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Patterns and Differentials of Birth Intervals in Bangladesh

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I. Introduction

In recent years, Population scientists and policy makers have shown their keen interest to study on birth intervals and its determinants. The reasons are that birth intervals are not only related to childbearing period of women but also closely associated with fertility, reproductive health and child mortality. Lengthening the duration between births lessens the number of children a woman can have during her reproductive span assuming that the age at marriage and the age at which women cease childbearing do not change. Short birth spacing increase infant and child mortality (Mturi and Curtis, 1995), and this, in turn, can increase the number of births for a woman as infant and child mortality is positively connected to fertility in most cases (Preston, 1978).

The births of women may depend on many factors such as education, religion, socioeconomic status, region of residence, age at first marriage, sex of previous child, survival status of previous child, nutritional status and effective use of contraception. Earlier study shows that formal education of the respondents is one of the main avenues through which changes in fertility behavior take place (Gyimah, 2001). Stephen et al. (1988) has found that regional differences in childbearing patterns have mainly been interpreted in terms of socioeconomic developments and health care. Nath et al. (1999) has shown that per capita income of the households is one of the main covariates that strongly influence the length of the first birth interval. In addition, age at first marriage of females was found to be associated only with the timing of the first two children (Gyimah, 2005).

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II. Methods and Materials

This study uses the data collected in the Bangladesh Demographic and Health Survey conducted from March to August 2007. Details of the reproductive history of women were collected using the individual women's questionnaire together with background information. In this study, for analyzing the birth intervals of different parities, the dependent variable is measured in single months. A birth interval, defined as the length of time between two successive live births, indicates the pace of childbearing. First close birth interval is the interval between the date of marriage and the date of first live birth; the second birth interval is the interval between the first and the second birth, and so on. In the BDHS data, date of birth of each child was given in birth histories. Length of birth intervals are calculated by subtracting the date of birth of a child from the date of first marriage or the date of birth of next child (CMC). In 2007 BDHS data set, maximum fourteen live birth intervals have been observed but first five birth intervals cover most of the range of fertility histories of study women. Thus, in this study we have considered only first to fifth birth intervals as dependent variables.

The study only deals ever married women who had at least one live birth. Out of 10996 ever married women, 9849 women had at least one live birth. That is, there are 9849 marriages to first birth intervals. 119 women who did not give first birth within 15 years after their marriages are excluded from the analysis considering them as primary sterile. 929 respondents whose birth intervals are less than 9 months are also excluded from the analysis. The study didn't consider those respondents who had twin or multiple births. With these restrictions, the study has finally found 9948 respondents for first birth interval for analysis.

Accordingly, the study considers 9829, 7630, 5141 and 3326 respondents for second, third, fourth and fifth birth intervals respectively.

The present study has used a proportional hazard model with fixed covariates. Cox's proportional hazard model is suitable for the analysis of the data with censored observations (Cox, 1972). The proportional

hazard models, a specified case of the more general survival models, combined efforts of life table and regression. The model also recognizes the fact that chance of having a birth is time dependent and not constant over time. In addition, unlike parametric models, the Cox model does not make any assumption about the functional distribution of the timing and therefore, appropriate for events whose empirical distribution is unknown. The proportional hazard model assumes that all women with same covariates have identical risk of having birth over the course of study but these may vary among the groups with different covariates. The cases only considered here are those who have at least one live birth but women who do not have any birth at the time of survey are treated as right censored for first birth interval because in retrospective survey it is not possible to follow them until they either have a birth or reach menopause or even no longer to conceive. Those women who already have one child but have not given birth to a second child until the survey time are treated as "censored" for the second birth interval. Similarly, women with only two, three and four children on the survey date are considered as "censored" cases for the third to fifth birth intervals respectively. Thus, censored cases require special treatment in estimating exposure time because normal regression procedures are not appropriate. To overcome the problem of censoring, survival models make the assumptions that censored individuals will eventually experience the event at some future date. In that case, it would be appropriate to use a multivariate technique that allows for the inclusion of both censored and uncensored cases regarding time varying variable birth intervals.

The hazard function enables one to examine the risk of such variable by exponenting the regression coefficients, exp (ß). For the variable which is coded as dummy, each exponent of the coefficients exp (ß) represents the effect of the covariate on the hazard function for the reference group. The category with the relative risk 1.00 represents the reference category for the categorical variables. Value greater than one indicates that the relative risk of having birth is greater for this group compared with the reference group, while value less than one indicates a decrease in the risk.

Since the dependent variables, length of birth intervals are time dependent event, the proportional hazard regression is made to the relative risk of covariates of having birth among ever-married women in Bangladesh using 12 independent variables as predictors.

III. Distribution of Birth Intervals

The percentage distribution of respondents by marriage to first birth and subsequent birth intervals according to interval in months has been shown in the Table 1 which shows that about 47 percent women give their first birth within two years of marriage. In case of higher parities, about 26 to 29 percent women give births within same interval from the preceding births. This indicates that women are so eager to get their first birth within short time period since first birth after marriage is the most important event in the conjugal life.

Table 1 : Cox's proportional hazard estimates of relative risk of selected factors on neonatal mortality, BDHS, 2007

Factors	Independent variables	Model-1	Model-2	Model-3	Model-4
Socioeconomic	**Maternal Education**				
	No education	1.000	1.000	1.000	1.000
	Primary	0.892	0.835	0.877	0.782
	Secondary and above	0.814	0.769	0.774	0.772
	Father's Education				
	No education	1.000	1.000	1.000	1.000
	Primary	0.903	0.894	0.882	0.901
	Secondary and above	0.391***	0.370***	0.406***	0.378**
	Socioeconomic Status				
	Lower	1.000	1.000	1.000	1.000
	Medium	0.976	0.987	1.041	1.064
	Higher	0.872	0.892	0.992	0.996
	Place of Residence				
	Urban	1.000	1.000	1.000	1.000
	Rural	1.526*	1.688*	1.679**	1.609*
	Region of Residence				
	Barisal	1.000	1.000	1.000	1.000
	Chittagong	0.909	0.902	0.763	0.676
	Dhaka	0.795	0.747	0.731	0.692
	Khulna	0.559	0.636	0.728	0.701
	Rajshahi	1.341	1.366	1.396	1.324
	Sylhet	1.590	1.747	1.290	1.036

Environmental	**Housing material** Cement Tin Others		1.000 4.000*** 3.071**	1.000 3.575*** 2.802**	1.000 3.566*** 2.763**
Demographic	**Preceding birth Interval (in months)** ≤24 25-48 49 & above **Children under five** 1 2 and above **Mother's age** (in years) 15-19 20-34 35-49 **Previous death of sibling** No Yes			1.000 0.363*** 0.600** 1.000 1.429*** 1.000 0.713 0.689 1.000 1.348**	1.000 0.345*** 0.596** 1.000 2.430*** 1.000 0.717 0.699 1.000 1.697**

Table 1 : Contd

Factors	Independent variables	Model-1	Model-2	Model-3	Model-4
Health care	**Contraceptive Use** 0=No 1=Yes **Place of Delivery** 1=Home 2=Hospital /other places **Tetanus injection before birth** 0=No 1=Yes				1.000 0.608** 1.000 0.874 1.000 0.781
	-2 log likelihood **Chi-square** **DF** **Significance**	1694.47 28.875 12 0.004	1684.22 37.18 14 0.003	1622.30 114.80 20 0.000	1613.44 127.29 23 0.003

Note: *** p ‹0.01; ** p ‹0.05; * p ‹0.10.

This finding is very alarming for the reproductive health of the mothers as well as their children because these births occurred before legal age at first marriage (18 years) in Bangladesh. From second to fifth birth, highest percentage of women lies between 25 to 36 months, thereafter, percentage of women sharply decreases for all births with increases of higher intervals. In addition to tabular form of birth intervals the same is also displayed in Figure 1 to observe the patterns at a glance.

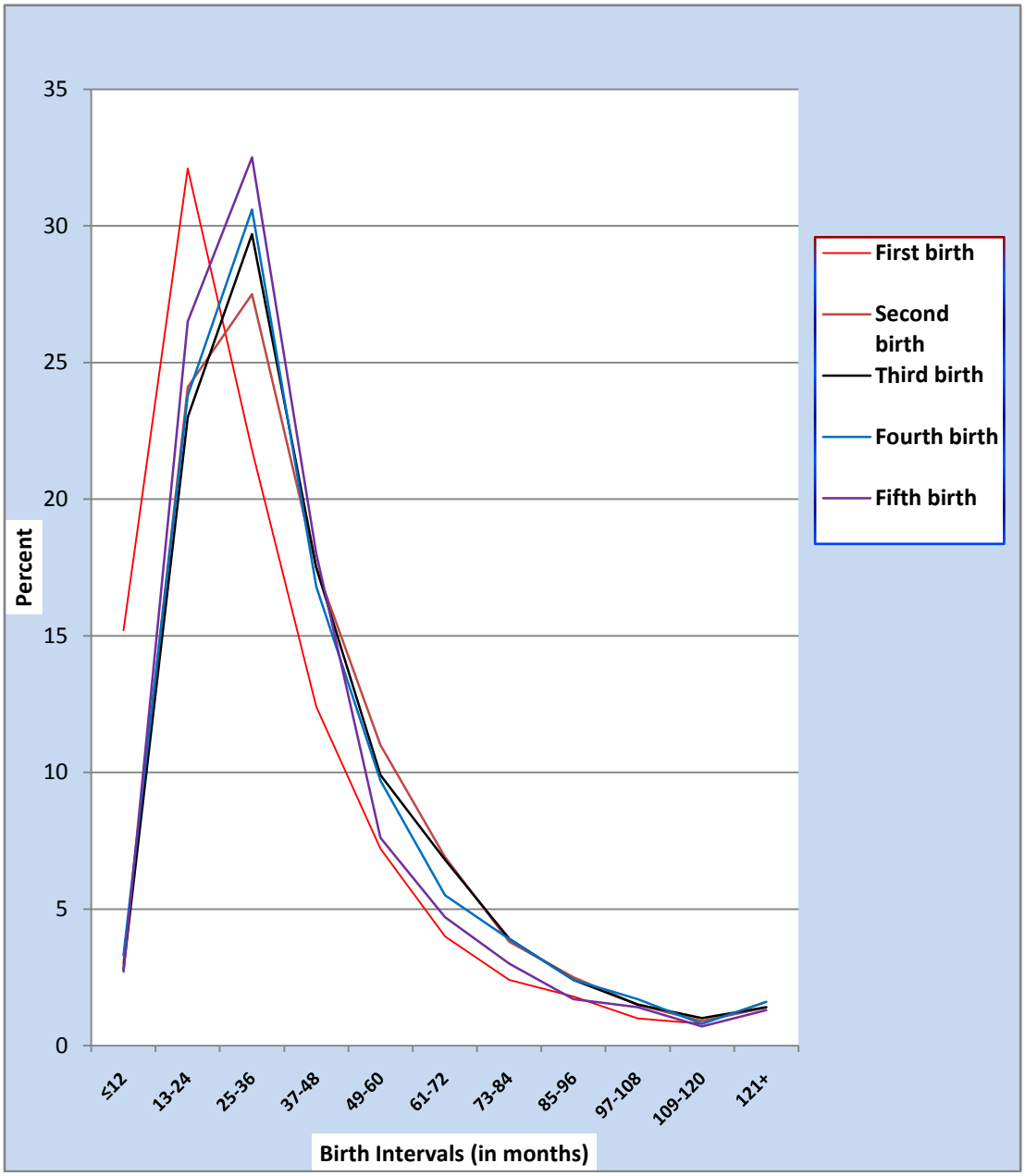

Figure 1 : Frequency curves of percentage distribution of birth intervals of the respondents, 2007

The line diagram given above illustrates that higher percentage of women gave their first birth within 3 years after marriage. After that the curve is declined. The shape characteristics of the curves are found to have positively skewed and unimodal, lies between 13 to 36 months.

In addition to percentage distribution and graphical representation of the respondents by different birth intervals, the descriptive statistics of the birth intervals for all births are also shown in Table 2.

Table 2 : Cox's proportional hazard estimates of relative risk of selected factors on post-neonatal mortality, BDHS, 2007

Factors	Independent Variables	Model-1	Model-2	Model-3	Model-4	Model-5
Socioeconomic	**Maternal Education**					
	No education	1.000	1.000	1.000	1.000	1.000
	Primary	0.672	0.839	0.846	0.857	0.816
	Secondary & above	0.391**	0.547*	0.537*	0.522*	0.519*
	Father's Education					
	No education	1.000	1.000	1.000	1.000	1.000
	Primary	0.972	0.960	0.978	0.982	0.989
	Secondary & above	0.820	0.849	0.942	0.945	0.941
	Place of Residence					
	Urban	1.000	1.000	1.000	1.000	1.000
	Rural	1.353	1.137	1.019	1.125	1.125
	Region of Residence					
	Barisal	1.000	1.000	1.000	1.000	1.000
	Chittagong	0.688	0.592	0.539	0.466	0.464
	Dhaka	0.644	0.607	0.627	0.598	0.615
	Khulna	0.735	0.701	0.830	0.821	0.819
	Rajshahi	0.465	0.412	0.461	0.480	0.465
	Sylhet	1.812*	1.911*	1.709	1.297	1.288
Environmental	**Drinking Water**					
	River/Pond/Unprotected		1.000	1.000	1.000	1.000
	Tubewell/Pipe		0.510	0.503	0.568	0.561
	Toilet Facility					
	Flush		1.000	1.000	1.000	1.000
	Pit/Hanging toilet		1.637	1.758	1.796	1.805
	No facility		4.441**	4.598**	4.414***	4.365**
	Housing Material					
	Cement		1.000	1.000	1.000	1.000
	Tin		1.023	1.038	1.045	1.027
	Others		1.057	1.066	1.087	1.059
Demographic	**Preceding Birth Interval (in months)**					
	≤24			1.000	1.000	1.000
	25-48			0.391***	0.361***	0.365***
	49 & above			0.503**	0.465**	0.471**
	Children Under Five					
	1			1.000	1.000	1.000
	2 & above			1.815**	1.715*	1.615*
	Previous Death Of Sibling					
	No					
	Yes			1.000	1.000	1.000
				1.606**	1.585	1.506
	Mother's Age (in years)					
	15-19			1.000	1.000	1.000
	20-34			0.908	0.947	0.969
	35-49			1.223	1.298	1.258

Table 2 : Contd

Factors	Independent Variables	Model-1	Model-2	Model-3	Model-4	Model-5
Health care	**Contraceptive Use**					
	0=No				1.000	1.000
	1=Yes				0.438***	0.426***
	Tetanus Injection before Birth					
	0=No				1.000	1.000
	1=Yes				0.962	0.973

Nutritional	**Body Mass Index**					
	≤18.5					1.000
	18.51-24.99					0.923
	25 and above					1.018
	Breastfeeding					
	0=No					1.000
	1=Yes					0.227**
	-2 log likelihood	952.02	937.59	909.78	901.86	899.17
	Chi-square	37.06	55.60	91.24	105.90	111.66
	DF	10	15	21	23	26
	Significance	.000	.000	.000	.000	.000

Note: *** p ‹0.01; ** p ‹0.05; * p ‹0.10.

Table 2 shows that mean birth intervals of first and subsequent births in Bangladesh are found about 33.5, 41, 41, 40 and 38 months respectively. The observed intervals are higher compared to other countries. The reasons behind the higher birth intervals are lower age at first marriage which is associated with adolescent fecundity for first birth, postpartum amenorrhea and breastfeeding for second to higher births. Malnutrition, intra-uterine mortality, temporary separation and contraception may be the other reasons for higher birth intervals in Bangladesh. Unexpectedly, fourth and fifth birth intervals are found lower than first three birth intervals. The reasons may be that while collecting data mothers may not give exact date of their children birth because of memory lapse.

The figures of standard deviation for all births indicate that women are heterogeneous in their reproductive characteristics. The mean age at first birth and subsequent births considered in this research work indicate the depressing situation among women in Bangladesh. Findings from Table 2 show that the mean age at first birth of the respondents is extremely lower (17.85 years), which is lower even than the legal age at first marriage. The result further shows that at the age of 24 years mothers already gave on an average three births in Bangladesh, which is one of the important barriers for the reduction of fertility.

IV. Differentials of Birth Intervals

The purpose of this section of the study is to examine possible variation of length of birth intervals by related background characteristics of the respondents. Since duration of birth intervals of Bangladeshi females significantly varies with their socioeconomic, cultural and demographic characteristics, therefore, in the present study a detailed examination has been made of length of birth intervals and its differentials by background variables and the results are presented in Table 3 accordingly. After categorizing every variable into different suitable classes, mean length of birth intervals by different background characteristics are determined. The associations between lengths of birth intervals with categorical background characteristics are tested by Chi-square test statistic after constructing the contingency tables.

Among the socio-economic factors, women's education has been widely recognized to have a major effect on birth interval and it is hypothesized that schooling delays marriage and subsequent births.

Table 3 : Mean birth intervals (months) of respondents and corresponding p-values of chi-square by different background characteristics, 2007

Background Characteristics	1st live birth interval		2nd live birth interval		3rd live birth interval		4th live birth interval		5th live birth interval	
	Mean	p-value	Mean	p-value	Mean	p-value	Mean	p-value	Mean	p-value
Respondent's Education										
0= No education	35.34	.000	38.55	.000	38.36	.000	38.87	.000	36.59	.096
1= Primary	30.20		39.10		40.98		40.46		38.86	
2= Secondary & above	27.35		49.11		52.48		49.56		42.60	
Husband's Education										
0= No education	33.53	.000	38.74	.000	39.09	.000	39.24	.001	36.46	.000
1= Primary	29.59		39.42		39.03		39.35		36.08	
2= Secondary & above	29.34		45.82		47.30		44.56		43.09	
Place of Residence										
Urban	29.72	.000	43.25	.000	44.28	.000	42.60	.027	41.61	.001
Rural	31.47		39.70		39,55		39.16		36.66	

Region of Residence										
Barisal	30.12		41.29		40.95		39.57		37.39	
Chittagong	28.16		37.45		38.41		39.10		36.66	
Dhaka	31.67	.000	41.55	.000	42.13	.000	41.47	.000	40.12	.000
Khulna	33.63		45.27		46.30		41.93		40.88	
Rajshahi	30.88		44.58		44.23		44.34		41.37	
Sylhet	29.64		35.20		36.15		36.64		34.22	
Socio-economic Status										
Lower	32.15	.000	39.37	.000	38.87	.000	38.51	.016	35.77	.022
Medium	30.90		39.44		38.31		39.82		38.03	
Higher	29.75		43.10		44.79		42.46		40.44	
Respondent's Working Status										
Working	32.61	.000	43.07	.000	41.92	.112	40.98	.017	37.57	.259
Not-working	30.63		40.04		40.83		39.98		38.82	
Religion										
Muslim	30.85	.204	40.84	.003	41.12	.440	40.27	.287	37.92	.268
Non-Muslim	30.50		42.52		41.65		40.39		37.99	
Access to Mass Media										
No access	31.48	.034	39.92	.000	39.07	.000	38.89	.019	36.72	.029
Have access	30.00		43.34		43.95		42.35		39.81	
Age at First Marriage (in years)										
≤14	35.34	.000	40.51	.000	40.68	.052	40.02	.856	37.93	.552
15-18	27.45		40.82		41.87		40.58		37.86	
19 & above	24.76		44.89		41.16		41.37		38.34	
Spousal Age Difference										
≤5										
6-10	31.86	.006	44.12	.000	43.05	.000	41.51	.000	39.36	.000
11 & above	31.58		40.70		41.68		40.81		37.87	
	31.14		39.62		39.75		39.02		37.76	

Table 3 : Cont

Background Characteristics	1st live birth interval		2nd live birth interval		3rd live birth interval		4th live birth interval		5th live birth interval	
	Mean	p-value	Mean	p-value	Mean	p-value	Mean	p-value	Mean	p-value
Age of the Respondents (in years)										
≤24	22.34	.000	35.51	.000	32.62	.000	32.35	.572	22.86	.023
25-34	29,43		43.54		42.41		38.12		34.70	
35 & above	37.96		40.62		41.23		41.37		38.88	
Sex of previous Child										
Male			41.97	.025	42.15	.542	40.67	.933	38.98	.458
Female			39.96		40.13		39.92		36.90	
Survival Status of Previous Child										
No			31.01	.000	31.67	.000	33.45	.000	32.26	.000
Yes			43.11		42.94		41.52		38.94	
Contraceptive Use										
Never Use	38.98	.000	40.18	.000	37.10	.000	37.54	.001	35.14	.002
Ever Use	29.17		41.14		41.94		40.88		38.66	
Body Mass Index										
≤18.50	32.29	.078	38.50	.000	38.77	.000	39.20	.092	36.81	.000
18.51-24.99	30.20		41.04		41.23		40.36		36.98	
25 and above	30.42		45.36		45.96		42.68		45.65	

Khan et al. (1998) found that the higher the educational attainment of women, the later they would have had subsequent births. Rindfuss et al. (1982) has obtained that at higher parities the pace of fertility has been lower throughout the entire period for those with the higher education. From Table 3, two major observations can be made with respect to mean birth intervals by education. First, the mean length of first birth interval falls with the rising of women education level. Since median age at marriage for uneducated and primary educated women are comparatively low in Bangladesh (Karim, 2008) and many women got married before menarche, hence their first mean birth intervals are higher than secondary or higher educated women. Secondly, in higher parities, the mean birth intervals have a positive relationship with the education level. The test statistic shows that there is a highly significant association between length of birth interval and female education.

Women whose husbands are educated have longer birth interval in second to fifth birth intervals except first one than those whose husbands have no formal education. In first birth interval, respondents whose husbands have no education have higher birth interval compared to women whose husbands have formal education. Lower age at first marriage among illiterate couples may be the important cause for higher mean first birth interval. The test statistic shows significant association in the difference of birth intervals with husband's education.

Place of residence may be another important determinant influencing birth intervals. According to the place of residence, people's traditions and lifestyles may differ. Rural females may breastfeed for a longer period than urban females, urban women may use contraceptives more often than rural females, and the socioeconomic status of urban women may be higher than that of rural females, resulting in better health and knowledge of and easier access to family planning methods for the former. It is observed from the Table 3 that mean duration of first birth interval of rural women is higher than those of urban females. The reason behind the fact that girls born and brought up in rural areas enter into wedlock at an early age than those who are exposed grew up in urban environment. Women having an urban background naturally get civic opportunity such as education, greater access to mass media and employment as compared to their rural counterparts, consequently they less likely to marry earlier. But after entering wedlock, urban women are much eager to get as soon as their first child. Khan and Raeside (1998) have also obtained same findings while studying the determinants of first and subsequent births in urban and rural area of Bangladesh using 1989 Bangladesh fertility survey data. Mean birth interval of higher parities urban respondents are greater than rural women. Urban females are observed to space their subsequent mean birth intervals after getting their expected first birth. The test statistic shows significant association between birth intervals and place of residence.

Region of residence plays an important role in the variation of timing of births. Regional differentials with timing of births are found to be significant in this study because of heterogeneous socio-economic characteristics among the respondents living in the different divisions of the country. The variations primarily stem from the cultural, educational, religious, climate, social and other socio-cultural diversities and differentials developmental effects that largely regulate the social norms and values. From Table 3, it is seen that women of Sylhet division have shorter birth interval than females of other divisions. Respondents living in Chittagong division have also shorter birth interval in the timing of first birth. Women residing in Khulna division have longer birth interval than women in other divisions. Higher mean age at first marriage among the women residing in Chittagong and Sylhet divisions is probably the main reason for shorter birth interval, mainly for timing of first motherhood.

Socio-economic status is an important determinant influencing in the difference of length of birth intervals. The test statistic shows significant association in the timing of first to fifth birth intervals with socio-economic status. In the marriage to first birth interval, women of lower socio-economic status have longer birth interval than women belong to medium and higher socio-economic strata. From second to fifth birth interval women belongs to lower socio-economic status have shorter mean birth interval than women of medium and higher socio-economic status.

Respondent's working status is one of the major determinants of birth interval. Mturi (1997) shows significant association between working status and length of birth intervals. Table 3 reveals that women who are working have longer spacing of births than who are not working. Higher parities women have higher mean length of birth interval than first one. The test statistic indicates statistically significant association in the first, second and fourth birth interval with employment status.

Access to mass media plays an important role in the variation of timing of spacing of births. Women who have no access to mass media have higher first birth interval than those who have access. This may occur due to early age at marriage before menarche, lower level of education and having rural background of those females who have no access to mass media. Mass media increases awareness regarding family service programs and also increase knowledge for keeping good health of mother as well as child. Thus, respondents having access to mass media have longer subsequent birth intervals compared to their counterparts.

Religion is significantly associated with birth spacing (Bavel and Kok, 2004). Mean birth interval of

Non-muslim women is slightly higher than Muslim women except first birth interval. Table 3 shows that religion has only significant association with second birth interval. Mean birth intervals of higher parities are longer than first mean birth interval.

Marriage is the starting point of legitimate sexual union and marks the beginning of child bearing period. Age at first marriage is considered as an important demographic variable affecting first and subsequent fertility. Marini and Hodsdon (1981) have shown that age at first marriage has a causal effect on the occurrence of a short first birth interval. Al-Nahedh (1999) found that age at marriage influenced not only the time to first birth but also subsequent fertility. Table 3 shows that there is an inverse relationship between age at first marriage and first birth interval. First mean birth interval is lower than mean birth intervals of higher parities. The test statistics shows significant association between age at first marriage and first to third birth intervals.

Reproductive behavior may vary depending on the age of the couples. Gubhaju (1986) demonstrated that first births exhibited many unique characteristics and tended to be proportionately more frequent in younger women in rural Nepal. There is also evidence that reproductive function declines with age and can contribute to longer interbirth intervals (Al-Nahedh, 1999). For examining the effect of age of the respondents, it is grouped into three categories based on the frequency of the respondents. Age of the respondents is found to be positively significant association with all birth intervals except fourth birth. First mean birth interval is observed to be lowest (22.34 months) for youngest cohort whereas it is increased to 29.43 months and 37.96 months for the middle aged women and women aged 35 years and above respectively. Same patterns of results are observed in fourth and fifth birth intervals. The mean length of birth interval for youngest is found lowest in all parities. The study shows that first birth intervals are very short compared to other intervals. Couples try to have their first birth as soon as possible after marriage. The length of the first birth interval is mainly determined by fecundity, which is closely correlated with a woman's age. Lastly, length of birth interval is increased with rising age of the respondents except oldest category of second and third parity. Spousal age difference is another determinant of length of birth intervals. The test statistics shows significant association in the differences of first to fifth mean birth interval with age differences of couples. Lengths of first to fifth mean birth intervals decrease with the increasing of age differences of couples except some categories.

Sex of previous child is another determinant affecting the spacing of second and subsequent births. The Table 3 presents significant association in the timing of second birth intervals with sex of previous child but insignificant association in the timing of other birth intervals. If first child is male then length of mean birth interval is 41.97 months whereas for female child, the mean birth interval is 39.96 months. From the Table 3, it is evident that for previous male child women have longer birth intervals than the previous female child. The results reveal that still there is a son preference among the couples in Bangladesh.

Survival status of previous child is considered a major determinant of subsequent births spacing. The death of the index child in infancy or early childhood has been found to be associated with short subsequent intervals in Tanzania (Mturi, 1997). From the Table 3, it is observed that for first dead previous child the length of second mean birth interval is 31.91 months where as for first alive previous child, the mean birth interval is 43.11 months. Thus, it is evident that for dead previous child women have shorter subsequent lengths of mean intervals than the previous alive child. The test statistic indicates significant association in the timing of spacing of births with survival status of previous child. This has been happened for several reasons. Sometimes, parents deliberately plan a new pregnancy to replace a lost child. There are involuntary causes for short spacing too-the death of a child cuts short nursing durations which results in earlier resumption of menses and ovulation. Reduction of infant and child mortality could increase the subsequent birth intervals.

Several studies reveal that contraceptive use affects length of birth interval (Yeakey et al., 2009; Bumpass et al., 1986). Sather (1988) suggests that the use of contraception is protective against short birth intervals. First mean birth interval of those women who didn't use contraception is found longer than that of ever users. Though the finding may be unexpected but is consistent with some earlier studies (Sather, 1988 and Azad, 2001). It has occurred due to the fact that most of the never users have no education, come from countryside and have lower age at first marriage. In higher parities women, birth intervals of ever users are found higher than those of never users. It has been found to be significant association between birth intervals and contraceptive use.

Nutritional status of women is known to affect the length of birth intervals. The women whose body mass index is less than 18.50 (malnourished) have shorter birth interval than those whose body mass index is greater than 18.50 except first birth interval. In the timing first birth, the women whose body mass index is less than 18.50 have longer birth interval. The test statistic presents significant association in the timing of first to fifth birth interval with body mass index of study women in Bangladesh.

V. Covariates of Birth Intervals: Proportional Hazard Analysis

In the preceding section, to study variations among categories of different background characteristics, mean birth intervals are examined. The associations of certain explanatory variables with the length of birth intervals have also been discussed on the basis of bivariate analysis. In the analysis, tests for independence were employed to identify the factors associated with duration of birth intervals of the females in Bangladesh. However, it is impossible to draw conclusions about presence or absence of controlled birth spacing by background characteristics from a simple comparison of mean lengths of birth interval between groups and testing associations (Knodel, 1987). However, from the forgoing analysis and discussion, it is obvious that some of the independent variables selected for the study have considerable impact on length of birth intervals. The results of the hazard analysis in terms of the hazard coefficients [exp (ß)] are presented in the Table 4. As suggested by the log likelihood ratio and the associated chi-square, the models are found to be statistically significant.

Table 4 : Cox's proportional hazard estimates of relative risk of birth intervals from first to fifth birth, Bangladesh

Background Characteristics	1st live birth interval	2nd live birth interval	3rd live birth interval	4th live birth interval	5th live birth interval
Respondent's Education					
0= No education	0.904***	1.436***	1.660***	1.538***	1.405***
1= Primary	0.993*	1.362***	1.489***	1.382***	1.280***
2= Secondary & above	1.000	1.000	1.000	1.000	1.000
Place of Residence					
Urban	1.012	0.938**	0.902**	0.933*	0.847**
Rural	1.000	1.000	1.000	1.000	1.000
Region of Residence					
Barisal	0.843***	0.709***	0.636***	0.704***	0.675***
Chittagong	0.958	0.923**	0.893**	0.864**	0.802**
Dhaka	0.820***	0.732***	0.673***	0.662***	0.651***
Khulna	0.754***	0.588***	0.446***	0.500***	0.510***
Rajshahi	0.892***	0.636***	0.547***	0.495***	0.484***
Sylhet	1.000	1.000	1.000	1.000	1.000
Socio-economic Status					
Lower					
Medium	1.028	1.129***	1.087*	1.139**	1.188**
Higher	1.010	1.086**	1.097**	1.099*	0.982
	1.000	1.000	1.000	1.000	1.000
Respondent's Working Status					
Not-working	1.047**	1.184***		1.166***	
Working	1.000	1.000		1.000	
Religion					
Muslim		1.141***			
Non-Muslim		1.000			
Age at First Marriage (in years)					
≤14	0.737***	1.262***	1.459***		
15-18	0.921**	1.170***	1.318***		
19 & above	1.000	1.000	1.000		
Spousal Age Difference					
≤5					
6-10	0.872***	0.871***	0.882***	0.920	0.806***
11 & above	0.956**	0.903***	0.906***	0.890***	0.919*
	1.000	1.000	1.000	1.000	1.000
Sex of Previous Child					
Male	-	0.891***			
Female		1.000			

Table 04 : Cont

Background Characteristics	1st live birth interval	2nd live birth interval	3rd live birth interval	4th live birth interval	5th live birth interval
Survival Status of Previous Child	-				
No		1.738***	2.120***	1.897***	1.763***
Yes		1.000	1.000	1.000	1.000
Contraceptive Use					
Never use	0.531***	1.127***	1.212***	1.315**	1.089
Ever use	1.000	1.000	1.000	1.000	1.000
Body Mass Index					
≤18.50	1.026	1.106***	1.131**	1.149**	1.158*
18.51-24.99	1.052**	1.091**	1.066	1.058	1.127
25 & above	1.000	1.000	1.000	1.000	1.000
-2log Likelihood	103035.99	125535.48	83314.78	51985.65	29648.45
Chi-square	1290.14	1303.49	1276.26	705.44	381.26
Model Significance	.000	.000	.000	.000	.000
Degree of freedom	18	21	18	17	16

Note: *** p ‹0.01; ** p ‹0.05; * p ‹0.10.

Women's education has important significant effect on risk of having births. From Table 4, it is observed that women with no educational background have less chance of having first birth than educated women specially, women having secondary and above level of education. From second to fifth birth intervals, the likelihood of having births decreases with the increasing level of education of the respondents. In general, educated women marry relatively in late. They intend to get first child in short period after marriage but not for subsequent births. The spacing between births after first birth among educated women indicates the intention to limit total children ever born.

Place of residence is an important factor in explaining the variation of vital events in the country like Bangladesh. In this study, the place of residence is found to have a significant impact on timing of first motherhood and also on the subsequent births.

Table 4 indicates that urban women have 1.012 times more risk to terminate first birth than rural women. As urban women are more educated and are get married late, they are more eager to get first birth and are intended to lengthen subsequent births. The findings of this study show that urban women are less likely to terminate their subsequent births compared to their rural counterparts.

The regional variation of birth intervals in Bangladesh is remarkable. The odd ratios reveal that women living in Chittagong, Rajshahi, Barisal, Dhaka, and Khulna division are likely to have 4 percent, 11 percent, 16 percent, 18 percent, and 25 percent less risk of first birth than women living in Sylhet division. Women of Khulna division have comparatively longer first to third birth intervals than other divisions. Women residing in Rajshahi division have longer fourth and fifth birth intervals than women of other divisions. Women from Chittagong division have shorter birth interval than other divisions except Sylhet division. Most of the women of five divisions have longer spacing of births than Sylhet division.

Socio-economic status has been observed to have significant influence on termination of second to fifth birth intervals but insignificant impact on first birth interval. Women of lower and medium socio-economic status have shorter birth interval than women belonging to higher socio-economic status. The risk of having second birth by women of lower and medium socio-economic status is 1.129 and 1.086 times higher compared to respondents of higher socio-economic stratum.

Respondent's working status has been found to have significant influence on termination of birth intervals. Women who are not working are 5, 18 and 17 percent more likely to cease first to second and fourth birth respectively than women who are working. Working women have longer birth intervals than non-working women. The cultural variable like religion is one of the important predictors for the variation of length of birth intervals. In a multivariate analysis, Nath et al. (1993) and Singh et al. (1993) reported substantial variations in the duration of birth intervals among different castes and religions. The findings of the study indicate that there are higher chances of having birth in Muslim women than to non-Muslims. The likelihood of having second birth is 1.14 times higher in Muslim respondents compared to non-Muslim females. The less contraceptive use and religiosity may be important causes for shorter birth intervals and consequently higher total children ever born. The study thus suggests that the fertility among vast majority is higher in Bangladesh.

Marriage is almost universal in Bangladesh and births are confined within wedlock. Therefore, marriage has a direct effect on fertility. In this study, age at first marriage is found to have significant impact on the first three birth intervals. The results in table 4 indicate that among the covariates considered in this analysis age at

marriage of the respondents is found to have a significant predictor of the probability of having births in Bangladesh. The odd ratios show that for first birth interval, women married at age less than 14 years and (15-18) years have 26 percent, and 8 percent lower risk of having a first birth respectively compared to those who got married at age 19 years and above. Though the result may be considered as unexpected but it may occur because of two reasons. Firstly, many women got married at a very low age of around their menarche and hence first birth is taking long time because of immaturity regarding reproductive performance.

Secondly, late marrying women may attempt to make up their lost time in a single state and hence having short first birth interval.

As age differences of couples are apparently higher in Bangladesh (9.5 years), spousal age difference is one of the important covariates in fertility analysis. In a study based on 54 developing countries, Abadian (1996) reported that fertility was strongly related to spousal age difference. From Table 3.4, it has been observed that spousal age difference has a significant influence on risk of having first to fifth births. The women whose spousal age difference is $\leq$5 and (6 -10) years have 13 percent and 4 percent less chances for having first birth than the women whose spousal age difference is 11 and more years. Almost similar patterns have been observed for higher birth orders. One of the important reasons is that higher spousal age difference usually be the higher age of male partners and higher age at first marriage for males. In these circumstances, the male partners are less likely to use contraception for achieving desired family size, which may be the cause of shorter birth intervals among couples whose spousal age difference is high.

Sex of previous child has been found to have strong significant effect on termination of second birth interval. Recent researches (Low, 1991 and Mace and Sear, 1997) indicate that the length of birth intervals is influenced by the sexes of the children born at the beginning and end of the birth interval. The odd ratios show that woman for previous male child are about 11 percent less likely to terminate their second birth interval than women who have female previous child. Blanchard and Bogaert (1997) show that birth intervals are longer following a male than a female child. The greater the cost of each child to the mother, and the longer the period over which that cost is extracted, the longer the birth interval should be. A few empirical studies (Hrdy, 1987 and Sieff, 1990) demonstrate within society differences in the attention, care and resource allocation to sons and daughters. It has been hypothesized that parents provide better care for males than females when males have a reproductive advantage over females with respect to resource access (Trivers and Willard, 1973).

Survival status of the previous child is one of the major determents of termination of birth intervals. The odd ratios show that child survival has a significant impact on length of birth intervals. The women whose previous child is dead have about twice more likely to terminate birth intervals than women whose previous child is alive. An inverse relationship has been frequently observed between birth interval and infant mortality (Pebley et al., 1991; Fuster et al., 1995).

Contraceptive use is one of the important proximate determinants of fertility, which has direct effect on birth interval dynamics. Couples use contraceptive methods either to space birth intervals or for stopping fertility. Contraceptive use has significant effect on termination of first to fourth birth and insignificant on fifth birth. Table 4 presents that never user women are 47 percent less likely to have first birth than ever users. As ever user females are more educated, get married in late and in greater access to mass media, thus they expect their first birth soon than their never user counterparts. The odd ratios also show that never user respondents have 13, 21, 32, and 9 percent more likelihood of having second to fifth birth than ever user females. The result implies that after having first birth, ever user females may lengthen their subsequent birth intervals.

Body mass index has been observed to have significant effect on having first to fifth birth. From Table 4, it has been observed that women whose body mass index is less than 25 have shorter birth interval than women whose body mass index is greater than 25. For first birth interval, women whose body mass index is less than 25 are 2.6 percent and 5.2 percent respectively more likelihood for termination of first birth interval than those whose body mass index is greater than 25.

VI. Conclusion

The purpose of this paper is to analyze five consecutive birth intervals to gain a better understanding of the fertility behavior of Bangladeshi women. For understanding distribution of birth intervals, percentage distribution of respondents of marriage to first birth and subsequent birth intervals is made. The study reveals that about 50 percent of ever married women become mother within first two years of marriage. The mean age at first marriage and first birth of the respondents are found 15.49 years and 17.85 years respectively. Thus, the results indicate that existing legal age at marriage act (18 years for females) is not functioning well across the country. From the curves of percentage distribution of birth intervals, it is observed that the distributions are positively skewed and unimodal.

Mean length of birth intervals of different background characteristics are calculated in order to study the variations among the categories. To examine whether there is any association between duration of birth spacing and selected background characteristics,

chi-square test for independence is employed. Bivariate analysis reveals that all independent variables have shown significant association with marriage to first birth interval except religion of the respondents. Similarly, except few variables, all explanatory variables are significantly related to third to fifth birth intervals. In addition to examine the association, to investigate the effect of each variable independently, which are found significant in bivariate analysis, Cox's proportional hazard regression model is employed.

Among the socio-economic factors, education level of women has been found to have important significant impact on risk of having birth. Educated respondents intend to get first birth in short period after marriage but longer period for subsequent births which is probably to limit family size. Therefore, emphasis should be given to increase the literacy rates irrespective of gender, which can increase spacing of births in Bangladesh. Urban-rural differentials have been observed in birth intervals. Thus, along with educational opportunities better civic facilities should be ensured in the vast populated rural areas. Women who have no work experience have more chances of having first and subsequent births compared to those who have work experience. It may be concluded that creating opportunity of work status of females could reduce the fertility in Bangladesh.

The women whose previous child is dead have about 2 times more likely to terminate birth intervals than women whose previous child is alive. Based on the findings, it can be concluded that reduction of infant and child mortality could increase the subsequent birth intervals. The Contraceptive use is also found to have significant effect on birth intervals. Modern and effective contraceptive methods should be supplied among mothers particularly to rural adolescent and illiterate women. In this context, unmet need of contraception should be ensured. Women whose previous child was male have longer birth interval than those whose previous child is female. As Bangladesh is still an agriculture-based, male-dominant, backward-cultured and developing country, couples expect male child who will eventually be inheritor and family earning member.

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