ISSN 1022-8594
JUJS

© 2018 Jahangirnagar University Journal of Science
Vol. 41, No. 2, pp.103-118

Socio-Economic and Demographic Determinants of Birth Intervals among Married Women in Bangladesh

Md. Abdus Sobhan[1], Md. Farooq Hasan[1], and Md. Moyazzem Hossain[2]

[1]Department of Mathematics and Statistics, Bangladesh University of Business and Technology, Dhaka-1216, Bangladesh

[2]Department of Statistics, Jahangirnagar University, Savar, Dhaka-1342, Bangladesh

Abstract

One of the important goals for sustainable development imposed by the United Nations is to ensure healthy lives and promote well-being for the people of all ages. The goal placed a target; that is, to reduce the global maternal mortality ratio to less than 70 per 100,000 live births and reduce under-five mortality to at least as low as 25 per 1000 live births in every country. However, the length of the preceding birth interval is one of the major determinants of infant and early childhood mortality. In order to identify the socio-economic and demographic determinants of preceding birth interval among married women in Bangladesh, this study considered a secondary dataset taken from the national representative survey Bangladesh Demographic and Health Survey (BDHS) 2014. At first, the Log-rank test is implemented for scrutinizing the association between the length of preceding birth intervals and different socio-economic and demographic variables. After that, the unadjusted and adjusted Cox proportional hazard regressions are applied separately to analyze the data. The overall mean duration of the birth interval was 58 months (median 52 months) among the surveyed women, almost one-third (30.5%) of the respondents having subsequent birth within 36 months. The results from unadjusted and adjusted Cox proportional hazard model examined that number of living children, the status of current contraceptive use, respondent's employment status, husband's age, husband's educational level, and wealth index were identified as significant determinants for increasing the length of birth intervals of currently married women in Bangladesh. It also found that women's birth intervals of Chattogram and Sylhet division had significantly ($p<0.01$) sorter birth intervals compared to other regions of the country. Hence, the organization who are concerned about women's birth intervals in Bangladesh should be taken an action on the mentioned determinants.

Keywords: Birth Intervals; Log-rank Test; Proportional Hazard Ratio; BDHS

E-mail of correspondence: mmhmm.justat@gmail.com

Introduction

The United Nations adopted global Sustainable Development Goals (SDGs) will have significant implications for national development planning in both developed and developing countries in the post-2015 period to 2030. In September 2015 more than 190 world leaders committed to 17 Sustainable Development Goals (SDGs) and 169 targets. Bangladesh government also determined to achieve all the goals by 2030. One of the important goals is to ensure healthy lives and promote well-being for the people of all ages [1]. The goal proposed to reduce the global maternal mortality ratio to less than 70 per 100,000 live births and also end of preventable deaths of newborns under-five children by 2030. In Bangladesh recently the maternal mortality rate is 176 deaths per 100,000 live births and the infant mortality rate is 31.7 deaths per 1,000 live births [2]. This ratio is too high in comparison with the desired goal. It is a big challenge for the government to achieve the goal. The length of the preceding birth interval is one of the major determinants of infant and early childhood mortality [3, 15, 17-18]. The maternal mortality rate also depends on birth spacing. Birth Spacing refers to the time from the date of birth of one child to the date of birth of another child [4]. It is one of the important indicators of fertility scenario of a country. Birth spacing affected by some socio-economic and demographic factors. Analysis of those factors affecting the birth cycles and those influencing the spacing of fertility has proven useful effects since in many cases they appear to vary quite substantially across populations [5]. There may be very personal reasons why it takes time between pregnancies. Planning a sufficient amount of time between pregnancies increases the chances of a good result for the mother and every child. If a parent has suffered an abortion or loss of a child, he may need time to suffer, assess risks, and work through fears and concerns before considering future pregnancy [6]. However, the birth interval of children varied with different biological and socio-economic factors of their families. Although the factors may vary in rural and urban areas of Bangladesh.

Many researchers of different countries have exercised about this matter and identified different factors led to increase or decrease the length of birth intervals. Mother's age at first birth [7, 14-16] and sex preference of child [7-8, 11-12] played an important role in the length of birth spacing. They showed for the previous female child the average preceding birth

interval was significantly shorter. The association between a mother's age at marriage and birth intervals was positive [11-12, 21]. Status of contraceptive use is found to be a major differential on determining the length of birth intervals [3, 7-8, 11]. Respondent's education level and working status were shown a positive association with the length of the birth interval [8-9, 12-13, 15-16]. Rabbi, et al., [7] showed in their research that a higher educated woman have 40 percent larger birth interval than that of illiterate women, while mothers completing the secondary education has 37 percent larger birth intervals than that of illiterate women. They also revealed working status as another important differential of the length of the birth interval [20-21]. Employed women found to have 11 percent larger birth interval than that of non-employed women [7]. The place of residence was found to be a significant difference for overall birth intervals and showed urban women have longer birth interval than rural women [7, 10-11]. Mass media exposure was seen as a significant determinant of births intervals.Therefore, the aim of this research paper is to determine the socio-demographic determinants of increasing length of birth intervals among currently married women in Bangladesh.

Methodology

Data Collection

This study considers a secondary dataset of Bangladesh Demographic and Health Survey (BDHS) 2014 to identify the most influential factors of the length of preceding birth intervals. The sample for the 2014 BDHS is nationally representative and covers the entire population residing in non-institutional dwelling units in the country. The survey used a sampling frame from the list of enumeration areas (EAs) of the 2011 Population and Housing Census of the People's Republic of Bangladesh, provided by the Bangladesh Bureau of Statistics (BBS). The details information on survey design and sampling frame is available in the report of BDHS 2014.

Methods

The Log-rank test is implemented for scrutinizing the association between the length of preceding birth intervals and different socio-economic and demographic variables. Unadjusted and adjusted Cox proportional hazard regressions are applied separately to analyze the data.

Log-Rank Test

If there are two samples, the goal is to test whether the hazard functions in the two samples are equal. Let $h_1(t)$ and $h_2(t)$ be the two hazard functions, and define the null hypothesis as:

$$H_0 : h_1(t) = h_2(t)$$

and the alternative hypothesis as: $H_0 : h_1(t) \neq h_2(t)$

To construct a test statistic, let r_{1j} and r_{2j} be the number of observations just before time t_j in samples 1 and 2, with $r_j = r_{1j} + r_{2j}$. Finally, let i_j be a variable that takes the value 1 if t_j occurs in sample 1, and 0 otherwise. Then, the log-rank (LR) test is

$$Z_{LR} = \frac{\sum_{j=1}^{n} i_j - \sum_{j=1}^{n} \frac{r_{1j}}{r_j}}{\sqrt{\sum_{j=1}^{n} \frac{r_{1j} r_{2j}}{r_j^2}}}$$

and Z_{LR} can be approximated by a normal distribution [19].

Cox Hazard Model

Studying the survival curves and performing a log-rank test is usually the first step in a survival analysis. A second step is often to control for other covariates, which is done with Cox regression, where the hazard function can be expressed as:

$$h(t) = h_0(t).\exp\left(\beta_1 x_1 + \beta_2 x_2 + ... + \beta_p x_p\right)$$

Here, $h_0(t)$ is the baseline hazard, $x_1, x_2, ..., x_p$ are the covariates, and $\beta_1, \beta_2, ..., \beta_p$ are regression coefficients that express the relationship between the covariates and the time to event. For the Cox regression model, the regression coefficients are interpreted via the HR. A 1-unit change in, say, x_1 will induce a change of $\exp(\beta_1)$ for the hazard rate, which means that the $HR = \exp(\beta_1)$.

To estimate the parameters $\beta_1, \beta_2, ..., \beta_p$, the partial maximum likelihood method is used. This produces estimates of the regression coefficients, standard errors, the statistical test with *P*-value, and confidence interval [19]. For the proportional hazard regression analysis, if a woman terminated her pregnancy with live birth that is uncensored, is coded "1" and "0" for otherwise that is censored and used as a new variable namely birth. In the multivariate analysis, women are compared according to the factors that could potentially affect their length of preceding birth intervals. The Proportional Hazard Ratio (PHR) is calculated at the individual level, factors related to birth spacing and in other contextual factors along with unadjusted PHR. A statistical software package STATA 14.0 has been used for all data analysis.

Results

Descriptive statistics

The analysis disclosed the determinants of birth spacing time among the currently married women of Bangladesh who had at least one live birth. Although the overall mean duration of the birth interval was 58 months (with median duration 52 months) among the surveyed women, almost one-third (30.5%) of the respondents having subsequent birth within 36 months. Even the birth interval time of 13.2 percent of respondents is less than 24 months (Table 1).

Table 1: Respondent's preceding birth interval time (in months), BDHS 2014

Birth duration (in months)	Count	Percentage	Mean	SE	Median
0-12	63	1.3	11.3	0.09	11
13-24	568	11.9	19.8	0.14	20
25-36	824	17.3	30.6	0.13	31
37-48	750	15.7	42.6	0.13	43
49-60	677	14.2	54.5	0.13	54
60-84	997	20.9	71.4	0.22	71
85 and above	891	18.7	112.3	0.88	104
Total	4770	100.0	58.1	0.48	52

The present study (Table 2) revealed from the descriptive statistics of some socioeconomic variables that most of the respondents were Muslims

(92.6%) and resided (70.8%) in rural areas. Place of residence had a significant association ($p<0.001$) with the birth interval of women. The median birth spacing time (50 months) in rural areas was lower than that of urban (55 months) areas. The highest percentage (19.7%) of respondents were taken from Chattogram division and second highest (18.6%) from Sylhet. The median preceding birth duration (64 months) was highest in Khulna while the lowest (37 months) was in Sylhet. Mother's age at survey date of the highest birth duration (median 72 months) group was 45 to 49 years while the lowest (24 months) group was 15-19. Birth spacing time had gradually been increased with the increases in the mother's current age. About one-third (33.2%) of the respondents became married at their age of fewer than 15 years and three-fourth were less than 18 years at marriage. The median length of birth interval decreases with the increase in the age of marriage of women. The log-rank test showed the highly ($p<0.001$) significant association between age at marriage of women and birth spacing time. About one of each eight mothers have been given birth of their first baby at the age of 15 years or less. On the other hand, half (48.8%) of participants whose age at first birth were more than 20 years. The median length of birth interval also decreases slightly with the increase of mother's age of first birth. The current research discovered that the length of birth spacing time was increased with the increases in the educational level of women. Husband's educational attainment also played an important role in increasing the duration of the birth interval (Table 2). It is noted and also alarming that 2 out of each 5 respondents and one-third of their husbands were not having formal education in the survey areas. About 7 out of each 10 (71.2%) of the respondents were not employed. There was seen a significant difference in the median birth interval between employed and unemployed women. A half (49.4%) of women have more than two living children and who have exactly two living children those preceding birth duration were very high (median 54 months). Respondents had the highest median birth interval who use modern methods, who had mass media exposure, whose previous child is a female. The median birth spacing time increased with changes in the status of wealth index as poorer to richer and it had the significant ($p<0.001$) association with the birth interval.

Table 2: Percentage distribution and mean duration of birth interval time by socioeconomic and demographic characteristics, BDHS 2014

Background characteristics	Percentage	Birth duration (in months)		Log-rank test
		Mean (SE)	Median	P value
Place of residence				
Urban	29.3	61.9 (0.96)	55	<0.001
Rural	70.8	56.6 (0.55)	50	
Religion				
Muslim	92.6	57.9 (0.50)	51	0.003
Non-muslim	7.4	60.3 (1.8)	57	
Region				
Barisal	11.0	61.2 (1.42)	57	<0.001
Chittagong	19.7	52.5 (0.94)	47	
Dhaka	17.0	61.0 (1.18)	55	
Khulna	10.3	69.8 (1.73)	64	
Rajshahi	11.6	67.1 (1.58)	63	
Rangpur	11.9	64.7 (1.41)	61	
Sylhet	18.6	43.5 (0.84)	37	
Mother's current age				
Mean (SD)	**25.5(0.07)**			
15-19	2.3	26.6 (1.09)	24	<0.001
20-24	24.4	41.5 (0.58)	38	
25-29	36.3	57.1 (0.64)	55	
30-34	24.2	68.4 (1.03)	63	
35-39	9.7	77.5 (2.01)	67	
40-44	2.3	85.9 (5.45)	69	
45-49	0.8	75.8 (7.84)	72	
Age at marriage				
Less than 15 years	33.2	63.1 (0.92)	57	<0.001
15-17	42.5	57.3 (0.70)	51	
18 years or more	24.3	52.8 (0.88)	46	
Mother's age at first birth				
15 years and below	11.7	61.4 (1.55)	54	<0.001
16-20	39.4	60.5 (0.79)	54	
21-25	34.4	55.3 (0.76)	49	
26 years and above	14.4	55.9 (1.25)	50	
Respondent's Education				
No education	21.4	60.4 (1.19)	50	<0.001
Primary	31.2	57.0 (0.87)	50	
Secondary	40.8	57.6 (0.69)	53	

Background characteristics	Percentage	Birth duration (in months)		Log-rank test
		Mean (SE)	Median	P value
Higher	6.7	59.3 (1.75)	57	
Husband's current age				
Mean (SD)	**34.0(0.09)**			
Less than 25 years	1.3	34.8 (2.17)	29.5	<0.001
25-29	12.1	43.4 (0.94)	39	
30-34	23.5	51.9 (0.79)	48	
35-39	28.2	58.8 (0.82)	55	
40-44	18.4	66.2 (1.22)	60	
45 years and above	16.5	69.1 (1.56)	59	
Husband's Education				
No education	31.9	57.7 (0.90)	49	<0.001
Primary	30.9	55.7 (0.82)	49	
Secondary	25.6	61.1 (0.97)	56	
Higher	11.6	59.3 (1.30)	55	
Respondent's employment status				
Non-employment	71.2	57.5 (0.57)	51	<0.001
Employment	28.8	59.6 (0.91)	54	
Number of living children				
Less than 2	3.9	41.3 (2.41)	30	<0.001
Exactly 2	46.8	59.5 (0.68)	54	
More than 2	49.4	58.2 (0.70)	50	
Wealth index				
Poorest	25.7	52.0 (0.85)	46	<0.001
Poorer	19.6	59.4 (1.12)	52	
Middle	19.0	58.4 (1.06)	53	
Richer	18.7	60.3 (1.19)	54	
Richest	17.0	63.2 (1.21)	58	
Use of Contraception				
Non-user	29.7	55.3 (0.86)	47	<0.001
User	70.3	59.4 (0.58)	54	
Mass media exposure				
No	82.6	57.6 (0.53)	51	<0.001
Yes	17.4	60.6 (1.15)	56.5	
Sex of previous child				
Male	51.8	57.3 (0.66)	51	0.224
Female	48.2	59.1 (0.71)	52	
Sample size (n)	**4770**			

Model Summary

The findings of the unadjusted proportional hazard model (Table 3) illustrated that the place of residence was found as a significant indicator ($p<0.001$) and it showed the rural women had 22 percent shorter birth interval than urban women. It is also observed that there was a 15 percent longer birth interval among non-Muslim women compared to Muslim women. The respondents of Chattogram and Sylhet division had shorter birth duration compared to that of Barisal while for others division had longer birth intervals. Mother's current age was found as a significant ($p<0.001$) differential on birth intervals. With the increases in mother's current age, the birth intervals were shorter. The analysis discovered that the women's age at marriage and age at first birth were significant ($p<0.001$) determinants on preceding birth intervals. It has observed that women's age at marriage with 15 to 17 years and more than 18 years increased 20 percent and 32 percent birth intervals respectively compared to that of less than 15 years. Respondent's and their husband's level of education played an important role ($p<0.001$) for increasing the birth intervals. Mothers with the educational level of primary, secondary and higher increased the larger birth intervals compared to illiterate mother by 29 percent, 51 percent, and 69 percent respectively. Fathers with the educational level of primary, secondary and higher increased the larger birth intervals by 28 percent, 47 percent, and 51 percent respectively compared to their illiterate counterparts (Table 3). The birth intervals were shorter with increases the number of living children ($p<0.001$). The wealth index was found to be a significant determinant for increasing of birth intervals. Use of contraception was a substantial factor ($p<0.001$) on determining the duration of birth intervals. Use of contraceptive methods showed a negative association with the length of birth intervals. It may be happened due to they start to use contraceptive after taking off their desired children. Women who use any contraception method had 17 percent less birth interval compared to contraceptive nonusers. The mass media exposure was found to be an important cause of increasing the length of birth intervals. Women who have mass media exposure were found to have 24 percent greater birth interval than those who have not.

Table 3: Proportional hazard model on the determinants of birth interval time for the significant socioeconomic and demographic covariates, BDHS 2014

Background characteristics	Having live birth			Having live birth		
	Unadjusted PHR	p value*	Confidence Interval	Adjusted PHR	p value*	Confidence Interval
Place of residence						
Urban	Ref			Ref		
Rural	1.22	<0.001	(1.15, 1.30)	1.04	0.332	(0.96, 1.11)
Religion						
Muslim	Ref			Ref		
Non-muslim	0.85	0.003	(0.76, 0.95)	0.98	0.723	(0.88, 1.09)
Region						
Barisal	Ref					
Chittagong	1.20	0.001	(1.07, 1.34)			
Dhaka	1.03	0.602	(0.92, 1.15)			
Khulna	0.93	0.265	(0.82, 1.05)			
Rajshahi	0.96	0.467	(0.84, 1.08)			
Rangpur	1.01	0.931	(0.89, 1.13)			
Sylhet	1.56	<0.001	(1.39, 1.73)			
Mother's current age						
15-19	Ref			Ref		
20-24	6.14	<0.001	(5.04, 7.48)	2.00	<0.001	(1.62, 2.47)
25-29	15.24	<0.001	(12.54, 18.52)	2.22	<0.001	(1.78, 2.77)
30-34	18.21	<0.001	(14.94, 22.20)	1.68	<0.001	(1.33, 2.13)
35-39	16.84	<0.001	(13.65, 20.77)	1.40	0.009	(1.09, 1.81)
40-44	17.45	<0.001	(13.38, 22.75)	1.27	0.132	(0.93, 1.73)
45-49	17.45	<0.001	(12.01, 25.36)	1.28	0.240	(0.85, 1.93)
Age at marriage						
Less than 15 years	Ref			Ref		
15-17	0.80	<0.001	(0.75, 0.86)	1.04	0.341	(0.96, 1.12)
18 years and more	0.68	<0.001	(0.63, 0.73)	1.07	0.206	(0.96, 1.19)
Mother's age at first birth						
Less than 15 years	Ref			Ref		
15-17	0.73	<0.001	(0.66, 0.80)	0.93	0.147	(0.83, 1.03)
18-20	0.62	<0.001	(0.57, 0.69)	0.93	0.278	(0.83, 1.06)
21 years and above	0.46	<0.001	(0.42, 0.52)	0.92	0.307	(0.79, 1.08)
Respondent's Education						
No education	Ref			Ref		
Primary	0.71	<0.001	(0.66, 0.77)	1.02	0.590	(0.94, 1.12)
Secondary	0.49	<0.001	(0.46, 0.53)	1.02	0.727	(0.93, 1.12)
Higher	0.31	<0.001	(0.28, 0.36)	0.95	0.546	(0.81, 1.12)

Background characteristics	Having live birth			Having live birth		
	Unadjusted PHR	p value*	Confidence Interval	Adjusted PHR	p value*	Confidence Interval
Husband's current age						
Less than 20 years	Ref			Ref		
25-29	3.01	<0.001	(1.31, 3.93)	1.26	0.096	(0.96, 1.66)
30-34	6.06	<0.001	(4.67, 7.85)	1.38	0.022	(1.05, 1.81)
35-39	9.40	<0.001	(7.26, 12.18)	1.32	0.048	(1.00, 1.74)
40-44	11.66	<0.001	(8.97, 15.15)	1.26	0.115	(0.95, 1.67)
45 years and above	12.32	<0.001	(9.48, 16.04)	1.34	0.048	(1.00, 1.79)
Husband's Education						
No education	Ref			Ref		
Primary	0.72	<0.001	(0.67, 0.78)	0.95	0.163	(0.88, 1.02)
Secondary	0.53	<0.001	(0.49, 0.57)	0.87	0.001	(0.79, 0.95)
Higher	0.49	<0.001	(0.44, 0.54)	0.87	0.031	(0.76, 0.99)
Respondent's employment status						
Non-employment	Ref			Ref		
Employment	1.32	<0.001	(1.24, 1.40)	1.08	0.025	(1.01, 1.15)
Number of living children						
Less than 2	Ref			Ref		
Exactly 2	27.98	<0.001	(24.05, 32.56)	23.47	<0.001	(19.98, 27.58)
More than 2	44.81	<0.001	(38.47, 52.19)	40.66	<0.001	(34.03, 48.58)
Wealth index						
Poorest	Ref			Ref		
Poorer	0.75	<0.001	(0.69, 0.82)	0.84	<0.001	(0.77, 0.91)
Middle	0.71	<0.001	(0.65, 0.78)	0.90	0.026	(0.82, 0.99)
Richer	0.64	<0.001	(0.59, 0.70)	0.86	0.002	(0.78, 0.95)
Richest	0.58	<0.001	(0.53, 0.64)	0.88	0.026	(0.78, 0.98)
Use of Contraception						
Non-user	Ref			Ref		
User	1.17	<0.001	(1.10, 1.24)	0.97	0.318	(0.91, 1.03)
Mass media exposure						
No	Ref			Ref		
Yes	0.76	<0.001	(0.71, 0.82)	1.02	0.562	(0.94, 1.11)

PHR = *Proportional hazard ratio;* **Ref** = *Reference category*

Discussions and Conclusions

From the above analysis and findings, it has been found that different determinants have different consequences on the length of birth intervals. It is revealed that 60 percent women were terminated their pregnancy with live birth and those overall mean duration of the birth interval was 58 months (median 52 months); almost one-third (30.5%) of the respondents having subsequent birth within 36 months. Place of residence had a significant association ($p<0.001$) with the birth interval of women. The birth spacing time in rural areas was lower (unadjusted PHR=1.22) than that of in urban areas that are similar to Rabbi's research [7, 11]. The birth intervals were very short with increases the number of living children ($p<0.001$) found by adjusted and unadjusted PHR and it is consistent with others [15]. The wealth index was found to be a significant ($p<0.001$) determinant for increasing of birth intervals. The birth spacing time increased with changes in the status of wealth index as poorer to richer. Use of contraception was found as a substantial factor ($p<0.001$) on determining the duration of birth intervals. Use of contraceptive methods showed a negative association with the length of birth intervals while others showed the negative association. It may be due to a couple start to use contraceptive after taking off their desired children. The women's birth intervals of Chattogram and Sylhet division had significantly ($p<0.01$) sorter birth duration compared to that of Barisal. It was also seen that women's age at marriage and age at first birth were significant ($p<0.001$) determinants on preceding birth intervals. The length of birth interval increases (PHR=0.80 for the age of 15-17 years and PHR=0.68 for more than 17 years) with the increase in the age of marriage of women. The log-rank test showed the highly ($p<0.001$) significant association between age at marriage of women and birth spacing time.

For both unadjusted and adjusted proportional hazard ratio, the length of birth spacing time was increased with the increases of husband's educational level. There was seen a significant difference in the median birth interval between employed and unemployed women. A half (49.4%) of women have more than two living children and who have exactly two living children those preceding birth duration were very high (median 54 months). Respondents had the highest median birth interval who use

modern methods, who had mass media exposure, whose previous child is a female. Using data analysis, findings, and above discussion, it might conclude that authority has to emphasize on some remarkable determinants for increasing length of birth intervals. The birth spacing time increased with changes in the status of wealth index as poorer to richer and it had the significant ($p<0.001$) positive association with the birth interval. Husband's educational attainment also played an important role in increased duration of the birth interval. Number of living children, Status of current contraceptive use, and Respondent's employment status were detected as significant determinants to increase the length of the birth spacing of currently married women in Bangladesh.

References

[1] https://www.un.org/sustainabledevelopment/health/ Dated: March 08, 2019

[2] https://www.indexmundi.com/bangladesh/demographicsprofile.html Dated: March 05, 2019

[3] Fotso, J. C., Cleland, J., Mberu, B., Mutua, M., & Elungata, P., Birth spacing and child mortality: an analysis of prospective data from the Nairobi urban health and demographic surveillance system. *Journal of biosocial science*, 2013, **45(6)**: 779-798.

[4] Guide to DHS Statistics: DHS-7

[5] Rodríguez, G., Hobcraft, J., McDonald, J., Meneen, J., & Trussel, J., A Comparative Analysis of Determinants of Births Intervals, WFS Comparative Studies. International Statistical Institute, World Fertility Survey, 1984.

[6] Maitra, P., & Pal, S., Birth spacing and child survival: Comparative evidence from India and Pakistan. Labor and Demography 0403023, University Library of Munich, Germany. Available at SSRN 287235, 2001.

[7] Rabbi, A. M. F., Karmaker, S. C., Mallick, S. A., & Sharmin, S., Determinants of birth spacing and effect of birth spacing on fertility in Bangladesh. *Dhaka University Journal of Science*, 2013, **61(1)**: 105-110.

[8] Hailu, D., & Gulte, T., Determinants of Short Inter-birth Interval among Reproductive Age Mothers in Arba Minch District, Ethiopia. *International journal of reproductive medicine*, 2016. Article ID 6072437. Doi:10.1155/2016/6072437.

[9] Kashem, S. R., Arokiasamy, J. T., Khanam, S. T., Anthonisamy, A. N., Bhatt, P., & Islam, M., Sociodemographic factors associated with birth interval: a study among rural women in Chandina, Comilla, Bangladesh. *Journal of Public Health*, 2019, 1-5.

[10] Yohannes, S., Wondafrash, M., Abera, M., & Girma, E., Duration and determinants of birth interval among women of child bearing age in Southern Ethiopia. *BMC pregnancy and childbirth*, 2011, **11(1)**: 38.

[11] Singh, S. N., Singh, S. N., & Narendra, R. K., Demographic and socio-economic determinants of birth interval dynamics in Manipur: A survival analysis. *Online Journal of Health and Allied Sciences*, 2011, **9(4)**: 3.

[12] Yadav B, Pandey S., Study of knowledge, attitude, and practice regarding birth spacing and methods available for spacing in rural Haryana, India. *International Journal of Reproduction, Contraception, Obstetrics and Gynecology*, 2018, **7**: 1389-93.

[13] Al-Almaie, S. M., The pattern and factors associated with child spacing in eastern Saudi Arabia. *The journal of the Royal Society for the Promotion of Health*, 2003, **123(4)**: 217-221.

[14] De Jonge, H. C., Azad, K., Seward, N., Kuddus, A., Shaha, S., Beard, J. & Fottrell, E., Determinants and consequences of short birth interval in rural Bangladesh: a cross-sectional study. *BMC pregnancy and childbirth*, 2014, **14(1)**: 427.

[15] Abdel-Fattah, M., Hifnawy, T., El Said, T. I., Moharam, M. M., & Mahmoud, M. A., Determinants of birth spacing among Saudi women. *Journal of family & community medicine*, 2007, **14(3)**: 103.

[16] Chakraborty, N., Sharmin, S., & Islam, M. A., Differential pattern of birth intervals in Bangladesh. *Asia-Pacific population journal*, 1996, **11(4)**: 73-86.

[17] Karmaker, S.C., Lahiry, S., Roy, D.C. and Singha, B., Determinants of infant and child mortality in Bangladesh: time trends and comparisons across South Asia. *Bangladesh Journal of Medical Science*, 2014, **13(4)**: 431-437.

[18] Da Vanzo, J., Hale, L., Razzaque, A., & Rahman, M., The effects of pregnancy spacing on infant and child mortality in Matlab, Bangladesh: how they vary by the type of pregnancy outcome that began the interval. *Population studies*, 2008, **62(2)**: 131-154.

[19] Laake, P., Benestad, H.B. and Olsen, B.R., *Research methodology in the medical and biological sciences*, Academic Press, 2015.

[20] Nahar, M.Z. and Zahangir, M.S., Patterns and determinants of age at first birth in Bangladesh, *Turkish Journal of Population Studies*, 2013, **35**: 63-77.

[21] Chowdhury, A.H. and Karim, A., Patterns and differentials of birth intervals in Bangladesh, *Global Journal of Science Frontier Research Interdisciplinary*, 2013, **13(2)**: 11-24.