots, X_p$  where  $p$  denotes the number of predictor variables. The true relationship between  $Y$  and  $X_1, X_2, \dots, X_p$  can be approximated by the regression model,

$$Y = f(X_1, X_2, \dots, X_p) + \epsilon$$

Where  $\epsilon$  is assumed to be a random error representing the discrepancy in the approximation. It accounts for the failure of the model to fit the data exactly. The function  $Y = f(X_1, X_2, \dots, X_p)$  describes the relationship between  $Y$  and  $X_1, X_2, \dots, X_p$ . An example is the linear regression model

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_p X_p + \epsilon$$

Where  $\beta_0, \beta_1, \beta_2, \dots, \beta_p$  called the regression parameters or coefficients, are unknown constants to be determined (estimated) from the data. We follow the commonly used notational convention of denoting unknown parameters by Greek letters. The predictor or explanatory variables are also called by other names such as independent variables, covariates, repressors, factors and carriers.

### Estimation of the Parameters

Suppose we have a sample of  $n$  observations of the pair  $(X_{ji}, Y_i)$ ,  $i=1,2,\dots,n; j=1,2,\dots,p$ . In linear regression we use least technique to estimate the unknown regression coefficients, which provides a number of desirable properties under the assumption of linear regression model.

In logistic regression model, method of least square is not applicable because the outcome variable is dichotomous and the estimators do not have the desirable statistical properties. In such situation, the general method for estimating parameters of the logistic regression model is the maximum likelihood method. 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, the Newton Raphson method. In this method we have to evaluate the value of score vector and information matrix.

### The Score Vector

Let  $L(\beta)$  be the likelihood function where  $L(\beta)$  is a  $(p+1)$  vectors of parameters i.e.

$$\beta = (\beta_0, \beta_1, \beta_2, \dots, \beta_p)$$

$$L(\beta) = \prod [\pi(x_i)^{y_i} [1 - \pi(x_i)]^{1-y_i}]$$

The principle of maximum likelihood states that we use the value of  $\beta$  which maximum the likelihood equation. It is easier to work mathematically with log likelihood function

$$\text{Taking the first likelihood we get, } U(\beta) = \frac{\partial}{\partial \beta} l(\beta)$$

This equation is called the score vector.

### Interpretation of the Regression Coefficients

In linear regression, the interpretation of the regression coefficients is straightforward. It tells us amount of the change in the dependent variable for a one unit change in the independent variable. The coefficients of the logistic regression model are not that simple to interpret. To understand the interpretation of these coefficients, we have to consider rearrangement of the equation for the logistic regression. If we take logarithm of the ratio  $P_i$  and  $1-P_i$ , it will change to a simple linear

### Analysis of the Study

function of  $x_{ij}$ . Therefore the logistic coefficient can be defined as the change in the log of odds associated with a one unit change in the independent variables.

### Estimation of Odds Ratios

In logistic regression analysis the main purpose of estimating parameters of the independent variables is centered on the interpretation of the association between outcome and independent variables. In order to draw practical inference from the estimated coefficients of a fitted model odds ratio is used. In linear regression model the estimated coefficients for the independent variables represent the slope or rate of change in the function of the dependent variable for per unit change in the independent variable. Since dependent variable is in continuous scale. But for logistic regression such interpretation of the estimated coefficients will not be meaningful since the dependent variable is categorical. The interpretation will be feasible if the change in independent variable is compared with the change in logit since the logit is continuous and linear in the independent covariates. Hence, we see that interpretation involves the determination of the functional relationship between the dependent variable and the independent variables as well as the definition of the unit of change for the independent variables.

The first step is to determine which function of the dependent variable yields a linear function of the independent variables. Actually, the function that relates the dependent variables with independent variables is called the link function.

### P-Value

p-value is the minimum level of significance. p-value for a hypothesis test is the probability of obtaining a value of test statistic as extreme as more extreme than the one actually computed. The p-value for a statistic may be defined as the smallest value of which the null hypothesis can be rejected. If the p-value is greater than the significance level we reject null hypothesis. If the p-value is less than the significance level we do not reject.



**Table1.** Coefficients and p-values of the fitted regression model

Variables and their categories	Coefficient	t-value	p-value
<b>Intercept</b>	5.80721	37.530	0.0000
<b>Age at first sexual intercourse</b>	0.76856	108.435	0.0000
<b>Place of residence</b> Rural Urban **	0.02081	0.546	0.585
<b>Religion</b> Non-Muslims Muslims***	0.08877	1.587	0.113
<b>Husband/partner's education level</b> Not highly Educated Highly educated***	-0.29230	-4.809	0.0000
<b>Respondents working status</b> yes No***	0.29178	5.603	0.0000
<b>Respondent education level</b> Not highly Educated Highly educated***	-0.66513	-7.867	0.0000
<b>Age at first marriage</b>	0.06281	25.333	0.0000
<b>wealth index</b> Solvent Insolvent***	0.01397	0.396	0.692

\*\*\* Reference Category

Now from the table we can conclude that, the coefficient of age at first sexual intercourse has a positive value (0.76856) and the p-value is 0.000. This indicates that age at first sexual intercourse has positive impact on age at first birth. The coefficient of category rural has a positive value (0.02081) and the p-value is 0.585. Since the p-value is greater than the level of significance 0.05. From the p-value (0.113) we can say that, religions are not significant for age at first birth.

The estimated coefficient of mother's education level is negative (-0.29230) which reveals those who become less educated has early age at first birth. The p-value shows that women education level is highly significant for age at first birth. The coefficient of working women's is positive (0.29178). So, by increasing the rate of working women the age of mother at first birth will increase. The p-value shows that the factor is highly significant.

The coefficient of Husband/partner's education level is negative (-0.29230). That means if the partners are not highly educated then the age at first birth of mother will be low. From the p-value, partner's education is significant for age at first birth. Another important factor of this study is age at first marriage has highly significant effect over age at first birth. The

coefficient is positive (0.06281). which implies that, age at first birth increases with the age at first marriage.

### Model Comparison using Deviance

We, test the hypothesis  $H_0$ , that the response does not depend on Religion, that is  $\beta_3 = 0$ . The corresponding model is,

$$\text{Model1: } E(Y_i) = \beta_0 + \beta_1 x_{i1} + \beta_4 x_{i4} + \beta_6 x_{i6} + \beta_7 x_{i7}$$

$$\text{Model 2: } E(Y_i) = \beta_0 + \beta_1 x_{i1} + \beta_4 x_{i4} + \beta_6 x_{i6} + \beta_7 x_{i7} + \beta_3 x_{i3}$$

**Table2.** Analysis of variance table comparing model1 and model2

	Sum of Squares	DF	F	P-Value
<b>model1</b>	78699	5		
<b>model2</b>	78711	6	2.5691	0.109
<b>improvement</b>	12.622	1		

From the p-value, we can conclude that the data provide no evidence against  $H_0$  that is the response appears to be unrelated to religion.

Again, we test the hypothesis,  $H_0$ , that the response does not depend on Place of residence, that is  $\beta_2 = 0$ . The corresponding model is,

$$\text{Model 1: } E(Y_i) = \beta_0 + \beta_1 x_{i1} + \beta_4 x_{i4} + \beta_6 x_{i6} + \beta_7 x_{i7}$$

$$\text{Model 3: } E(Y_i) = \beta_0 + \beta_1 x_{i1} + \beta_4 x_{i4} + \beta_6 x_{i6} + \beta_7 x_{i7} + \beta_2 x_{i2}$$

**Table3.** Analysis of variance table comparing model1 and model 3

	Sum of Squares	DF	F	P-Value
model1	78710	5	2	
model3	78711	6	2.5691	0.5549
improvement	1.713	1		

From the p-value, we can conclude that the data provide no evidence against  $H_0$  that is the response appears to be unrelated to Place of residence.

Again, we test the hypothesis,  $H_0$ , that the response does not depend on Wealth index, that is  $\beta_8=0$ . The corresponding model is,

$$\text{Model 1: } E(Y_i) = \beta_0 + \beta_1 x_{i1} + \beta_4 x_{i4} + \beta_6 x_{i6} + \beta_7 x_{i7}$$

$$\text{Model 4: } E(Y_i) = \beta_0 + \beta_1 x_{i1} + \beta_4 x_{i4} + \beta_6 x_{i6} + \beta_7 x_{i7} + \beta_8 x_{i8}$$

**Table4:** Analysis of variance table comparing model1 and model4

	Sum of Squares	DF	F	P-Value
model1	78711	5		
model4	78711	6	.1324	0.716
improvement	1	1		

From the p-value, we can conclude that the data provide no evidence against  $H_0$ , that is the response appears to be unrelated to Wealth index.

## DISCUSSION

For a woman, first birth is a transition marks. Fertility depends on various social factors. In the demographic literature, age at marriage has long been regarded as one of the proximate determinants of fertility (Davis and Blake, 1956; Bongaarts, 1982). However the empirical evidence for the effects of age at marriage on fertility is inconsistent (Durch, 1980; van de Walle and Foster, 1990). In existing study, regression techniques are used to discover the fundamental factors that determine the respondent's age at first birth using the data of BDHS-2011. Although fertility depends not only on the choices of couples but also on many socioeconomic, demographic, health related factors. From the visualization of the study, it can be assumed that respondent's education level, respondent's working status, and partner's education level has significant level on age at first birth. A growing number of studies suggest that family wellbeing is conditioned by how soon child bearing begins and how rapidly it proceeds. The complete family sizes appear to be strongly influenced by age at first motherhood.

Bumpass (1978) in a study on age and marital status at first birth in the USA came up with a conclusion that both a young age at first birth and premarital first conception might be associated with rapid subsequent fertility. Therefore, he associated adolescent motherhood with rapid subsequent fertility.

Women who start child bearing at early ages are likely to have lower levels of education. They are likely to be rural residents or urban poor. Studies have shown that these women would adhere more to traditional patterns of birth spacing that results in long birth intervals and thus reduced fertility (Trussell and Reinis, 1989). It is found that the age at first birth varies by the educational levels of the mother's. The estimated coefficient is negative which reveals those who become less educated have early age at first birth. Educated mother always search for less number of child and have consciousness about advantage of late childbearing. Another significant factor, which is considered as an important determinant of age at first birth, is the age at first marriage. The coefficient estimated to be positive which implies that, age at first birth increases with the age at first marriage. The results shown in the above table also indicate that the variable age at first sexual intercourse, husband/partner's education level, respondent's(mother) working status all have significant effect on age at first birth. The remaining variables, place of residence, religion, wealth index are statistically insignificant. According to the study, mother's occupation status displays major influence on it. Without development in women's education scenario, rapid improvement in fertility scenario is not possible. There are some relations with education level and working status. If educated mothers don't have suitable job they will not be concerned to get higher education. So, government also need to suitable job market for them, which is still tough one for a developing country like Bangladesh.

## CONCLUSION

In this study we are trying to demonstrate the various key factors that are related to age at first birth. The findings of our analysis suggest that, the educational level of the women's and their partners is to be a key factor of age at first birth in Bangladesh. Birthplace don't strongly influence the age at first birth, but education and premarital work experience do. Work roles before marriage make a significant contribution to postponement of childbearing. Age at first marriage is highly correlated with age at first

birth, and when introduced as a covariate in a regression equation, age at first marriage mediates practically all the influence of all other social background variables on age at first birth. In other words, the way in which initial fertility is typically postponed is by delaying marriage, not by using contraception to delay the first birth. Traditionally, marriage and child bearing are probably planned together by most couples.

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