Factors Influencing Progression to a Larger Family in Mid- and Late-Transitional Fertility Stalls: A Case Study of Bangladesh

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Abstract

Bangladesh has experienced stalls in fertility decline in different stages of fertility transition. This study explored the predictors of progression to a larger family in Bangladesh during the mid-transitional fertility stall that occurred in the late 1990s and the late-transitional fertility stall in the early 2010s by analyzing the progression to third and fourth births, and progression to third birth. This study analyzed the 1999/2000 and 2014 Bangladesh Demographic and Health Survey data using descriptive analysis technique, chi-square test, and random-effects Cox hazard model. Results showed that women were significantly slower in having a higher-order birth in both stalls if they noticed family planning messages, attained secondary or higher education, were non-Muslim, did not experience child death, and lived outside of the Chattogram and Sylhet regions. Although progression to a higher-order birth in the late-transitional stall became more homogeneous among different groups, the urban-rural difference in having a higher-order birth that was nonsignificant in the mid-transitional stall became significant in the late-transitional stall. Besides these factors, the effects of religion and region increased substantially in the late-transition stall. The findings highlight a necessity for the government's attention to family planning programs along with the increasing gaps between urban-rural residences, regions, and religious groups in having higher-order births.

Keywords

Bangladesh; fertility stall; parity progression; random-effects Cox hazard model

Background of the study

Bangladesh is ranked as the eighth-most populous country in the world. The country has become the most crowded country in South Asia, with 1,265 persons per square kilometer (United Nations, 2017). Bangladesh faces multifarious socioeconomic, health, and environmental problems because of its rapid population growth resulting from high fertility and a large population (Khan & Khan, 2010; SIDA, 2001). Although Bangladesh has experienced a rapid decline in fertility, the decline stalled twice in two different stages of fertility transition. The decline in fertility over a time period is known as *fertility transition*, while the level off or increase in fertility following a transition is known as *fertility stall* (Bongaarts, 2006). The first fertility stall manifested in mid-transition of fertility at 3.3 births per woman during 1996–2000, and the second fertility stall manifested in late transition at 2.3 births per woman during 2011–2014 (NIPORT et al., 2016). A fertility transition was considered in the middle stage of transition if the total fertility rate (TFR) during that transition period was between 3 and 4.9 births per woman, and a transition was considered in the late stage if the TFR ranged from 2.1 to 2.9 births per woman (Bongaarts, 2003; Kumar, 2016). Bangladesh's government considered fertility reduction the key strategy of controlling its burgeoning population (MOHFW, 2012). Nevertheless, because of the fertility stalls, the population in Bangladesh increased quicker than expected. This population surge is expected to contribute more significantly to the existing socioeconomic and environmental problems.

The projection of World Population Prospects in 2017 showed that if fertility in Bangladesh maintains the existing declining trend, the country will have 92 million working-age people by the end of the twenty-first century, even after experiencing a population decline following 2070 due to a sub-replacement fertility rate (TFR < 2.1) (United Nations, 2017). Therefore, the size of the working-age population by the end of the twenty-first century is not expected to create substantial problems in keeping the economy running in a country like Bangladesh. Therefore, expectedly, fertility reduction could have helped harness the rapid growth of the vast population of Bangladesh. Hence to help avert future humanitarian, environmental, and economic disasters, it is vital to understand the population dynamics, particularly the determinants of having larger families by different segments of women, that influenced the fertility stalls in Bangladesh.

Since the first detection of fertility stall by Gendell in 1985, many studies have examined fertility stalls in African countries; but other parts of the world are underrepresented. The existing studies on fertility stall concluded with mixed results for the differences in their data, socioeconomic and cultural contexts, and analysis techniques (Ezeh et al., 2009). Factors that were cited as associated with the fertility stalls in countries other than Bangladesh included declining or stalling contraceptive use and age at marriage, declining duration of breastfeeding, increase in marriage and adolescent fertility, desire for a larger family, increasing unintended births, unmet need for family planning (FP), and unfocussed FP programs, declining or stalling female education and female labor force participation, regional and religious differences, increasing poverty, low child-rearing cost, and rising child mortality due to HIV/AIDS epidemic (Bongaarts, 2006, 2008; Ezeh et al., 2009; Garenne, 2009; Gendell, 1985; Khawaja et al., 2009; Mutuku, 2015; Shapiro & Gebreselassie, 2008; Westoff & Cross, 2006). Although these studies were not conducted in Bangladesh, the relevance of the cited factors can also be examined in the context of Bangladesh.

In a study on seven fertility-stalling countries, including Bangladesh, Bongaarts (2006) concluded that the reverse of the mid-transitional stall in Bangladesh would depend on a substantial decline in unmet need for FP. In another study based on Bangladesh Demographic and Health Survey (BDHS) data, Islam et al. (2004) claimed that a fertility decline in Bangladesh was in progress during 1996-2000. Still, the trend seemed stalled because of an overestimated total fertility rate (TFR) resulting from a shift of childbearing to women of younger ages. Nonetheless, this study showed an increase in mean age at childbearing during that stalling period, indicating a shift of childbearing to the women of older ages. These mixed results create a strong premise for revisiting the determinants of fertility stalls in Bangladesh.

Besides these above factors, other studies that analyzed the determinants of fertility in Bangladesh argued that women's higher age, lower age at marriage, lower level of education, lower level of husband's education, poor wealth index, child loss experience, living in the Chattogram region, rural residence, not having a son, not earning cash, not being engaged in work, being Muslim, and non-use of FP services exerted a positive effect on family size or fertility level (Islam et al., 2003; Islam et al., 2010; Miah, 1993; Nahar et al., 2013; van Ginneken & Razzaque, 2003). Some of the findings are contradictory to that of each other and the framework of fertility. For example, the study of Miah (1993) found that the husband's education and practice of FP had a positive effect on fertility in Bangladesh. Still, theoretically, these factors should exert a negative influence on fertility (Bongaarts, 2006). Islam et al. (2003) found that women with no education were more likely to have higher-order births in Bangladesh, while the study of Islam et al. (2010) found that illiteracy exerted a delaying effect on progression to a higher-order birth. A thorough examination shows that these studies could not show any significant systematic regional difference in the determinants of progression to a higher-order birth, and as the analysis at the regional level may distort the result because of the small sample size, limiting the analysis of the current study in total sampled women at a national level is considered reasonable.

Existing studies on mid-transitional fertility stalls in Bangladesh analyzed aggregate national data that linked trends in TFR with the trends in different socioeconomic indicators at the national level. Still, evidence showed that such aggregate data (data at national and sub-national levels) mask essential differences in reproductive behavior among socioeconomic groups (Bongaarts, 2003). Another major limitation of analyzing aggregate data is that adequate time series data on fertility and its predictors required to perform multivariate analysis to obtain reliable results are not available at the national level.

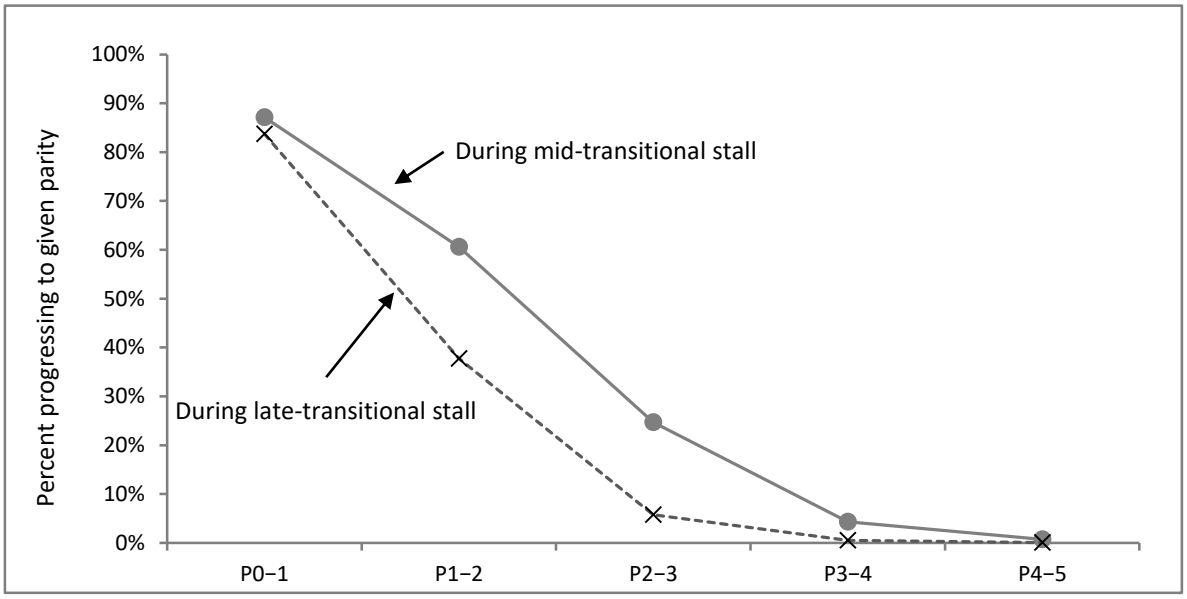
In addition, to date, studies discussing the late transitional fertility stall in Bangladesh are rarely found. Change in national fertility depends upon the overall change in the family size of individual women in a country. Therefore, to reverse a fertility stall or to sustain a fertility transition, in-depth knowledge is required about the underlying factors (e.g., socioeconomic, reproductive preference, and family planning program-related factors) that influence women through intermediate variables (e.g., birth control) to progress to a larger family (i.e., higher-order birth) during that stalling period. This requirement led this study to mainly exploring the underlying factors that influenced Bangladeshi women to progress to a higher-order birth (larger family) in mid- and late-transitional fertility stalls in the country. The analysis of late-transitional stall is also expected to reveal the determinants of higher-order births in recent years. Analysis in this study accounts for the effects of the patterns of having a higher-order birth by the women within the clusters. The findings of this study may help formulate strategies by highlighting the

areas that need to be prioritized in reducing the number of women with a larger family, which in turn is expected to help in reversing the recent fertility stall in Bangladesh, as well as the stalls in other countries with socioeconomic and demographic conditions similar to Bangladesh.

Parity progression during the fertility stalls in Bangladesh

Figure 1 shows a considerable difference in the patterns of progression to different parities (i.e., the progression to the births of different orders during the two stalling periods) in Bangladesh. Although the proportion of women who progressed to the first birth from a childless state during mid- and late-transitional stalls are very close, the proportion of women that progressed to a second birth and above during late-transitional stall are much lower than those during mid-transitional stall.

Figure 1: Percentage of Women who Progressed to the Given Births During the Mid- and Late-Transitional Fertility Stalls in Bangladesh



Note: *Author's calculations from data of 1999/2000 and 2014 BDHSs*

During both stalls, the proportions of women who progressed to the given births dropped drastically with each increase in birth order. A quarter of the women were found to progress to a third birth during the mid-transitional stall. This proportion was 6% during the late-transitional stall. During the mid-transitional stall, 4% of the women transitioned to fourth birth. The proportions of women who progressed above fourth and third births, respectively, are minimal during mid- and late-transitional stalls (see Figure 1).

Data and methodology

This study used data from two Bangladesh Demographic and Health Surveys (BDHSs) conducted in 1999/2000 and 2014. The DHS program has earned a worldwide reputation for collecting and disseminating accurate and nationally representative data. This program has assisted more than 400 surveys in over 90 countries (USAID, 2019).

The BDHS of 1999/2000 interviewed 10,544 ever-married women from 500 clusters of six regions, and the 2014 survey interviewed 17,863 ever-married women from 600 clusters of seven regions (Mitra et al., 2001; NIPORT et al., 2016). In both surveys, clusters were considered as the primary sampling unit. A cluster approximately corresponds to a village (Mitra et al., 2001). For analyzing the progression to the selected births, only those currently married women of reproductive age (15–49 years) who already progressed to the immediate preceding births of the births in questions and did not progress to the births in question before the seven-year period preceding the surveys in 1999/2000 and 2014 were retained. The women who were not currently married (e.g., widowed, divorced, not living together, and separated) were excluded from the analysis because they were least likely to have a birth during a short study period of seven years. During the study period for mid-transitional stall, only two out of 131 and one out of 95 formerly married women had third and fourth births, respectively. During the study period for the late-transitional stall, only three out of 219 formerly married women had third birth.

The mid-transitional fertility stall manifested between the 1996/1997 and 1999/2000 BDHSs, and the late-transitional stall manifested between the 2011 and 2014 BDHSs. The seven-year periods preceding the surveys in 1999/2000 and 2014 are considered as the study period for the mid- and late-transitional fertility stalls. The total fertility rate (TFR) estimates of BDHSs present the birth experience of the women in the last three years of each survey, and the intervals between the surveys that revealed the fertility stalls are four years. These seven-year periods are the actual periods of fertility stalls. If a woman's birth in question resulted from twin birth, she was dropped from the analysis. A total of three pools of women were created for analysis. Women in pool 1 and pool 2 were selected from the 1999/2000 BDHS for use in analyzing the progression to third and fourth births in a mid-transitional stall, respectively. Pool 3 was created from the 2014 BDHS to study the progression to a third birth in a late-transitional stall. Pool 1 and pool 2 comprised 2,544 and 1,626 currently married women of reproductive age from 340 clusters, respectively. Pool 3 comprised 4,734 currently married women covering all 600 clusters.

This study analyzed progression to third and fourth birth during the mid-transitional stalling period, and progression to a third birth during the late-transitional stalling period using all univariate, bivariate, and multivariate techniques. Bivariate associations were checked using the chi-square test. Finally, as BDHS data are clustered, progression to parity is time-dependent, and the cases were right-censored, a random-effects Cox hazard regression model was considered appropriate for analyzing the data where survey clusters were included as a frail group (Islam et al., 2010; Nahar & Zahangir, 2013). The interval between the date of each birth in question and the date immediately preceding the birth of that specific birth in question (measured in months) was considered the exposure time of progression to that birth. Although the test of fertility stall and assessment of data quality are out of the scope of this paper, a detailed test of fertility stall and transition and a concise assessment of data quality have been given in the appendix (see

Rahman (2019) for a thorough assessment of the dataset). The statistical test of slopes of TFRs substantiates the claims of both fertility stalls in Bangladesh, reflecting in statistically nonsignificant changes in the slopes during the stalling periods (see Table 4 in appendix). The assessment of data quality also showed no overwhelming abnormalities that may produce an unrealistic fertility estimates, which may provide a misguiding idea about the fertility trends during the stalling and transitioning periods in Bangladesh (see appendix).

The selection of independent variables was based on an extensive literature review and the availability of a variable in both study surveys. The eleven independent variables included in the analysis are age at first birth; children's sex composition (sex combination of the children born before the indexed birth); having unmet need for family planning; heard or saw FP messages (any) on radio, television, billboards, or posters, or in newspapers or magazines in the month prior to the survey; respondents' education; education of respondents' husband; current work status of the respondents; religious identity; experience of child death; residence; and region. As the rate of childbearing was observed to be comparatively lower among the younger and older women, and seeing as younger women do not have enough time to progress to a higher-order birth, the current age of respondents (classified into five-year age groups) was included as a control variable in multivariate analysis (Mitra et al., 2001; NIPORT et al., 2016).

Religious identity was classified into two sub-categories: Muslim and non-Muslim (Hindu, Buddhist, Christian, and others). In the 1999/2000 and 2014 BDHSs, TFRs in Chattogram were 2.6 and 2.5, respectively, and TFR in Sylhet in those years was 2.9. In comparison, TFRs in the rest of Bangladeshi regions were around 2 in those years (Mitra et al., 2001; NIPORT et al., 2016). In order to examine the difference in having a large family by the women of Chattogram and Sylhet with those of the rest of the regions, the regions were divided into the following three groups: rest of Bangladesh, Chattogram, and Sylhet.

Results

Sample profiles

Table 1 displays the background characteristics of the selected women in the pools. A sizeable proportion of women in all the pools (pool 1, 11%; pool 2, 14%; pool 3, 11%) were observed to present first birth before age 15. A substantial proportion of women in all the pools (pool 1, 19%; pool 2, 16%; pool 3, 11%) reported that they had unmet need for family planning. In all the pools, the majority of the women reported that they did not notice any FP messages. A large proportion of women in pool 1 (41%) and pool 2 (44%) did not have any education, whereas the proportion of women with no education in pool 3 was only 15%. A large majority of the women in all the pools were found not working. A vast majority of the women in all the pools were Muslim. About 23% and 27% of the women in pool 1 and pool 2, respectively, had an experience of child death, whereas 8% of the women in pool 3 had the same experience. A large proportion of women in all the pools resided in rural areas.

Table 1: Percentage Distribution of the Selected Currently Married Women Aged 15–49 by Background Characteristics

Characteristics	Percentage		
	Pool 1 (N=2,544)	Pool 2 (N=1,626)	Pool 3 (N=4,734)
Age at first birth			
Younger than 15 years	11.4	14.1	11.2
15-17 years	42.1	46.5	36.4
18 years or older	46.5	39.4	52.3
Children's sex composition			
All sons	27.1	13.7	27.1
All daughters	20.9	10.4	19.1
Mixed	52.0	75.9	53.8
Having unmet need for FP			
Yes	18.7	16.0	10.8
No	81.3	84.0	88.2
Heard or saw FP messages			
Yes	44.7	44.3	24.6
No	55.3	55.7	75.4
Respondent's education			
No education	40.7	43.7	15.5
Primary	27.6	31.2	29.4
Secondary and higher	31.7	25.0	55.1
Husband's education			
No education	39.4	36.9	24.2
Primary	21.8	24.7	27.6
Secondary and higher	38.8	38.4	48.2
Current work status			
Working	20.2	22.3	32.7
Not working	79.8	77.7	67.3
Religion			
Muslim	86.2	84.9	88.8
Non-Muslim	13.8	15.1	11.2
Experienced child death			
Yes	23.0	27.4	8.2
No	77.0	72.6	91.8
Residence			
Urban	30.9	29.4	36.4
Rural	69.1	70.6	63.7
Region			
Rest of Bangladesh	68.9	71.7	75.7
Chattogram	20.2	19.0	14.3
Sylhet	11.0	9.4	10.0
Total	100.0	100.0	100.0

Note: *Author's calculations using data from 1999/2000 and 2014 BDHSs*

Progression to a higher-order birth during the stalling periods

Table 2 presents the distribution of selected women progressing to the selected births during mid- and late-transitional stalls among the selected characteristics. During mid-transitional stall, 24% and 4% of the selected women, respectively, progressed to third and fourth births, and 6% of the selected women progressed to a third birth during late-transitional stall.

The association between progression to a third birth and age at first birth was found significant only during mid-transitional stall. During this stall, the proportion of women who had their first birth before age 15 also progressed to a third birth (29%) was found much higher than those who had their first birth when they were 18 years or older (19%). Progression to a third birth during both stalls was much higher among the women who had daughters only than those in other categories. Proportions of the women who had an unmet need for family planning and those who did not hear or see any FP messages also had the selected births during both stalls were higher than that of their respective counterparts. Both respondents' education and their husbands' education showed a negative relationship with the proportion of women progressing to all the selected births during both stalls. Engaging in work showed a significant-negative impact only on progression to the third birth during the mid-transitional stall. Women who were Muslim and who experienced a child death were more likely to progress to all the selected births during both stalls than their respective counterparts. Proportions of women who progressed to the selected births during both stalls among those living in rural areas, and the Chattogram and Sylhet regions were much higher than those living in their respective counterparts (see Table 2).

Table 2: Percentage Distribution of Bangladeshi Women Progressing to a Higher-Order Birth in Mid- and Late-Transitional Fertility Stalls by Background Characteristics

Characteristics	Percentage of women progressing to		
	Third birth during mid-transitional stall (N=2,544)	Fourth birth during mid-transitional stall (N=1,626)	Third birth during late-transitional stall (N=4,734)
Age at first birth	**P=0.000**	**P=0.869**	**P=0.082**
Younger than 15 years	29.3	4.4	5.1
15-17 years	28.3	3.8	5.3
18 years or older	19.0	3.6	7.5
Children's sex composition	**P=0.009**	**P=0.847**	**P=0.010**
All sons	24.5	3.2	5.1
All daughters	28.8	4.1	7.5
Mixed	22.0	3.9	4.9
Having unmet need for FP	**P=0.000**	**P=0.000**	**P=0.000**
Yes	44.1	8.5	9.6
No	19.5	2.9	5.0
Heard or saw FP messages	**P=0.000**	**P=0.000**	**P=0.000**
Yes	13.0	1.8	2.2
No	33.0	5.4	6.5

Characteristics	Percentage of women progressing to		
	Third birth during mid-transitional stall (N=2,544)	Fourth birth during mid-transitional stall (N=1,626)	Third birth during late-transitional stall (N=4,734)
Respondent's education	**P=0.000**	**P=0.072**	**P=0.000**
No education	35.2	4.6	10.4
Primary	24.4	4.1	7.9
Secondary and higher	9.7	2.0	2.8
Husband's education	**P=0.000**	**P=0.005**	**P=0.000**
No education	32.5	5.7	9.6
Primary	29.1	3.7	6.9
Secondary and higher	12.8	2.1	2.6
Current work status	**P=0.000**	**P=0.161**	**P=0.108**
Working	17.2	2.5	4.7
Not working	25.8	4.2	5.8
Religion	**P=0.000**	**P=0.006**	**P=0.000**
Muslim	25.6	4.3	5.9
Non-Muslim	14.8	0.8	2.1
Experienced child death	**P=0.000**	**P=0.000**	**P=0.000**
Yes	56.8	11.0	29.9
No	14.3	1.1	3.3
Residence	**P=0.000**	**P=0.088**	**P=0.000**
Urban	14.9	2.5	3.1
Rural	28.2	4.4	6.8
Region	**P=0.000**	**P=0.000**	**P=0.000**
Rest of Bangladesh	17.0	2.7	2.5
Chattogram	37.0	5.8	9.4
Sylhet	44.8	8.6	22.0
Total	24.1	3.8	5.5

Note: *Author's calculations using data from 1999/2000 and 2014 BDHSs. The p-values are from the Chi-square test*

Random-effects Cox hazard regression analysis

Results of random-effects Cox hazard regression analysis are presented in Table 3. Controlling for other factors, common factors found significantly associated with progression to either third or fourth birth during the mid-transitional stall, and progression to a third birth during the late-transitional stall include noticing family planning messages, respondent's education, religion, experience of child death, and region. During both stalls, women who did not hear or see any FP messages were more likely to have all the selected births sooner than those who heard or saw any FP messages. Attainment of secondary and higher education by the women showed a significant delaying effect on having third birth during both stalls. Non-Muslim women were significantly slower in progressing to all the selected births during both stalls. The risk of having third birth for non-Muslim women during the late-transitional stall (0.33) was observed, with half of that

during the mid-transitional stall (0.66). The risk of having all the selected births for the women who did not experience any child death was significantly lower than that for those who experienced a child death. During both stalls, women of Chattogram and Sylhet were more likely to have a third birth sooner than the rest of the women in Bangladesh. Hazard ratios of having third birth for Chattogram and Sylhet showed a substantial increase in the late-transitional stall.

Table 3: Random-Effects Cox Hazard Regression Estimates of the Effects of Predictors on Progression to Higher-order Births in Mid- and Late-Transitional Fertility Stalls in Bangladesh

Characteristics	Hazard ratio (HR) of progression to					
	Third birth during mid-transitional stall **Model 1**		Fourth birth during mid-transitional stall **Model 2**		Third birth during late-transitional stall **Model 3**	
	HR	95% CI	HR	95% CI	HR	95% CI
Age at 1st birth						
Younger than 15 years (ref)	–	–	–	–	–	–
15-17 years	0.964	0.747−1.245	0.683	0.317−1.474	0.746	0.495−1.123
18 years or older	0.716*	0.544−0.943	0.708	0.306−1.640	0.836	0.555−1.259
Children's sex composition						
All sons (ref)	–	–	–	–	–	–
All daughters	0.980	0.779−1.233	1.363	0.461−4.030	1.189	0.825−1.713
Mixed	0.863	0.709−1.050	1.357	0.645−3.245	1.204	0.878−1.650
Having unmet need for FP						
Yes (ref)	–	–	–	–	–	–
No	0.531***	0.445−0.635	0.397**	0.233−0.676	1.061	0.745−1.509
Heard or saw FP messages						
Yes (ref)	–	–	–	–	–	–
No	1.637***	1.326−2.022	2.481**	1.249−4.926	1.767*	1.143−2.734
Respondent's education						
No education (ref)	–	–	–	–	–	–
Primary	0.917	0.748−1.123	1.539	0.830−2.854	1.021	0.728−1.432
Secondary and higher	0.594**	0.428−0.822	1.238	0.477−3.213	0.487**	0.323−0.734
Husband's education						
No education (ref)	–	–	–	–	–	–
Primary	0.966	0.789−1.183	0.770	0.399−1.487	0.870	0.639−1.185
Secondary and higher	0.823	0.629−1.078	0.580	0.262−1.284	0.704	0.479−1.034
Current work status						
Working (ref)	–	–	–	–	–	–

Characteristics	Hazard ratio (HR) of progression to					
	Third birth during mid-transitional stall **Model 1**		Fourth birth during mid-transitional stall **Model 2**		Third birth during late-transitional stall **Model 3**	
	HR	95% CI	HR	95% CI	HR	95% CI
Not working	1.395**	1.103−1.766	1.631	0.780−3.410	0.817	0.600−1.113
Religion						
Muslim (ref)	–	–	–	–	–	–
Non-Muslim	0.655**	0.480−0.893	0.166*	0.039−0.716	0.326**	0.168−0.633
Experienced child death						
Yes (ref)	–	–	–	–	–	–
No	0.248***	0.208−0.296	0.083***	0.044−0.156	0.128***	0.097−0.169
Residence						
Urban (ref)	–	–	–	–	–	–
Rural	1.137	0.897−1.442	0.797	0.3951.607	1.808**	1.246−2.624
Region						
Rest of Bangladesh (ref)	–	–	–	–	–	–
Chattogram	2.329***	1.877−2.889	2.774**	1.350−5.468	4.001***	2.687−5.958
Sylhet	2.264***	1.745−2.937	2.717**	1.498−5.135	7.912***	5.336−11.730
	Random effect: Within-cluster correlation ($\hat{\theta}$)					
Frail group						
Cluster	0.107** (SE=0.055)		0.000 (SE=0.000)		0.615*** (SE=0.198)	

*Notes: HR hazard ratio, CI confidence interval. *p<0.05, **p<0.01, ***p<0.001*

As shown in Table 3, in addition to the common factors, the women who had first birth when they were 18 years or older faced a 29% lower risk of having a third birth than those who had first birth before age 15 during the mid-transitional stall. During this stall, the risks of having third and fourth births for the women who did not have an unmet need for FP were significantly lower than those who had an unmet need for FP. Women who were not working faced a 40% higher risk of having a third birth than the women working during the mid-transitional stall. Besides these additional factors, the effect of urban-rural residence on having a third birth showed a significant increase in late-transitional stall. During this stall, rural women faced an 80% higher risk of having a third birth than urban women.

The within-cluster correlations in model 1 ($\hat{\theta}$ = 0.11) and model 3 ($\hat{\theta}$ = 0.62) were observed high and statistically significant. The value of $\hat{\theta}$ in model 2 was observed as zero and statistically nonsignificant; this can be a result of a small sample size and a minimal number of successes.

Discussion

This article explored the determinants of progression to a larger family during the fertility stalls in Bangladesh by investigating the factors that may influence women to progress to third and fourth births during the mid-transitional stall, and third birth during the recent late-transitional

stall. Progression to a higher-order birth became more homogeneous among different groups during the late-transitional stall, reflected in a smaller number of significant predictors of progression to a higher-order birth during the late-transitional stall than in a mid-transitional stall. During the mid-transitional stall, having first birth before age 15, having an unmet need for family planning (FP), and not engaging in work exerted significant influence on having a higher-order birth. Still, the effects of these factors became nonsignificant during the late-transitional stall.

Nonetheless, urban-rural gaps in having a higher-order birth showed a significant increase in late-transitional stall. During this stall, rural women were significantly more likely to have a higher-order birth sooner than urban women. In contrast, the effect of urban-rural difference was nonsignificant in mid-transitional stall. The programmatic factor—not noticing FP messages—persistently influenced women to have all the selected higher-order births sooner during both stalls. Besides these, the common socioeconomic factors that are found significantly associated with slower progression to a higher-order birth during both stalls include attaining secondary and higher education by the women, being non-Muslim, not having child death experience, and living in the rest part of Bangladesh other than Chattogram and Sylhet. Preference for particular sex did not show any significant influence on having a higher-order birth in any stall.

The analysis shows that having first birth before age 15 exerted a significant quickening effect on having third birth only during the mid-transitional stall. Analysis of the current study included age at first birth and excluded age at first marriage because of the following reasons: i) age at first birth is more close to childbearing than the age at first marriage because age at first marriage primarily influence fertility through the age at births, such as a low age at first marriage of a woman brings her timing of births forward and allows her enough time to progress to a higher-order birth (Bongaarts, 2006), and ii) in a country like Bangladesh where marriage is universal and sex out of wedlock is infrequent, age at first marriage and age at first birth are highly correlated (Mitra et al., 1997; Nahar & Zahangir, 2013). The effect of the most critical intermediate variable—contraceptive use—on having a higher-order birth could not be examined in this study because of the lack of correspondence between the births in question and contraceptive use status referring to the time of interview. Nonetheless, the role of contraceptive use in rapid fertility decline is well documented in Bangladesh (Kabir et al., 1994). Along with this, lactational amenorrhea is a determinant of natural marital fertility (Bongaarts, 1982); this works as an effective contraceptive method if a baby is breastfed exclusively whenever the baby wants. Nevertheless, fertility in Bangladesh already came under control in the mid-1990s by means of a high prevalence of contraception (NIPORT et al., 2016). Because of these reasons, fertility in Bangladesh declined even during the periods that experienced a decline in postpartum infecundability (mainly composed of lactational amenorrhea) (Rahman, 2020). Considering all these facts, lactational period was not included in the analysis.

Sex preference was found nonsignificant in influencing the progression to a higher-order birth during both stalls. This result is congruent with the finding of Talukder et al. (2014) in Bangladesh, where 88.4% of people are Muslim (BBS, 2017). Like other Muslim-dominated countries, the sex ratio is normal in Bangladesh, indicating no remarkable sex selection (Almond et al., 2013; Mitra et al., 2001; NIPORT et al., 2016). The sex ratio was typical even among the Muslim minorities in South Korea and India (Bhat & Zavier, 2007; Chung, 2007). A possible reason for this unremarkable sex preferences among Muslims could be the extension of religious

proscription against infanticide to the proscription against sex selection (Almond et al., 2013). The role of desired family size in progressing to a larger family could not be studied because of its strong association with other predictors included in the models. Nevertheless, a positive influence of desire for a larger family on progression to a higher-order birth is apparent in Bangladesh (Uddin et al., 2011).

The selected programmatic factors were observed to play a critical role in limiting the progression to a larger family during both stalls. During the mid-transitional stall, not having an unmet need for family planning and noticing FP messages showed a significant delay in having both third and fourth births. Ezeh et al. (2009) also identified unmet need for family planning as one of the numerous causes of fertility stalls in Africa. In Bangladesh, the level of unmet need for FP reflects two aspects of FP program: i) success of contraception demand-generation activities of FP program, and ii) the level of meeting the demand for contraception. Dissemination of family planning messages is one of the vital tasks of contraception demand-generation activities of the FP program in the country (MOHFW, 2016). Family planning program is inseparably conjoined with the rapid fertility decline in Bangladesh (Bongaarts, 2006; Islam et al., 2004). An important programmatic factor—visit of FP field workers at doorsteps—could not be included in the analysis for the following reason: the surveys recorded the information about the field visits only during 12 or six months preceding the survey. As the field visits are allocated on a priority basis in the areas where fertility is high, and contraceptive use rate is low, the information on the recent visit of field workers is not expected to reflect its actual impact on progression to a higher-order birth during the seven-year period before the survey.

Findings show that progression to the third birth in both stalls was significantly slower among the women with secondary and higher education than those with no education. The working status of women exerted a significant delaying effect only on having the third birth in mid-transitional stall. Educated and employed women have higher exposure to knowledge, broader access to health and FP services, and greater autonomy of decision-making; these, in turn, helping them to be emancipated from their traditional role of wife and mother and influencing them to have a smaller family (Giusti & Vignoli, 2006). Although the study of Islam et al. (2010) found women's higher education to exert a significant quickening effect on progression to a higher-order birth during the period between the late 1990s and mid-2010s, the study of Islam et al. (2003) found women's secondary and higher education to exert a significant negative effect on having a higher-order birth during the second half of the 1990s.

It is worth mentioning that although having first birth at age below 15 and non-working status showed a significant quickening effect on progression to a larger family during mid-transitional stall. Yet, their effects became nonsignificant during the recent late-transitional stall. Those who had first birth at a very young age and who were not working may also shift to a preference for a smaller family because of the reducing socioeconomic gap with their counterparts. Education could play a vital role in closing the socioeconomic gap and increasing awareness levels among disadvantaged groups. A substantial increase was observed in women's literacy rate between 2000 and 2014. The change was more pronounced at very young ages. In 2000, the percentage of 10–14-year-old women who completed primary education was only 6.8%. However, this percentage increased to 44.5% in 2014 (Mitra et al., 2001; NIPORT et al., 2016). Besides these elements, the availability of family planning services at proximity may also reduce the gap between the family size preferences of advantaged and disadvantaged groups. Bangladesh's

government started to construct community clinics (CC) in 1998 to provide FP and reproductive health services at the community level (DGHS, 2021). After constructing 8,000 functioning CCs during 1998–2001, CCs were closed in 2001. The CC project was resumed in 2009 and was planned to revitalize by undertaking a new project covering the time span of 2009–2014 (DGHS, 2021). As of 2018, a total of 13,907 community clinics had been constructed, indicating a significant improvement in moving service centers close to the communities (MOHFW, 2020). Despite this improvement, each CC with only one health care provider (HCP) has to cover around 6,000–12,000 people, which indicates that the catchment people for CCs were not homogeneous, and the number of CCs and HCP were not adequate; moreover, there are some vacancies in CCs, and a gradual decline in the number of HCP is causing a substantial barrier to service provision (DGHS, 2021; MOHFW, 2020).

Besides the issues with community clinics, some women in Bangladesh still may not go outside of their home to avail of family planning services because of a lack of knowledge, and the Purdah practice of concealing women from public observation by covering their bodies (Simmons et al., 1988). Although this immobility of women could be overcome in a short time period by delivering FP services at the doorsteps by using the FP fieldworkers, the percentage of women visited by FP field workers declined from 21.2% in 2000 to 19.7% in 2014, covering the period between the two stalls in question (Mitra et al., 2001; NIPORT et al., 2016).

Having an unmet need for FP also showed a significant quickening effect on having a larger family in mid-transitional stall. Still, its effect became non-significant in late-transitional stall. The proportion of women with unmet need for family planning was also observed to substantially decline during 1999/2000–2014, both among overall cases interviewed in the surveys and selected cases in this study (Mitra et al., 2001; NIPORT et al., 2016). After this decline, the number of cases with unmet need for FP became substantially smaller than those having no unmet need for FP. This remarkably smaller group size of those with unmet need for FP compared to its counterpart perhaps could not provide enough cases who had an unmet need for FP also progressed to a larger family, which was possibly associated with the non-significance of unmet need for FP during the second stall. Also, if the unmet need for FP does not last for a long time, that may not exert a significant effect on having a large family. This large decline in unmet need for FP indicates that a substantially larger number of women in 2014 compared to that in 1990/2000 were, somehow, able to meet their need for contraception. Overall improvement in awareness and FP program may contribute substantially to this decline.

The Muslim women were found much quicker in having all the selected higher-order births in both stalls. In Bangladesh, 88.4% of people are Muslim, and 10.6% are Hindu, while Buddhists constitute only 0.7%, Christians are 0.2%, and the remaining persons belong to other religions. Therefore, it was evident that Muslims and Hindus create a significant religious differential in fertility in Bangladesh. Although both Islam and Hinduism are pronatalist religions, differences in religious beliefs concerning reproduction could be fundamental reasons for the difference in fertility of these two groups. Some Islamic beliefs, in contrast to Hindu beliefs, that could contribute to the higher fertility of Muslims, may include support for polygamy and allowance for easy divorce for infertility, and easy remarriage in any case. Besides these points, more family support during pregnancy in Muslims, and lesser acceptance of FP among Muslim women than others could also contribute to larger families of Muslims (Balasubramanian, 1984; Miah, 1993). The study of Islam et al. (2010) also showed that Bangladeshi Muslim women were remarkably

quicker than others in progressing to a third birth during the period between the late 1990s and mid-2010s. However, the study of Islam et al. (2003) found the effect of religion nonsignificant. Also, the effect of religion in late-transitional stall was overserved much higher than that in mid-transitional stall. Muslim women are more inclined to have a larger family. When the family planning program was rebuilt in independent war-ravaged Bangladesh in the mid-1970s, the program did not have expected success because of a lack of knowledge and immobility of women (especially Muslim women). This problem was solved by providing FP services at the doorsteps using FP field workers (Ezeh et al., 2012; Simmons et al., 1988). Nevertheless, the percentage of women visited by FP field workers declined during the periods between the fertility stalls in question (Mitra et al., 2001; NIPORT et al., 2016). This declining visit, in turn, could have contributed to the increase in the odds of having a larger family by Muslim women in late-transitional stall.

Child loss experience emerges as a very important discriminant in having all the selected higher-order births sooner in both stalls. A woman with an experience of child loss may progress to a higher-order birth because of replacing the deceased child (Bongaarts, 2001). The study of Islam et al. (2010) also found child loss experience to significantly positively influence having a third birth sooner.

One of the notable changes in Bangladesh revealed by this study is that the urban-rural difference in having a higher-order birth increased significantly in the recent stall. Findings of existing studies also showed that the urban-rural difference was nonsignificant in the past (Islam et al., 2003; Islam et al., 2010). Rural women were significantly more likely to have a higher-order birth sooner than the urban women during the recent stall in late-transition. Still, the effect of urban-rural residence was found nonsignificant during the earlier stall in mid-transition. Although rural Bangladeshi women always lagged behind urban women in terms of status in family and society, knowledge about FP, and mobility (Caldwell et al., 1999), studies reveal a deterioration in FP services in remote rural areas in recent years. The main reason for weakened family planning services in rural areas is the long-term vacancies in the posts for FP field staff, which has primarily resulted from not recruiting necessary staffing for a long time and inadequate budget allocation (MOHFW, 2016; Streatfield & Kamal, 2013). As of 2018, a total of 13,907 CCs were constructed for moving FP service points closer to the people (MOHFW, 2020). Although each CC is supposed to have one HCP, current statistics show that there were 13,822 HCPs compared to 13,907 CCs after the last recruitment phase. The latest number of HCP stands at 13,622. Currently, the number of HCP is showing a gradual declining trend (DGHS, 2021).

Analysis of the current study shows that the regional difference played a vital role in having a higher-order birth sooner during both stalls. Results also show a considerable increase in the effect of the regional disparity in late-transitional stall from mid-transitional stall. Women of Chattogram and Sylhet were found much quicker in having all the selected higher-order births than the rest of the women in Bangladesh. In the Chattogram and Sylhet regions, levels of female participation in the labor force and contraceptive use are much lower, and unmet need for FP is much higher than any other regions and national level (NIPORT et al., 2016; Shafiq, 2009). The Purdah practice of concealing women in public in these regions is one of the stiff barriers to changing women's lifestyle (Shafiq, 2009). The barrier of the Purdah system in the FP programs in Bangladesh was overcome by deploying female FP field workers to the doorsteps (Ezeh et al., 2012). Nonetheless, this strategy in Sylhet and Chattogram is not found as effective as in other

regions because of long-term vacancies in the posts of FP field workers in these regions, and the non-availability of local women in these regions as FP field workers, which emerges as a substantial barrier to reaching the local women (Streatfield & Kamal, 2013). In these regions, the primary source of income in many households is overseas remittance from male migrant workers (Siddiqui, 2008). Nonetheless, the research on the effect of high male-migration on fertility in these regions is rare. It is essential to explore the effect of male-migration on fertility in these regions.

It is important to acknowledge the limitation of this study. Despite all efforts to improve data quality, data from BDHSs are contingent on the same types of errors that are intrinsic in all retrospective sample surveys. Some such errors may arise from the omission of some births (especially births of those who died at a very young age) and the difficulty of accurately determining each child's date of birth. Therefore, considering the possibility of these errors, the TFR trends should be interpreted within the context of data quality and sample size (NIPORT et al., 2016). Considering these facts, this study provided a stochastic explanation of the trends in TFR during the inter-survey periods by testing the directions and slopes using the regression technique. The data quality assessment also did not show overwhelming errors that may give misleading estimates of TFR. Besides these limitations, as this study is cross-sectional, the analysis only shows the association between selected characteristics and having a larger family; therefore, the rates showed in the analysis should be interpreted with caution.

Conclusions

The findings of the current study provide important insights into the predictors of progression to a higher-order birth in Bangladesh. Findings also show a substantial difference from that of the existing studies in the country. The current study reveals increases in the differences between urban-rural residences, regions, and religious groups in terms of higher-order childbearing, which should receive special attention from the government of Bangladesh. Findings indicate that further decline in fertility of Bangladesh is likely to come from an increased focus on existing gaps of family planning programs and improvement in socioeconomic condition at the individual level. In particular, improving the dissemination of existing and more timely family planning messages and female schooling, further decline in under-five mortality, closing the urban-rural and regional gaps in female education and FP service provision, and increased female labor force participation can help limit the family size.

Making a variety of contraceptives available and reducing contraceptive stock-out at the service points can help increase contraceptive use among Muslim women and reduce the overall unmet need for FP (Hollander, 2003). Family planning service operation with a combination of public and private sector workers in the Chattogram and Sylhet regions may help solve the service crisis to some extent (Streatfield & Kamal, 2013). Although women's work status showed a significant negative effect on having a larger family during the mid-transitional stall, its impact on having a larger family became nonsignificant and positive during the late-transitional stall. An independent and extensive research could productively investigate the relationship of women's work status with higher-order childbearing in Bangladesh. Finally, the use of the findings of this study may enable the Bangladesh government to address existing socioeconomic and

environmental problems at an earlier stage by helping control the rapid growth of the already vast population by reversing the fertility stall in the country.

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Appendix

Test of fertility stall and transition and quality of data

Estimates of periodic total fertility rate (TFR) at two points of time usually give information about the transition or stall in the fertility trend during that period. This study first examined the estimates in two consecutive Bangladesh Demographic and Health Surveys (BDHSs) to determine whether fertility during that inter-survey period declined or was delayed. Afterward statistical test was performed to substantiate the trend in the estimated fertility. This section performs a statistical test of the validity of the reported fertility trend by testing the direction and statistical significance of the changes in the slopes of retrospective single calendar year fertility trends during each stalling and transitional period in Bangladesh. The slope was tested using the technique used by Kabagenyi et al. (2015). Following linear regression line was used to test the slope,

$$TFR(i) = Constant + B \times i,$$

where *TFR(i)* is the single-year TFR in calendar year *i*, and B is the slope. As the TFR estimates of BDHSs refer to the period three years preceding the survey, the baseline calendar year for the test was chosen three years prior to each terminal year of the survey at which onset of stall or transition in published TFRs was observed. The published BDHS estimates of TFR exclude the births in the month of the interview (Rutstein & Rojas, 2006), and the surveys end at some intermediate point in the survey year; because of this reason, the terminal calendar year for the test is chosen one year prior to the terminal year of the survey at which the stall or transition ended. For example, the published TFRs by BDHS in 1993/1994 was 3.44, while that in 1996/1997 was 3.27. All these estimates included the births in three years preceding the corresponding surveys (see columns 1, 2, and 3 in Table 4). To test the slope of TFRs published in 1993/1994 and 1996/1917 BDHS reports, the TFRs estimated in single calendar years 1991, 1992, 1993, 1994, 1995, and 1996 were included in the regression model (see columns 1 and 4 in Table 4). The single-year TFR estimates in 1991 and 1996 were, respectively, 3.94 and 3.14 (see columns 4, 5, and 6 in Table 4). The single-year TFR estimates were obtained using the method suggested by Schoumaker (2013). The cut-off level for the significant change in the slope of TFRs was considered $p \geq 0.05$.

Table 4: Linear Regression Estimates of Single-Year TFRs in Bangladesh Against Calendar Years

Inter-survey periods	Published TFR[1]		Range of single calendar years used in regression	TFR by Single calendar year[2]		Time coefficient: Slope	*p*-value	R^2
	Begin	End		Begin	End			
1993/1994–1996/1997	3.44	3.27	1991–1996	3.94	3.14	-0.1673 (0.0237)	0.002	0.926
1996/1997–1999/2000	3.27	3.31	1994–1999	3.45	3.06	-0.0802 (0.0304)	0.058	0.635
1999/2000–2004	3.31	3.00	1997–2003	4.03	2.93	-0.1651 (0.0226)	0.001	0.914
2004–2007	3.00	2.71	2001–2006	3.37	2.64	-0.1185 (0.0244)	0.008	0.855
2007–2011	2.71	2.32	2004–2010	3.54	2.31	-0.1915 (0.0388)	0.004	0.830
2011–2014	2.32	2.28	2008–2013	2.78	2.37	-0.0611 (0.0383)	0.186	0.388

Note: [1]Published TFRs (in BDHS reports) in the beginning and ending surveys of the corresponding inter-survey periods. [2]Estimated TFRs in the beginning and ending years of the corresponding ranges of single calendar years used in the regression. Values in parentheses are standard error

Along with the transitions in fertility, the statistical test of slopes substantiates the claims of both fertility stalls in Bangladesh. During all the transitional periods (1993/1994–1996/1997, 1999/2000–2004, 2004–2007, 2007–2011), the slopes of TFRs were significantly negative ($p < 0.05$) (see columns 7 and 8 in Table 4). While changes in the slopes of TFRs during both stalling periods (1996/97–1999/2000 and 2011–2014) were statistically nonsignificant ($p \geq 0.05$). Fertility decline during the inter-survey periods preceding both stalling periods indicates that the fertility stalls in Bangladesh were genuine.

Besides the slope test of a fertility trend, in assessing the quality of birth data is also essential in identifying the direction of a fertility trend correctly. Nevertheless, the assessment of data quality is beyond the scope of this study. Although the summary of a detailed evaluation of birth data has been presented here, Rahman (2019) presented a thorough assessment of the full dataset. The birth data were assessed mainly by examining the trends in available indicators in all BDHSs by using the descriptive method.

Although the births in the years included in each survey for fertility estimation were observed to fluctuate, no sharp spike is observed in any year (Rahman, 2019). The fluctuation can be the result of a genuine increase or decrease in births. This trend in the numbers of births thus indicates that the level of understatement or overstatement was not remarkable enough to severely distort the TFR estimates in any BDHS conducted between 1993 and 2014. Also, the proportions of pregnant women (an indicator of current childbearing status) at the time of the survey were observed to noticeably decline during all the transitional inter-survey periods, while that proportion did not decline during the two stalling periods 1996/1997–1999/2000 and 2011–2014. This trend in the

proportion of pregnant women advocates the authenticity of fertility transition and stalls in question.

High response rates (≥ 97%) of eligible women, and availability of both month and year of birth for almost 100% children born in all survey years and past three years of the surveys reflect a high degree of diligence of field workers, and a high spontaneity of the respondents in preserving and reporting the information. The very few missing birth dates were imputed using the method suggested by Croft (1991) in Rutstein & Rojas (2006). An inaccuracy is expected in imputed data, but when the ages of mothers are classified into five-year age groups, the inaccuracies in the age of mothers and distribution of births by the age of mothers get adjusted to a large extent (United Nations, 1986). Finally, BDHS calculated TFRs using the births that took place three-year period preceding each survey, which reflected the current situation without unduly increasing sampling error (NIPORT et al., 2016). From this discussion, it can be concluded that the birth data showed no overwhelming abnormalities that may produce an unrealistic fertility estimates in any survey years that may provide a misguiding idea about the fertility trends during the stalling and transitioning periods in Bangladesh (see Rahman (2019) for the supplementary dataset).