Assessing the Determinants of Women's Age at First Marriage in Rural and Urban Areas of Bangladesh: Insights From Quantile Regression (QR) Approaches

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Submitted: 30 June 2021, Accepted: 16 March 2022, Published: 3 May 2022
Volume 30, 2022. pp. 602–624. http://doi.org/10.25133/JPSSv302022.034

Abstract

This study aims to assess the determinants of age at first marriage of women in rural and urban areas of Bangladesh. The multiple linear regression (MLR) and quantile regression (QR) were employed for analyzing the secondary datasets collected from the 2006, 2012–2013, and 2019 Multiple Indicator Cluster Surveys (MICS). The study reveals that the prevalence of early marriage in both rural and urban areas of Bangladesh was extremely high (79% vs. 21%) in 2019. An increasing trend of early marriage in rural areas is evident from 2006 to 2012 compared to a decreasing trend from 2013 to 2019. On the contrary, an opposite scenario is evident in the urban areas. The MLR and QR analysis consistently show that women's age, geographical division, ethnic group, religion, wealth index, and women's education are significantly associated with age at first marriage. More specifically, the higher likelihood of early marriage is evident for women living in rural areas, with a low family income, and lower education, living either in Barisal, Rangpur, Khulna, or Rajshahi, and believing in Islam. Generating and implementing more income opportunities for women, raising awareness about the drawback of early marriage, and designing new strategies would improve the current situation.

Keywords

Age at first marriage; Bangladesh; multiple linear regression; quantile regression; rural area; urban area

Introduction

A ritual legal contract that establishes the rights and obligations between an adult man and woman is known as marriage, which is also considered universal social enactment. The minimum age of marriage is 18 years for Bangladeshi girls according to the Child Marriage Restraint Act (2017). Any marriage that occurred before the age of 18 years, when the girl is not physically, physiologically, and psychologically able to handle the duties of marriage and is not capable of childbearing, is considered child marriage in Bangladesh (Child Marriage Restraint Act, 2017). Early marriage is a long-standing problem in low and middle-income countries (LMICs) (Nour, 2009).

Early marriage is not only a violation of human rights but also a major issue in developing countries (Saleheen et al., 2021). The economic and health status of young girls and their offspring are highly impaired by early marriage, including increased risk of sexually transmitted diseases (STDs), malaria, cervical cancer, and maternal and child death (Svanemyr et al., 2012). Early marriage also has severe health consequences for young girls, including unwitting pregnancy, fetal mortality, premature delivery, low birth weight, and violence within marriage (de Groot et al., 2018). It is directly associated with a country's fertility behavior (Godha et al., 2013). Previous studies found that early marriage is significantly associated with child morbidity and mortality (Hossain et al., 2022; Nasrullah et al., 2014).

An estimation in 2020 revealed that 21% of girls worldwide were married before celebrating their 18th birthday, and this current rate added 18 million more girls to this cohort per year. In Sub-Saharan Africa, it is 16 percentage points higher than the global rate (Solanke et al., 2020). However, early marriage has decreased by 25% globally in the last ten years (UNICEF, 2018). In April 2020, a study reported that around 38% of women in low and middle-income countries were married before 18 years of age (UNICEF, 2020).

The scenario of early marriage in Bangladesh is even worse (Kamal et al., 2015). According to one of UNICEF's (2014) flagship reports, the early marriage rate was 66% in Bangladesh, one of the world's highest rates. The teenage pregnancy rate is also higher in Bangladesh among South Asian counties (Sayem & Nury, 2011). About 38% of early fertilization occurred among young girls married under 18 years in Bangladesh (Santhya, 2011). According to a UNICEF report, the percentage of early marriages under the age of 15 and 18 years were 22% and 59%, respectively (UNICEF, 2014). The BDHS 2007 showed that 57.1% of people had no education, and 67.1% were unemployed among those with early marriage (NIPORT et al., 2009). According to BDHS 2011, about 32.9% of the respondents had primary education, 32.8% of the respondent's husbands had no education, and 40% of the respondents were in the poor class among those in the early married cohort (NIPORT et al., 2013). In 2014, the prevalence of early marriage was 80.6%, and 42.1% had education up to the secondary level (Chowdhury et al., 2020). Despite a declining early marriage rate between 2011 to 2014, the current rate has impeded the achievement of Millennium Development Goal 5 (MDG 5) in South Asia. It can further create a hurdle to achieving the Sustainable Development Goals (SDGs) related to child and women's health in Bangladesh by 2030 (Hossain & Majumder, 2019).

Several studies pointed out that the women's education, partner's education, socioeconomic condition, the region of residence, place of residence, husband's occupation, religion, types of family, lack of women's independence, etc., were significantly associated with early marriage (Bhowmik et al., 2021; Uddin, 2015). These studies mostly applied the multiple linear regression model to identify the correlates of age in women's first marriage (Kamal et al., 2015; Mahdaviazad et al., 2019; Wong, 2005). However, this study aimed to assess the determinants using both multiple linear regression (MLR) and quantile regression (QR) models in rural and urban areas of Bangladesh. To perform the analysis, this study used three nationally representative datasets, 2006 (BBS & UNICEF Bangladesh, 2007), 2012–2013 (BBS & UNICEF Bangladesh, 2015), and 2019 (BBS & UNICEF Bangladesh, 2019). The justification for using the QR models was its ability to estimate the complete interrelations over typical regression models (Davino et al., 2014). Earlier, a study by Hossain and Majumder (2019) used the QR approach to determine the correlates of the mother's age at first birth in Bangladesh. In another study, an MLR approach was used to determine various factors associated with early marriage (Hossain et al., 2016). The MLR provides the conditional mean of the response variable for the given predictor variables (Grégoire, 2015). On the other hand, QR estimates the conditional quantiles of the response variable for a given set of predictor variables, which allows us to have a better scenario at different quantile levels (Das et al., 2019; Hossain et al., 2021). It is also effective in the case of heavy-tailed distributions (Davino et al., 2014).

The authors anticipated that the findings of the study might help identify the cohort of women who are at risk and respond appropriately to stop early marriage. The process can prevent the several consequences of early marriage and eventually lead to achieving the targets under the Sustainable Development Goals (SDGs) in Bangladesh by 2030.

Methods

Data

This study used the secondary dataset of women from the nationwide 2006, 2012–2013, and 2019 Multiple Indicator Cluster Surveys (MICS) conducted in Bangladesh funded by UNICEF. The data contains information on sociodemographic, socioeconomic, and public health-related indicators of the eight geographical divisions of Bangladesh. The MICS applied a two-stage stratified sampling procedure for collecting the required information. Firstly, the districts were considered as the primary sampling strata, and several census enumeration areas (EAs) were sampled deliberately utilizing the likelihood relative to the measure inside every stratum. A systematic sample of 20 families was then drawn from every EA following the family unit posted inside the chosen EAs. The original survey consisted of a sample of sizes N = 78,206 in 2006; 59,999 in 2012–2013, and 68,709 in 2019. However, this study included currently married and ever-married women; incomplete cases and never-married women are excluded from this study. Therefore, the subsequent analysis of this study is based on 33,143 women in 2006; 43,621 in 2012–2013, and 51,382 in 2019 MICS.

Outcome variable

The outcome variable was the age at first marriage of women in Bangladesh for 2006, 2012–2013, and 2019 MICS datasets.

Independent variables

This study aimed to identify the effects of several socioeconomic and demographic variables on the women's age at first marriage in Bangladesh. The independent variables under the study were the age of women (15–19, 20–24, 25–29, 30–34, 35–39, 40–44, and 45–49), geographical division (Barisal, Chittagong, Dhaka, Khulna, Rajshahi, Sylhet, and Rangpur), ethnicity (Bengali, Others [Chakma, Santal, Marma, Tripura, and Garo]), religion (Islam, Hinduism, Buddhism, Christianity, and Others), wealth index (poorest, poorer, middle, richer, and richest), and educational status (no education, primary, secondary, higher; non-standard curriculum). No information about religion was found in the datasets for the years 2006 and 2019, while the 2012–2013 survey did not include details on the ethnicity.

Statistical analysis

The summary statistics of women's age at first marriage were calculated for different levels of predictors in rural and urban areas, and ANOVA was performed to assess the primary association between age at first marriage and other categorical variables. Moreover, multiple linear regression (MLR) and quantile regression (QR) approaches were used to assess the relationship between age at first marriage and socioeconomic and demographic factors. The underlying MLR model was defined as,

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \cdots + \beta_k X_k + e \qquad \text{Equation 1}$$

In Equation 1, Y was the response variable, β_0 was the intercept term, β_i's was the vector of regression coefficients, $X_i's$ were the socioeconomic and demographic factors under investigation, and e was the random error term that was assumed to follow an $N(0, \sigma^2)$.

The corresponding QR model for each considered quantile θ was defined as (Das et al., 2019)

$$Q_\theta(\boldsymbol{y}|\boldsymbol{X}) = \boldsymbol{X}\beta(\theta) + \boldsymbol{e} \qquad \text{Equation 2}$$

In Equation 2, $Q_\theta(\boldsymbol{y} \mid \boldsymbol{X})$ was the quantile function, and $\boldsymbol{y}$ denotes the variable on which quantile was computed, $X_{[n\times p]}$ was the design matrix of covariates, $\beta(\theta)$ was the quantile regression parameter at quantile level θ, and **e** was the vector of error terms.

We used the R function 'lm' (Lortie, 2017) and R packages 'quantreg' for fitting the MLR and QR models, respectively (Koenker, 2009).

Limitations

There were a few limitations of this study. Firstly, the age at marriage was calculated from the survey respondents aged 15–49. It would be better to calculate women's age at first marriage from the sample who got married in the respective years rather than survey years. However, no such data is available, and thus consecutive surveys play an important role in this context. Secondly, instead of replacing the missing values in the data with appropriate methods, incomplete cases were excluded from the study. Thirdly, due to unavailability, the study could not include sociodemographic and economic variables such as the scope of income-generating activities for women, dropping out of school, social insecurity, safety in the locality, etc. Access to these variables could provide more adjustment to the estimated parameters of the models.

Results

The significant factors were identified by ANOVA and included in the predictor list for regressing the age at first marriage by MLR and QR. We found the deviation of the distribution of age at first marriage from the normality assumption, and the calculated skewness and kurtosis were between 0.82–1.28 and 5.57–6.92, respectively. The predictors selected for further analysis were women's age, geographical division, women's education level, wealth index, ethnicity, and religion.

Descriptive statistics of the sampled ever-married women

Frequency, percentage, and mean age at first marriage of women were calculated over the levels of socioeconomic and demographic characteristics in urban and rural areas for the 2006 to 2019 survey periods. From the survey in 2006, it was evident that the mean age at first marriage in rural and urban areas was higher for the age groups 25–29 and 30–34, respectively. For the 2012–2013 survey, the means were higher among women aged 20–24 in rural and 25–29 in urban areas. For the 2019 survey, the respective rural-urban age cohorts with the highest mean age at first marriage were 25–29 and 30–34. In all survey years, the highest average age at first marriage was observed in the Sylhet division. For the 2006 and 2019 surveys, the average age at first marriage was highest in Bengali ethnic communities in both rural and urban areas.

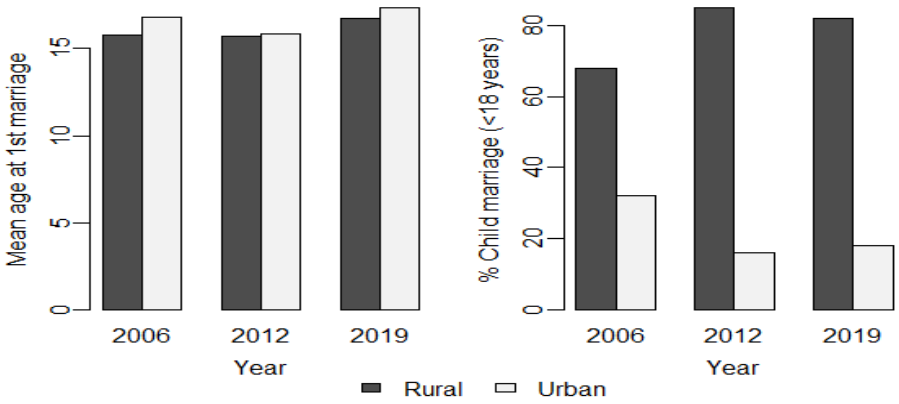
In contrast, for the 2012–2013 survey, the average age at first marriage was highest among Buddhist people in rural areas and Christian people in urban areas. Wealthy families in rural and urban areas consistently showed a higher mean age at first marriage over the survey years. Also, women with secondary or higher education showed a higher mean age at first marriage in rural and urban areas (See Appendix 1).

Trends in mean age at first marriage and percentage of child marriage

The mean age at first marriage of young girls in Bangladesh varied over the survey years in both rural and urban areas from 2006 to 2019. The mean age at first marriage in Bangladesh was 16.8 years in the urban area and 15.8 years in the rural area in 2006, which declined to 15.9 years and

15.7 years in 2012–2013, respectively, and increased again substantially to 17.3 years and 16.7 years, respectively in 2019 (Figure 1). Trend analysis demonstrated that the prevalence of early marriage in rural areas was 67.6% in 2006, which increased to 84% in 2012, and further decreased to 79% in 2019. Overall, this exhibited an increasing trend in the first six years (2006–2012) and a decreasing trend in the last six years (2013–2019) in rural areas. An opposite scenario was evident in urban areas. The prevalence of early marriage was 33% in 2006, which decreased to 16% in 2012–2013 and further increased to 21% in 2019.

Figure 1: Mean Age at First Marriage and Percentage of Child Marriage in Bangladesh from 2006 to 2019 by Rural-Urban Settings



Results of Multiple Linear Regression (MLR) analysis

Results of MLR revealed that age at first marriage was significantly associated with women's age, geographical division, ethnicity, religion, wealth index, and women's education. The MLR and QR model results for the 2006, 2012–2013, and 2019 periods in both rural and urban areas were shown separately in Tables 1–3, respectively. The quantiles (0.10, 0.25, 0.50, 0.75, and 0.90) were considered based on the previous literature on age at first marriage and fertility (Lacalle-Calderon et al., 2017). The risk of early marriage was more for lower age groups than for higher age groups. For the 2006 survey, the risk of early marriage was higher for the age group 25–29 than for the age groups 15–19. But for 2012–2013 and 2019 surveys, the women's age had a consistent increasing effect on age at first marriage. The risk of early marriage was especially decreased as the age increased, and this increment was higher for the urban areas than in rural areas. For example, the average age at first marriage in the rural area of 30–34 years was 0.92, 0.91, and 1.41 years higher than 15–19 years over the 2006, 2012–2013, and 2019 periods, respectively. Besides, the average age at first marriage in the urban areas for 30–34 years was 1.23, 0.97, and 1.79 years more than the age group 15–19 over the consecutive periods stated in Tables 1–3.

The risk of early marriage was lower in Khulna and Rajshahi than in Barisal in both rural and urban regions in 2006. The mean age at first marriage was higher in rural (1.78 years) and urban (1.54 years) areas of Sylhet compared to Barisal. The 2012–2013 survey data shows that the risk of

early marriage was higher in Khulna, Rangpur, and Rajshahi for both rural and urban areas than in Barisal. Similar to 2006, Sylhet had a lower risk of early marriage in rural and urban areas compared to the respective areas in Barisal in 2012–2013 and 2019 (Tables 1–3).

Women who belonged to the other ethnic groups managed to delay their marriage compared to their Bengali counterparts. It was higher by 2.56 years in rural areas and 2.38 years in urban areas in 2006. A similar scenario was evident from the 2019 survey data. As mentioned earlier, the 2012–2013 survey did not collect the ethnic identity of the respondent. It revealed that the risk of early marriage was higher among women who believed in any religion other than Buddhism in rural areas, while a similar pattern was evident compared to Christian in urban areas (Tables 1–3).

For the 2006 survey, the risk of early marriage was lower for wealthy families, and this risk was even lower in rural areas than in urban areas. However, this pattern contradicts the results of 2012–2013 and 2019 surveys. The average age at first marriage was also higher for women with higher education levels than no education, and this average was higher for urban areas than in rural areas. All three survey years provided evidence in favor of this. The positive effect of education on the average age at first marriage was much strong in 2019 compared to 2012–2013. Also, the urban area in this context was found better off than its counterpart (Tables 1–3).

Results of Quantile Regression (QR) analysis

The results of QR revealed that the women's age was significantly associated with age at first marriage through lower to upper quantile level. The average age at first marriage in the age group 20–24 years was 1.33 years more than the age group 15–19 years at 0.9 quantile level for rural areas. For the age group 30–34 years, the mean age at first marriage was two folds higher for rural areas in 2006. An increasing trend was evident in recent years in the average age of women at first marriage. For instance, the mean age was three years more for the age group 45–49 years in 2012–2013 for rural areas, and it was four years more in 2019. Likewise, the mean age at first marriage was four years higher for the age group 45–49 years in 2012–2013 for urban areas, and it was 4.71 years higher in 2019. For the 2006 survey, the QR estimate at 0.2 quantile level was negatively associated with the mean age at first marriage for the age group 45–49 years, but the MLR estimate showed a positive association (Tables 1–3).

Table 1: Results of Quantile Regression of Age of First Marriage of Women by Sociodemographic Factors in 2006

Background Characteristics	Rural						Urban					
	Q10	Q25	Q50	Q75	Q90	OLS	Q10	Q25	Q50	Q75	Q90	OLS
Women's Age												
15–19	-	-	-	-	-	-	-	-	-	-	-	-
20–24	8.47×10^{-11} (-2.80–2.80)	1.40×10^{-11} (-5.59×10^{-12}–3.36×10^{-11})	1.00 (1.00–1.00)****	1.00 (1–1)****	1.33 (0.42–2.24)***	0.76 (0.66–0.86)****	8.58×10^{-13} (-3.56–3.56)	0.50 (-0.79–1.79)	1.00 (-0.04–2.04)*	1.00 (-0.32–2.32)	2.00 (-1.5–5.59)	0.96 (0.78–1.15)****
25–29	4.97×10^{-11} (-2.99–2.99)	1.27×10^{-11} (-8.14×10^{-12}–3.36×10^{-11})	1.00 (1.00–1.00)****	1 (1–1)****	2.00 (1.03–2.97)****	1.00 (0.89–1.11)****	-9.48×10^{-14} (-3.64 – 3.64)	0.50 (-0.82–1.82)	1.00 (-0.06–2.06)*	1.50 (0.15–2.85)**	2.00 (-1.67–5.67)	1.15 (0.96–1.34)****
30–34	-1.89×10^{-11} (-3.33–3.33)	1.10×10^{-11} (-1.23×10^{-11}–3.43×10^{-11})	1 (1.00–1.00)****	1 (1–1)****	2.00 (0.92–3.08)****	0.92 (0.80–1.04)****	-1 (-4.87–2.87)	0.50 (-0.90–1.90)	1.00 (-0.13–2.13)*	1.50 (0.07–2.93)**	3.00 (-0.90–6.90)	1.23 (1.03–1.43)****
35–39	-8.46×10^{-11} (-3.56-3.56)	3.41×10^{-12} (-2.15×10^{-11}–2.83×10^{-11})	1 (1.00–1.00)****	1 (1–1)****	2.00 (0.84–3.16)****	0.86 (0.73–0.99)****	-1 (-4.93–2.93)	7.99×10^{-11} (-1.42–1.42)	1.00 (-0.14–2.14)*	1.50 (0.04–2.96)**	3.00 (-0.96–6.96)	1.12 (0.92–1.33)****
40–44	-1 (-5.11–3.11)	-3.53×10^{-12} (-3.22×10^{-11}–2.52×10^{-11})	4.44×10^{-10} (-6.40×10^{-12}–8.95×10^{-10})*	1 (1–1)****	1.67 (0.34–3.00)**	0.58 (0.43–0.72)****	-1 (-5.38–3.38)	-5.58×10^{-11} (-1.59–1.59)	0.50 (-0.78–1.78)	1.00 (-0.63–2.63)	2.00 (-2.42–6.42)	0.72 (0.49–0.95)****
45–49	-1 (-5.56–3.56)	-1 (-1.00 –-1.00)****	-1.21×10^{-10} (-6.21×10^{-10}–3.80×10^{-10})	2.04×10^{-10} (-6.65×10^{-11}–4.74×10^{-10})	1 (-0.48–2.48)	0.15 (-0.02–0.31)*	-1 (-5.85–3.85)	-0.50 (-2.26–1.26)	0.50 (-0.91–1.91)	0.50 (-1.30–2.30)	2.00 (-2.88–6.88)	0.38 (0.12–0.63)***
Geographical Division												
Barisal	-	-	-	-	-	-	-	-	-	-	-	-
Chittagong	2.63×10^{-10} (-3.52-3.52)	1 (1.00–1.00)****	1 (1.00–1.00)****	1 (1–1)****	0.67 (-0.47–1.81)	0.63 (0.51–0.76)****	1.41×10^{-12} (-3.56–3.56)	0.50 (-0.79–1.79)	0.50 (-0.54–1.54)	0.50 (-0.82–1.82)	2.60×10^{-14} (-3.59–3.59)	0.36 (0.17–0.55)****
Dhaka	1.95×10^{-10} (-3.27–3.27)	1 (1.00–1.00)****	1 (1.00–1.00)****	1 (1–1)****	0.67 (-0.39–1.73)	0.54 (0.42–0.66)****	2.02×10^{-13} (-3.45–3.45)	-5.41×10^{-12} (-1.25–1.25)	3.10×10^{-12} (-1.00–1.00)	1.59×10^{-14} (-1.28–1.28)	-2.92×10^{-14} (-3.47–3.47)	0.002 (-0.178–0.182)
Khulna	-1 (-4.46–2.46)	-2.75×10^{-11} (5.17×10^{-11}–3.41×10^{-12})	-3.57×10^{-10} (-7.36×10^{-10}–2.18×10^{-11})*	-1.00×10^{-10} (-3.04×10^{-10}–1.04×10^{-10})	-0.33 (-1.45–0.79)	-0.25 (-0.37–-0.13)****	-1.02×10^{-12} (-3.70–3.70)	-0.50 (-1.84–0.84)	-0.50 (-1.58–0.58)	-0.50 (-1.87–0.87)	-1.00 (-4.73–2.73)	-0.49 (-0.68– -0.29)****
Mymensingh	-	-	-	-	-	-	-	-	-	-	-	-
Rajshahi	-1 (-4.27–2.27)	-2.77×10^{-11} (-5.05×10^{-11}–4.84×10^{-12})	-2.31×10^{-10} (-5.89×10^{-10}–1.28×10^{-10})	-8.92×10^{-12} (-2.02×10^{-10}–1.85×10^{-10})	-3.60×10^{-14} (-1.06–1.06)	-0.13 (-0.25–-0.01)**	-5.65×10^{-13} (-3.49–3.49)	-0.50 (-1.77–0.77)	-0.50 (-1.52–0.52)	-0.50 (-1.80–0.80)	-1.00 (-4.52–2.52)	-0.39 (-0.58– -0.21)****
Rangpur	-	-	-	-	-	-	-	-	-	-	-	-
Sylhet	1 (-3.76–5.76)	2 (2.00–2.00)****	2 (2–2)****	2 (2–2)****	2 (0.45–3.55)**	1.78 (1.61–1.95)****	1 (-3.56–5.56)	1.00 (-0.65–2.65)	1.50 (0.17–2.83)**	1.50 (-0.19–3.19)*	2.00 (-2.60–6.60)	1.54 (1.30–1.77)****

Background Characteristics	Rural						Urban					
	Q10	Q25	Q50	Q75	Q90	OLS	Q10	Q25	Q50	Q75	Q90	OLS
Ethnicity												
Bengali	-	-	-	-	-	-	-	-	-	-	-	-
Others	2 (-6.00–10.00)	2 (2–2)****	2 (2.00–2.00)****	3 (3–3)****	3.33 (0.73–5.93)**	2.56 (2.27–2.84)****	2 (-6.70–10.70)	2.00 (-1.15–5.15)	2.50 (-0.03–5.03)*	2.50 (-0.73–5.73)	3.00 (-5.77–11.77)	2.38 (1.92–2.83)****
Wealth index quantile												
Poorest	-	-	-	-	-	-	-	-	-	-	-	-
Poorer	5.71×10^{-12} (-3.01–3.01)	1.12×10^{-12} (1.99×10^{-11}–2.21×10^{-11})	8.45×10^{-11} (-2.45×10^{-10}–4.14×10^{-10})	-8.75×10^{-12} (-1.87×10^{-10}–1.69×10^{-10})	-6.40×10^{-15} (-0.98–0.98)	-0.02 (-0.13–0.09)	7.26×10^{-13} (-6.50–6.50)	5.46×10^{-11} (-2.36–2.36)	5.21×10^{-12} (-1.89–1.89)	0.50 (-1.91–2.91)	-7.71×10^{-15} (-6.55–6.55)	0.14 (-0.20–0.48)
Middle	1.75×10^{-12} (-2.98–2.98)	1.53×10^{-12} (-1.93×10^{-11}–2.24×10^{-11})****	2.13×10^{-10} (-1.14×10^{-10}–5.40×10^{-10})	2.11×10^{-11} (-1.55×10^{-10}–1.98×10^{-10})	1.70×10^{-14} (-0.97–0.97)	0.06 (-0.05–0.16)	7.27×10^{-13} (-6.02–6.02)	1.51×10^{-11} (-2.18–2.18)	6.68×10^{-12} (-1.75–1.75)	0.50 (-1.73–2.73)	-4.59×10^{-14} (-6.06–6.06)	0.07 (-0.25–0.38)
Richer	6.54×10^{-11} (-3.06–3.06)	7.63×10^{-12} (-1.38×10^{-11}–2.90×10^{-11})****	3.74×10^{-10} (3.79×10^{-11}–7.09×10^{-10})**	1.24×10^{-10} (-5.73×10^{-11}–3.05×10^{-10})	0.33 (-0.66–1.32)	0.24 (0.13–0.35)****	2.48×10^{-13} (-5.63–5.63)	7.00×10^{-11} (-2.04–2.04)	7.47×10^{-12} (-1.64–1.64)	0.50 (-1.59–2.59)	-1.38×10^{-14} (-5.67–5.67)	0.16 (-0.14–0.45)
Richest	1.24×10^{-10} (-3.76–3.76)	1.38×10^{-11} (-1.25×10^{-11}–4.01×10^{-11})	6.09×10^{-10} (1.97×10^{-10}–1.02×10^{-9})**	1 (1–1)****	0.67 (-0.55–1.89)	0.47 (0.34–0.61)****	1.28×10^{-12} (-5.53–5.53)	0.50 (-1.50–2.50)	0.50 (-1.11–2.11)	1.00 (-1.05–3.05)	1.00 (-4.57–6.57)	0.57 (0.28–0.86)****
Women's education												
None	-	-	-	-	-	-	-	-	-	-	-	-
Primary	1.65×10^{-10} (-32.07–32.07)	2.93×10^{-11} (-1.95×10^{-10}–2.53×10^{-10})	-3.87×10^{-11} (-3.55×10^{-9}–3.48×10^{-9})	7 (7–7)****	0.67 (-9.75–11.09)	0.35 (-0.79–1.49)	7.50×10^{-15} (-35.67–35.67)	-1.00 (-13.92–11.92)	2.96×10^{-12} (-10.38–10.38)	1.50 (-11.72–14.72)	-3.00 (-38.95–32.95)	-0.23 (-2.09–1.63)
Secondary (High school)	1 (-31.10–33.10)	1 (1.00–1.00)****	1 (1.00–1.00)****	-1 (-1– -1)****	2 (-8.42–12.42)	1.71 (0.57–2.85)***	1 (-34.70–36.70)	0.50 (-12.43–13.43)	1.50 (-8.89–11.89)	3.00 (-10.23–16.23)	-1.00 (-36.97–34.97)	1.38 (-0.48–3.24)
Higher Secondary (College/ University)	5.00 (-28.45–38.45)	5 (5–5)****	6 (6.00–6.00)****	-2.69×10^{-11} (-1.93×10^{-9}–1.87×10^{-10})	7.33 (-3.53–18.19)	6.17 (4.98–7.36)****	4 (-31.89 – 39.89)	4.00 (-9.00–17.00)	6.00 (-4.45–16.45)	8.50 (-4.81–21.81)	4.00 (-32.17–40.17)	5.84 (3.97–7.71)****
Non-standard curriculum	-2 (-37.94–33.94)	2.48×10^{-11} (-2.26×10^{-10}–2.76×10^{-10})	-1 (-1.00– -1.00)****	1 (1–1)****	1.08×10^{-14} (-11.67–11.67)	-0.32 (-1.61–0.96)	-1 (-45.07–43.07)	3.83×10^{-11} (-15.96–15.96)	0.50 (-12.33–13.33)	2.00 (-14.34–18.34)	-2.00 (-46.41–42.41)	-0.12 (-2.42–2.18)

*Note: p value < 0.001****, 0.001 < p value < 0.01***, 0.01 < p value < 0.05**, 0.05 < p value < 0.1**

Table 2: Results of Quantile Regression of Age of First Marriage of Women by Sociodemographic Factors in 2012–2013

Background Characteristics	Rural						Urban					
	Q10	**Q25**	**Q50**	**Q75**	**Q90**	**OLS**	**Q10**	**Q25**	**Q50**	**Q75**	**Q90**	**OLS**
Women's Age												
15–19	-	-	-	-	-	-	-	-	-	-	-	-
20–24	-3.21×10^{-13} (-3.72–3.72)	7.96×10^{-12} (-2.74–2.74)	1.0 (-1.10–3.10)	1.00 (0.08–1.92)**	1.56 (1.12–2.00)****	0.74 (0.60–0.88)****	1.76×10^{-14} (-1.43×10^{-11}–1.43×10^{-11})	0.50 (-1.33–2.33)	1.00 (-1.84–3.84)	1.00 (-2.61–4.61)	1.67 (-0.01–3.35)*	0.77 (0.42–1.12)****
25–29	-9.25×10^{-13} (-3.62–3.62)	9.13×10^{-13} (-2.66–2.66)	1.00 (-1.04–3.04)	1.00 (0.10–1.90)**	2.06 (1.63–2.49)****	0.81 (0.68–0.95)****	-1.00 (-1.00–-1.00)****	-9.62×10^{-13} (-1.79–1.79)	1.00 (-1.77–3.77)	1.00 (-2.53–4.53)	2.67 (1.02–4.31)***	0.89 (0.55–1.23)****
30–34	-8.47×10^{-13} (-3.77–3.77)	-4.16×10^{-13} (-2.77–2.77)	1.00 (-1.13–3.13)	1.00 (0.06–1.94)**	2.43 (1.99–2.88)****	0.91 (0.77–1.05)****	-1.00 (-1.00–-1.00)****	-1.07×10^{-12} (-1.86–1.86)	1.00 (-1.88–3.88)	1.00 (-2.67–4.67)	3.33 (1.63–5.04)****	0.97 (0.62–1.33)****
35–39	-7.58×10^{-13} (-3.87–3.87)	2.44×10^{-12} (-2.84–2.84)	1.00 (-1.19–3.19)	1.33 (0.37–2.29)***	2.81 (2.35–3.27)****	1.11 (0.96–1.26)****	-1.00 (-1.00–-1.00)****	-8.77×10^{-13} (-1.90–1.90)	1.00 (-1.94–3.94)	1.00 (-2.74–4.74)	3.67 (1.93–5.41)****	1.12 (0.75–1.48)****
40–44	-7.51×10^{-13} (-4.06–4.06)	2.60×10^{-12} (-2.98–2.98)	1.00 (-1.29–3.29)	1.33 (0.33–2.34)***	2.81 (2.33–3.29)****	1.14 (0.98–1.29)****	-1.00 (-1.00–-1.00)****	-8.68×10^{-13} (-1.99–1.99)	1.00 (-2.08–4.08)	1.00 (-2.91–4.91)	3.00 (1.18–4.82)***	1.04 (0.66–1.42)****
45–49	-6.08×10^{-13} (-4.26–4.26)	4.32×10^{-13} (-3.13–3.13)	1.00 (-1.41–3.41)	1.67 (0.61–2.72)***	3.62 (3.12–4.13)****	1.34 (1.18–1.50)****	-1.00 (-1.00–-1.00)****	-1.61×10^{-12} (-2.08–2.08)	1.00 (-2.22–4.22)	1.00 (-3.10–5.10)	4.00 (2.09–5.91)****	1.17 (0.77–1.57)****
Geographical Division												
Barisal	-	-	-	-	-	-	-	-	-	-	-	-
Chittagong	1.21×10^{-12} (-3.52–3.52)	1.00 (-1.59–3.59)	1.00 (-0.99–2.99)	1.00 (0.12–1.88)**	1.13 (0.71–1.54)****	0.87 (0.74–1.01)****	1.00 (1.00–1.00)****	1.00 (-0.69–2.69)	1.00 (-1.62–3.62)	1.00 (-2.33–4.33)	1.33 (-0.22–2.89)*	1.14 (0.82–1.46)****
Dhaka	-1.00 (-4.16–2.16)	-1.17×10^{-12} (-2.33–2.33)	9.55×10^{-11} (-1.79–1.79)	6.82×10^{-13} (-0.79–0.79)	0.13 (-0.25–0.50)	0.03 (-0.08–0.15)	-5.87×10^{-14} (-1.29×10^{-11} –1.28×10^{-11})	0.50 (-1.14–2.14)	1.00 (-1.54–3.54)	6.86×10^{-11} (-3.23–3.23)	0.67 (-0.84–2.17)	0.60 (0.28–0.91)****
Khulna	-1.00 (-4.34–2.34)	-1.00 (-3.46v1.46)	-1.00 (-2.89–0.89)	-0.67 (-1.50–0.16)	-0.50 (-0.90–-0.10)**	-0.64 (-0.76–-0.51)****	–2.23×10^{-12} (-1.57×10^{-11} –1.12×10^{-11})	-0.50 (-2.22–1.22)	-1.15×10^{-11} (-2.67–2.67)	-1.00 (-4.39–2.39)	-0.33 (-1.91–1.25)	-0.27 (-0.60–0.06)
Mymensingh	-	-	-	-	-	-	–	-	-	-	-	
Rajshahi	-1.00 (-4.53–2.53)	-1.00 (-3.6–1.6)	-1.00 (-3.00–1.00)	-0.67 (-1.54–0.21)	-0.43 (-0.85–-0.02)**	-0.63 (-0.77–-0.50)****	-2.07×10^{-12} (-1.69×10^{-11} –1.27×10^{-11})	-0.50 (-2.39–1.39)	-9.95×10^{-12} (-2.93–2.93)	-1.00 (-4.72–2.72)	-0.33 (-2.07–1.40)	-0.27 (-0.63–0.09)
Rangpur	-1.00 (-4.45–2.45)	-1.00 (-3.54–1.54)	-1.00 (-2.95–0.95)	-0.67 (-1.52–0.19)	-0.87 (-1.28–-0.47)****	-0.69 (-0.82–-0.56)****	-1.66×10^{-12} (-1.63×10^{-11} –1.30×10^{-11})	-0.50 (-2.37–1.37)	-7.63×10^{-12} (-2.90–2.90)	-1.00 (-4.68–2.68)	5.16E-11 (-1.71–1.71)	-0.14 (-0.50–0.22)
Sylhet	1.00 (-3.17–5.17)	2.00 (-1.07–5.07)	2.00 (-0.36–4.36)*	2.33	2.50	1.99	1.00	2.00 (-0.26–4.26)*	2.00 (-1.50–5.50)	1.67 (-2.78–6.12)	2.33 (0.26–4.40)**	2.02

Background Characteristics	Rural						Urban					
	Q10	Q25	Q50	Q75	Q90	OLS	Q10	Q25	Q50	Q75	Q90	OLS
				(1.30–3.37)****	(2.01–2.99)****	(1.83–2.15)****	(1.00–1.00)****					(1.59–2.45)****
Religion												
Buddhism	-	-	-	-	-	-	-	-	-	-	-	-
Islam	-1.00 (-6.88–4.88)	-1.00 (-5.32–3.32)	-1.00 (-4.32–2.32)	-1.67 (-3.13–-0.21)**	-1.75 (-2.44–-1.06)****	-1.43 (-1.65–-1.20)****	-1.00 (-1.00–-1.00)****	-1.00 (-4.06–2.06)	-3.00 (-7.74–1.74)	-3.00 (-9.03–3.03)	-2.00 (-4.81–0.81)	-2.07 (-2.65–-1.49)****
Hinduism	-1.06×10^{-11} (-6.45–6.45)	-2.06×10^{-11} (-4.74–4.74)	-1.00 (-4.64–2.64)	-1.00 (-2.60–0.60)	-1.13 (-1.89–-0.36)***	-0.84 (-1.08–-0.60)****	-3.04×10^{-12} (-2.87×10^{-11} –2.26×10^{-11})	-0.50 (-3.78–2.78)	-2.00 (-7.08–3.08)	-2.00 (-8.46–4.46)	-1.00 (-4.01–2.01)	-1.19 (-1.81–-0.56)****
Christian	-9.51×10^{-12} (-12.63–12.63)	-9.51×10^{-12} (-9.29–9.29)	-3.53×10^{-10} (-7.14–7.14)	-0.67 (-3.80–2.47)	2.10×10^{-10} (-1.49–1.49)***	-0.29 (-0.77–0.18)	-7.77×10^{-13} (-5.76×10^{-11}–5.61×10^{-11})	-0.50 (-7.77–6.77)	-1.00 (-12.26–10.26)	-5.23×10^{-11} (-14.32–14.32)	1.67 (-5.00–8.33)	0.19 (-1.19–1.58)
Others	1.00 (-13.71–15.71)	-5.73×10^{-13} (-10.82–10.82)	-3.74×10^{-10} (-8.32–8.32)	-1.00 (-4.65–2.65)	-1.38 (-3.11–0.36)	-0.49 (-1.05–0.06)	-1.33×10^{-12} (-1.24×10^{-10}–1.21×10^{-10})	-0.50 (-16.18–15.18)	-3.00 (-27.27–21.27)	-4.00 (-34.88–26.88)	-2.33 (-16.71–12.04)	-2.19 (-5.18–0.79)
Wealth index quantile												
Poorest												
Poorer	-8.00×10^{-13} (-2.40–2.40)	-7.80×10^{-12} (-1.77–1.77)	-1.81×10^{-10} (-1.36–1.36)	-0.33 (-0.93–0.26)	-0.38 (-0.66–-0.09)***	-0.36 (-0.45–-0.27)****	-1.03×10^{-12} (-1.48×10^{-11}–1.27×10^{-11})	-0.50 (-2.26–1.26)	-1.15×10^{-12} (-2.72–2.72)	-2.45×10^{-11} (-3.46–3.46)	-7.19×10^{-12} (-1.61–1.61)	-0.18 (-0.52–0.15)
Middle	-1.00×10^{-12} (-2.53–2.53)	-8.52×10^{-12} (-1.86–1.86)	-2.09×10^{-10} (-1.43–1.43)	-0.33 (-0.96–0.29)	-0.38 (-0.67–-0.08)**	-0.40 (-0.49–-0.30)****	-1.22×10^{-12} (-1.39×10^{-11}–1.15×10^{-11})	-0.50 (-2.13–1.13)	-5.86×10^{-12} (-2.52–2.52)	-4.02×10^{-11} (-3.21–3.21)	-1.32×10^{-12} (-1.49–1.49)	-0.37 (-0.68–-0.06)**
Richer	-1.16×10^{-12} (-2.75–2.75)	-1.31×10^{-11} (-2.02–2.02)	-2.25×10^{-10} (-1.55–1.55)	-0.33 (-1.02–0.35)	-0.38 (-0.70–-0.05)**	-0.45 (-0.55–-0.35)****	-1.07×10^{-12} (-1.28×10^{-11}-1.06×10^{-11})	-0.50 (-2.00–1.00)	-5.93×10^{-12} (-2.32–2.32)	-2.74×10^{-11} (-2.95–2.95)	1.80×10^{-11} (-1.37–1.37)	-0.25 (-0.54–-0.03)*
Richest	-1.49×10^{-12} (-3.47–3.47)	-1.64×10^{-11} (-2.55–2.55)	-3.00×10^{-10} (-1.96–1.96)	-0.33 (-1.19–0.53)	-0.38 (-0.79–0.04)*	-0.53 (-0.66–-0.40)****	-2.17×10^{-12} (-1.41×10^{-11}–9.74×10^{-12})	-0.50 (-2.02–1.02)	-6.29×10^{-12} (-2.36–2.36)	-1.73×10^{-11} (-3.00–3.00)	2.19×10^{-11} (-1.40–1.40)	-0.34 (-0.63–-0.05)**
Women's education												
None	-	-	-	-	-	-	-	-	-	-	-	-
Primary	2.78×10^{-13} (-2.23–2.23)	3.70×10^{-12} (-1.64–1.64)	1.80×10^{-10} (-1.26–1.26)	0.33 (-0.22–0.89)	0.38 (0.11–0.64)***	0.22 (0.13–0.30)****	1.85×10^{-13} (-9.40×10^{-12}–9.77×10^{-12})	1.09×10^{-13} (-1.23–1.23)	4.65×10^{-12} (-1.90–1.90)	6.11×10^{-11} (-2.42–2.42)	0.33 (-0.79–1.46)	0.27 (0.04–0.51)**
Secondary (High school)	1.00 (-1.56–3.56)	1.00 (-0.88–2.88)	1.00 (-0.45–2.45)	1.00 (0.36–1.64)***	1.18 (0.88–1.49)****	1.08 (0.99–1.18)****	2.92×10^{-12} (-7.25×10^{-12}–1.31×10^{-11})	0.50 (-0.80–1.80)	1.00 (-1.01–3.01)	1.09×10^{-10} (-2.56–2.56)	0.67 (-0.53–1.86)	0.72 (0.47–0.96)****
Higher Secondary (College/ University)	2.00 (-1.73–5.73)	2.00 (-0.74–4.74)	2.00 (-0.11–4.11)*	3.00 (2.07–3.93)****	3.62 (3.18–4.07)****	2.85 (2.71–2.99)****	2.00 (2.00–2.00)****	2.50 (1.02–3.98)****	3.00 (0.71–5.29)**	3.00 (0.08–5.92)**	4.00 (2.64–5.36)****	3.13 (2.85–3.42)****

Background Characteristics	Rural						Urban					
	Q10	Q25	Q50	Q75	Q90	OLS	Q10	Q25	Q50	Q75	Q90	OLS
Non-standard curriculum	-	-	-	-	-	-	-	-	-	-	-	-

*Note: p value < 0.001****, 0.001 < p value < 0.01***, 0.01 < p value < 0.05**, 0.05 < p value < 0.1**

Table 3: Results of Quantile Regression of Age of First Marriage of Women by Sociodemographic Factors in 2019

Background Characteristics	Rural						Urban					
	Q10	Q25	Q50	Q75	Q90	OLS	Q10	Q25	Q50	Q75	Q90	OLS
Women's Age												
15–19	-	-	-	-	-	-	-	-	-	-	-	-
20–24	5.33×10^{-15} (-7.01×10^{-14}–8.07×10^{-14})	0.17 (0.17–0.17)****	1.00 (-1.06–3.06)	0.64 (0.37–0.90)****	1.00 (1.00–1.00)****	0.61 (0.49–0.74)****	3.12×10^{-12} (-5.40×10^{-11} – 6.03×10^{-11})	8.28×10^{-10} (-1.19–1.19)	9.59×10^{-13} (-2.85–2.85)	0.83 (0.13–1.54)**	1.14 (0.36–1.93)**	0.63 (0.33–0.93)****
25–29	3.01×10^{-14} (-4.43×10^{-14} – 1.05×10^{-13})	0.33 (0.33–0.33)****	1.00 (-1.03–3.03)	1.45 (1.19–1.72)****	2.00 (2.00–2.00)****	1.31 (1.18–1.43)****	2.48×10^{-11} (-3.08×10^{-11}–8.05×10^{-11})	0.33 (-0.82–1.49)	1.000 (-1.778–3.778)	1.83 (1.14–2.52)****	2.57 (1.81–3.33)****	1.49 (1.20–1.78)****
30–34	-3.14×10^{-15} (-7.72×10^{-14}–7.09×10^{-14})	0.17 (0.17–0.17)****	1.00 (-1.02–3.02)	1.55 (1.29–1.80)****	3.00 (3.00–3.00)****	1.41 (1.28–1.53)****	1.25×10^{-11} (-4.32×10^{-11} – 6.83×10^{-11})	0.33 (-0.83–1.49)	1.000 (-1.783–3.783)	2.17 (1.48–2.86)****	3.43 (2.67–4.19)****	1.794 (1.503–2.086)****
35–39	1.24×10^{-14} (-6.42×10^{-14} – 8.90×10^{-14})	0.33 (0.33–0.33)****	1.00 (-1.09–3.09)	1.64 (1.37–1.90)****	3.00 (3.00–3.00)****	1.53 (1.40–1.66)****	1.68×10^{-11} (-3.99×10^{-11} – 7.36×10^{-11})	0.33 (-0.85–1.51)	1.00 (-1.83–3.83)	2.00 (1.30–2.70)****	3.57 (2.79–4.35)****	1.798 (1.501–2.094)****
40–44	1.06×10^{-14} (-7.18×10^{-14}–9.30×10^{-14})	0.33 (0.33–0.33)****	1.00 (-1.25–3.25)	1.64 (1.35–1.92)****	3.00 (3.00–3.00)****	1.57 (1.43–1.71)****	2.45×10^{-11} (-3.59×10^{-11}–8.50×10^{-11})	0.33 (-0.92–1.59)	1.00 (-2.02–4.02)	2.17 (1.42–2.92)****	3.57 (2.74–4.40)****	1.75 (1.44–2.07)****
45–49	3.47×10^{-14} (-5.25×10^{-14}–1.22×10^{-13})	0.50 (0.50–0.50)****	1.00 (-1.38–3.38)	2.18 (1.88–2.49)****	4.00 (4.00–4.00)****	1.96 (1.81–2.10)****	2.23×10^{-11} (-4.12×10^{-11}–8.58×10^{-11})	0.33 (-0.99–1.65)	1.00 (-2.17–4.17)	2.67 (1.88–3.45)****	4.71 (3.84–5.58)****	2.23 (1.89–2.56)****
Geographical Division												
Barisal	-	-	-	-	-	-	-	-	-	-	-	-
Chittagong	1.00 (1.00–1.00)****	0.50 (0.50–0.50)****	2.76×10^{-11} (-2.01–2.01)	0.64 (0.38–0.89)****	1.00 (1.00–1.00)****	0.57 (0.45–0.69)****	0.50 (0.50–0.50)****	0.33 (-0.79–1.45)	8.80×10^{-13} (-2.69–2.69)	1.00 (0.33–1.67)***	1.14 (0.40–1.88)**	0.75 (0.47–1.04)****
Dhaka	1.00 (1.00–1.00)****	0.50 (0.50–0.50)****	3.63×10^{-11} (-1.95–1.95)	0.73 (0.48–0.98)****	1.00 (1.00–1.00)****	0.71 (0.59–0.83)****	4.66×10^{-11} (-6.08×10^{-12}–9.93×10^{-11})*	0.33 (-0.76–1.43)	8.19×10^{-13} (-2.63–2.63)	1.00 (0.35–1.65)***	1.36 (0.64–2.08)****	0.83 (0.55–1.11)****
Khulna	7.89×10^{-13}	-0.17 (-0.17–-0.17)****	-1.00 (-2.95–0.95)	-1.00 (-1.25–-0.75)****	-1.00 (-1.00–-1.00)****	-0.57 (-0.69–-0.45)****	3.03×10^{-11} (-2.59×10^{-11}–8.65×10^{-11})	-0.33 (-1.50–0.83)	-1.00 (-3.81–1.81)	-0.33 (-1.03–0.36)	-0.14 (-0.91–0.63)	-0.15 (-0.44–0.14)

Background Characteristics	Rural						Urban					
	Q10	Q25	Q50	Q75	Q90	OLS	Q10	Q25	Q50	Q75	Q90	OLS
	(7.18×10^{-13}–8.61×10^{-13})****											
Mymensingh	1.00 (1.00–-1.00)****	0.17 (0.17–0.17)****	-3.60×10^{-12} (-2.54–2.54)	0.27 (-0.05–0.60)	3.70×10^{-14} (-5.05×10^{-13}–-5.79×10^{-13})	0.24 (0.09–0.40)***	0.50 (0.50–0.50)****	0.33 (-1.24–1.90)	2.38×10^{-13} (-3.77–3.77)	0.50 (-0.44–1.44)	1.14 (0.11–2.18)**	0.51 (0.11–0.90)**
Rajshahi	-1.44×10^{-14} (-8.59 ×10^{-14} –6.06×10^{-14})	-0.50 (-0.50–-0.50)****	-1.00 (-3.05–1.05)	-1.09 (-1.35–-0.83)****	-1.00 (-1.00–-1.00)****	-0.72 (-0.84–-0.59)****	-0.50 (-0.50–-0.50)****	-0.67 (-1.89–0.56)	-1.00 (-3.94–1.94)	-0.50 (-1.23–0.23)	-0.21 (-1.02–0.59)	-0.35 (-0.66–-0.04)**
Rangpur	1.00 (1.00 –1.00)****	8.59×10^{-10} (-2.03 ×10^{-9}–3.75×10^{-9})	-1.00 (-3.01–1.01)	-0.27 (-0.53–-0.01)**	-2.56×10^{-13} (-6.85×10^{-13}–1.73×10^{-13})	-0.07 (-0.19–0.05)	5.13×10^{-11} (-1.15×10^{-11} – 1.14×10^{-10})	8.44×10^{-10} (-1.31–1.31)	1.06×10^{-13} (-3.14–3.14)	0.50 (-0.28–1.28)	0.857 (-0.004–1.718)*	0.37 (0.04–0.70)**
Sylhet	2.00 (2.00 –2.00)****	1.67 (1.67–1.67)****	1.00 (-1.38–3.38)	1.73 (1.42–2.03)****	2.00 (2.00–2.00)****	1.72 (1.58–1.87)****	1.50 (1.50–1.50)****	1.33 (-0.19–2.86)*	1.00 (-2.66–4.66)	2.00 (1.09–2.91)****	2.00 (1.00–3.00)****	1.91 (1.52–2.29)****
Ethnicity												
Bengali	-	-	-	-	-	-	-	-	-	-	-	-
Others	1.00 (1.00 –1.00)****	1.67 (1.67–1.67)****	2.00 (-1.35–5.35)	2.64 (2.21–3.07)****	3.00 (3.00–3.00)****	2.17 (1.96–2.37)****	1.00 (1.00–1.00)****	2.00 (0.05–3.95)**	2.00 (-2.68–6.68)	2.83 (1.67–3.99)****	3.29 (2.00–4.57)****	2.47 (1.98–2.96)****
Wealth index quantile												
Poorest	-	-	-	-	-	-	-	-	-	-	-	-
Poorer	-4.44×10^{-15} (-5.51×10^{-14}–4.62×10^{-14})	-9.16×10^{-10} (-2.90 ×10^{-9}–1.07×10^{-9})	-7.69×10^{-12} (-1.38–1.38)	-0.182 (-0.359–0.004)**	-1.32×10^{-13} (-4.27×10^{-13}–1.63×10^{-13})	-0.13 (-0.22–-0.05)***	-3.14×10^{-12} (-6.56×10^{-11} – 5.94×10^{-11})	-8.32×10^{-10} (-1.30–1.30)	-1.62×10^{-13} (-3.12–3.12)	-4.20×10^{-10} (-0.77–0.77)	6.86×10^{-11} (-0.86–0.86)	-0.17 (-0.50–0.16)
Middle	-1.57×10^{-14} (-6.85×10^{-14}–3.71×10^{-14})	-0.17 (-0.17–-0.17)****	-1.59×10^{-11} (-1.44–1.44)	-0.27 (-0.46–-0.09)***	–3.50×10^{-13} (-6.53 ×10^{-13}–4.28×10^{-14})**	-0.29 (-0.38–-0.21)****	-0.50 (-0.50–-0.50)****	-0.33 (-1.51–0.84)	-3.09×10^{-13} (-2.82–2.82)	-0.33 (-1.03–0.37)	-0.21 (-0.99–0.56)	-0.35 (-0.64–-0.05)**
Richer	-2.09×10^{-14} (-7.81×10^{-14}–3.64×10^{-14})	-0.17 (-0.17–-0.17)****	-1.66×10^{-11} (-1.56–1.56)	-0.27 (-0.47–-0.07)***	-3.19×10^{-13} (-6.53×10^{-13}–1.37×10^{-14})*	-0.30 (-0.39–-0.20)****	-0.50 (-0.50–-0.50)****	-0.333 (-1.440–0.773)	-5.83×10^{-13} (-2.66–2.66)	-0.50 (-1.16–0.16)	-0.50 (-1.23–0.23)	-0.58 (-0.85–-0.30)****
Richest	-3.33×10^{-14} (-1.05×10^{-13}–3.87×10^{-14})	-0.33 (-0.33–-0.33)****	-1.81×10^{-11} (-1.96–1.96)	-0.27 (-0.52–-0.02)**	-2.47×10^{-13} (-6.66×10^{-13}–1.72×10^{-13})	-0.32 (-0.44–-0.20)****	-0.50 (-0.50–-0.50)****	-0.333 (-1.444–0.778)	-6.34×10^{-13} (-2.67–2.67)	-0.33 (-1.00–0.33)	-0.14 (-0.87–0.59)	-0.51 (-0.79–-0.23)****
Women's education												
None	-	-	-	-	-	-	-	-	-	-	-	-
Primary	1.55×10^{-14} (-3.82×10^{-14}–6.92×10^{-14})	0.17 (0.17–0.17)****	1.11×10^{-11} (-1.46–1.46)	0.27 (0.08–0.46)***	-5.48×10^{-14} (-3. ×10^{-13}–2.58×10^{-13})	0.10 (0.01–0.19)**	0.50 (0.50–0.50)****	0.33 (-0.58–1.24)	6.38×10^{-13} (-2.19–2.19)	0.50 (-0.04–1.04)*	0.21 (-0.39–0.81)	0.41 (0.18–0.64)****
Secondary (High school)	1.00 (1.00	0.83 (0.83–	1.00 (-0.51–2.51)	0.91	1.00	0.87	1.00	1.00 (0.11–1.89)**	1.00 (-1.13–3.13)	1.17	0.79	1.13

Background Characteristics	Rural						Urban					
	Q10	Q25	Q50	Q75	Q90	OLS	Q10	Q25	Q50	Q75	Q90	OLS
	–1.00)****	0.83)****		(0.72–1.10)****	(1.00–1.00)****	(0.78–0.96)****	(1.00–1.00)****			(0.64–1.69)****	(0.20–1.37)***	(0.91–1.35)****
Higher Secondary (College/ University)	3.00 (3.00 –3.00)****	3.00 (3.00–3.00)****	3.00 (0.88–5.12)***	3.82 (3.55–4.09)****	4.00 (4.00–4.00)****	3.49 (3.36–3.62)****	3.50 (3.50–3.50)****	3.33 (2.32–4.35)****	4.00 (1.56–6.44)***	4.83 (4.23–5.44)****	5.29 (4.62–5.96)****	4.42 (4.16–4.67)****
Non-standard curriculum	-	-	-	-	-	-	-	-	-	-	-	-

Note: p value < 0.001****, 0.001 < *p* value < 0.01***, 0.01 < *p* value < 0.05**, 0.05 < *p* value < 0.1

The findings of QR provided more details of the association between geographical division and age at first marriage. For the 2006 survey, the geographical divisions like Chittagong, Sylhet, and Dhaka showed lower mean age at first marriage compared to the reference division Barisal at different quantiles in rural areas but not in urban areas. For the 2012–2013 survey, all geographical divisions were related to a higher level of quantiles. But at each quantile level, the average age at first marriage was higher for rural areas than urban areas. In the case of the 2019 survey, a significant effect on age at first marriage at 0.1 and 0.75 quantile levels was evident in the Rangpur division. Still, MLR showed an insignificant effect in rural areas. In all periods, the geographical division was significantly associated with higher quantile levels for urban areas, but for rural areas, it was associated with both lower and upper quantiles (Tables 1–3).

For the 2006 survey, the other ethnic group compared to Bengali showed a higher average of age at first marriage, and it was higher for rural areas than urban areas. The ethnicity group did not show any significant effect at different quantiles for urban areas. But in 2019, the average age at first marriage increased in urban areas compared to rural areas among the other ethnic group. At each quantile level, the average age at first marriage was higher for urban areas than rural areas in the other ethnic groups than the Bengali group. In rural areas, Islam, Hinduism, and Christianity showed a significant effect on age at first marriage at a 0.9 quantile level. On the other hand, in urban areas, only Islamic religious status was found significant with age at first marriage at a 0.1 quantile level (Tables 1–3).

Women from rural areas with middle-income families showed a significant positive association at a 0.25 quantile level in 2006. Besides, the richer and the richest families revealed significant positive effects at 0.25, 0.50, and 0.75 quantile levels. For the 2012–2013 survey, the wealth index showed a significant negative effect at higher quantile levels (0.75 and 0.9 quantile levels) in rural areas. The wealth index was also significantly associated with higher quantile levels in rural areas, and the middle, richer, and richest was statistically significant at 0.1 quantile level in urban areas in 2019 (Tables 1–3).

The results of QR also showed a significant association between women's education and age at first marriage, which was consistent with the MLR. Primary education showed a significant association with age at first marriage at a 0.75 quantile level. At the 75th quantile, the average age at first marriage of primary educated women was 7 years higher than women with no education (Table 1) in 2006. The secondary and higher secondary educated women were significantly associated with higher quantiles in rural areas (Table 1) in 2006. In 2012–2013, in rural areas, women's education was associated with higher quantiles only, and the risk of early marriage decreased with the increase in education level (Table 1).

On the other hand, a significant association was evident at lower to upper quantile levels in urban areas in 2012–2013. The average age at first marriage of higher educated groups in urban areas was higher by 4 years in 2012–2013 (see Q90). In 2019, women's education was significantly related to lower to upper quantile levels in both rural and urban areas. Women's education was also significantly linked with age at first marriage at different quantile levels in urban areas. However, the average age at first marriage was higher at different quantile levels in urban areas than in rural areas (Table 3), and it was much higher at upper quantile levels.

Discussion

This study explored the effects of sociodemographic and economic characteristics on age at first marriage of women in Bangladesh from 2006 to 2019 by applying trend analysis along with the MLR and QR on the nationally representative MICS data. Separate analyses for rural and urban respondents were performed and compared. Several sociodemographic and economic factors such as women's age, geographical division, ethnicity, religion, wealth, and educational status were significantly associated with age at first marriage. Over the last three time periods, a slight increase was observed in the mean age at first marriage in Bangladesh. The mean age at first marriage of women in urban and rural areas of Bangladesh was 17.3 years and 16.7 years, respectively, in 2019, which were 16.8 years and 15.8 years in 2006 and declined to 15.9 years and 15.7 years in 2012–2013, respectively. The trend analysis exhibited a decreasing trend for the prevalence of early marriage in rural areas over the last six years (2013–2019); still, it was high (79%) compared to the initial 2006 study period (67.6%). However, in urban areas, the prevalence of early marriage was relatively much lower than that of rural areas, which was 33% in 2006 and decreased to 16% in 2012 and further showed an increase in 2019 (21%).

The study revealed a significant variation in the mean age at marriage in the different divisions of Bangladesh: Khulna (15.7 years), Rajshahi (15.8 years), and Barisal (15.8 years) had the lower mean age at first marriage, and Sylhet (18.3 years) and Chittagong (17.4 years) showed the higher mean age at first marriage. This finding is consistent with existing literature (Streatfield et al., 2015). Some studies demonstrated that divisional and regional variations are among the significant predictor of mobility index, awareness index, IGA (Income Generating Activity) involvement, and Age at first marriage in literature (Bhattacharjee & Das, 2011; Caldwell, 2005).

The study also showed that the household's ethnicity was significantly associated with the age at first marriage of women in Bangladesh. At each quantile level, the other ethnic group showed a higher mean age at first marriage than the Bengali group. Moreover, the average was higher for rural areas than urban areas. These findings were analogous to the study on ethnic tribal women of Bangladesh by Kamal (2011). Another study by Ayiga and Rampagane (2013) showed that the household's ethnicity had a significant effect on the mean age at first marriage. The higher mean age among the ethnic women in Bangladesh may have resulted from existing distinctive social and cultural norms and beliefs in family formation.

Religion was also found as a significant factor of mean age at first marriage. Other studies also showed that ethnicity and religion significantly affect the age at first marriage (Ayiga & Rampagane, 2013; Carmichael, 2011). It was also found that wealth had a significant positive association with age at first marriage. The risk of early marriage was lower for well-off families than for low-income families, and a rural-urban comparison showed women in urban areas were better off. The prevalence of early marriage was high among the low-income households in Roma, Serbia (Hotchkiss et al., 2016) as well as in Sub-Saharan African nations (Laelago et al., 2019) because of social insecurity, economic hardship (Çöl et al., 2020). In developing countries like Bangladesh, early marriage has often been considered a survival strategy that reduces the economic burden for poverty-stricken families (Svanemyr et al., 2012).

The women's higher educational levels were significantly associated with elevated age at first marriage in all three survey periods in Bangladesh. Women with higher secondary education in both rural and urban areas had the highest average age at first marriage (21.42 vs. 21.84; 18.20 vs. 18.90; 19.02 vs. 20.03) years, respectively, which were consistent with the study conducted on the women of Uganda (Ariho & Kabagenyi, 2020). Also, an increasing trend was observed in the mean age at first marriage among the higher educated women than in the other groups. Literature also suggested that age at first marriage might be linked and influenced by women's education level (Godha et al., 2013; Mathur et al., 2003). Since education is a competing activity to family formation, women with higher educational attainment or commitment (at least a secondary level education) are facilitated to delay the timing of marriage compared with those with little to no education (Ikamari, 2005; Kamal et al., 2015; Nour, 2009).

Most existing studies identified the determinant of age at first marriage by applying only a multiple linear regression model. The significance of this study was using the QR approach in parallel with MLR. It helped to identify some significant differences (say, the effect of the Rangpur Division for rural areas in 2019 data) that may not be detected by using MLR. Apart from this, quantile regression (Hossain & Majumder, 2019) provides a more unbiased and robust estimate than linear regression, even if the normality and other assumptions are violated.

Conclusions

The prevalence of early marriage in Bangladesh in rural and urban areas was very high (79% vs. 21%) in 2019. The heterogeneous effects of the associated factors at different quantiles of the age distribution at first marriage are considered in the QR model, which provided insights into the vulnerable cohorts, and, consequently, demanded effective intervention strategies. Overall, women's age played a significant factor in various quantiles, especially in higher quantiles. The difference was visible in the type of residence. Wealth status was found to be associated significantly with age at first marriage. In addition, higher education was associated with the age at first marriage in both urban and rural regions in higher quantile regression, i.e., in 75th and 90th quantiles.

Although optimizing a universal policy to reduce early marriage in the country is difficult given Bangladesh's socioeconomic constraints and diversity, the positive sign is that adaptable approaches and targeted intervention measures are in order. The QR might be a better model here as it can specify the distribution of vulnerable quantiles, i.e., QR can identify which geographical division in which quantiles were more vulnerable and needed immediate attention. Most women from rural areas, having financial insolvency and lower education, living in Barisal, Khulna, Rangpur, and Rajshahi, and having religious status as Islam was found to be the most vulnerable cohorts in this study. This study suggests more effective and targeted interventions such as creating more income opportunities for women through proper training on income-generating activities and providing loans from banks and NGOs with the easy return policy, taking the initiative to improve the knowledge of uneducated people about women's health care, raising awareness about the drawbacks of early marriage as well as social cohesion among the youth and intervention measures based on geographical disparities. Allocation of support or implementation of strategies concerning significant

determinants would help to improve the current situation at a faster pace. Education needs to be accessible to all, and government should plan accordingly to achieve that target.

The development of women in a country would reflect on improving that country's economic health and many more indicators. The authors believe that this would eventually help to achieve the sustainable development goals (SDGs), especially those related to maternal and child health in Bangladesh by 2030.

Acknowledgments

The authors would like to thank UNICEF, which allowed free access to their data bank.

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Appendix

Appendix 1: Percentage Distribution and the Average Age at First Marriage of Women by Sociodemographic Factors

Background Characteristics	2006				2012–2013				2019			
	Rural		Urban		Rural		Urban		Rural		Urban	
	N (%)	Mean	N (%)	Mean	N (%)	Mean	N (%)	Mean	N (%)	Mean	N (%)	Mean
Women's Age												
15–19	3,821 (17.98)	15.25****	1,381 (11.61)	15.50****	2,620 (7.22)	15.71****	483 (6.59)	15.86****	3,171 (7.69)	15.77****	660 (98.64)	15.86****
20–24	5,374 (25.29)	16.02****	2,610 (21.94)	16.69****	5,846 (16.11)	16.51****	1,285 (17.54)	16.87****	6,644 (16.11)	16.63****	1,581 (15.60)	16.87****
25–29	4,227 (19.90)	16.19****	2,446 (20.56)	17.27****	7,471 (20.58)	16.42****	1,574 (21.49)	17.08****	7,228 (17.52)	17.02****	1,941 (19.15)	17.50****
30–34	2,839 (13.36)	16.05****	1,829 (15.37)	17.29****	6,108 (16.83)	16.38****	1,236 (16.87)	17.03****	7,841 (19.01)	16.88****	1,945 (19.19)	17.63****
35–39	2,321 (10.92)	15.82****	1,732 (14.56)	17.21****	5,791 (15.96)	16.32****	1,138 (15.53)	16.92****	6,980 (16.92)	16.80****	1,759 (17.35)	17.57****
40–44	1,516 (7.14)	15.43****	1,112 (9.35)	16.67****	4,708 (12.97)	16.23****	902 (12.31)	16.76****	5,142 (12.47)	16.68****	1,252 (12.35)	17.42****
45–49	1,148 (5.40)	14.97****	787 (6.62)	16.15****	3,751 (10.33)	16.30****	708 (9.66)	16.75****	4,239 (10.28)	16.88****	999 (9.85)	17.56****
Geographical Division												
Barisal	2,484 (11.69)	15.28****	1,501 (12.62)	16.79****	3,675 (10.13)	16.40****	592 (8.08)	16.63****	3,813 (9.24)	16.65****	729 (7.19)	16.98****
Chittagong	3,608 (16.98)	16.43****	2,355 (19.79)	17.18****	5,709 (15.73)	17.41****	1,555 (21.23)	17.64****	6,924 (16.79)	17.36****	2,221 (21.91)	17.56****
Dhaka	5,166 (24.32)	16.07****	2,741 (23.04)	16.76****	8,758 (24.13)	16.25****	1,972 (26.92)	17.63****	7,439 (18.04)	17.20****	2,933 (28.93)	17.63****
Khulna	3,768 (17.74)	15.32****	1,878 (15.79)	16.21****	6,018 (16.58)	15.75****	1,247 (17.02)	16.09****	6,979 (16.92)	16.05****	1,439 (14.20)	16.64****
Mymensingh	-	-	-	-	-	-	-	-	2,254 (5.46)	16.70****	419 (4.13)	17.46****
Rajshahi	5,057 (23.80)	15.33****	2,537 (21.32)	16.41****	4,543 (12.52)	15.60****	771 (10.52)	16.13****	5,272 (12.78)	15.81****	1,104 (10.89)	16.46****

Background Characteristics	2006				2012–2013				2019			
	Rural		Urban		Rural		Urban		Rural		Urban	
	N (%)	Mean	N (%)	Mean	N (%)	Mean	N (%)	Mean	N (%)	Mean	N (%)	Mean
Rangpur	-	-	-	-	5,106 (14.07)	15.62****	797 (10.88)	16.40****	5,622 (13.63)	16.49****	813 (8.02)	17.39****
Sylhet	1,163 (5.47)	17.34****	885 (7.44)	18.33****	2,486 (6.85)	18.16****	392 (5.35)	18.29****	2,942 (7.13)	18.04****	479 (4.73)	18.77****
Ethnicity												
Bengali	20,958 (98.64)	15.75****	11,740 (98.68)	16.76****	-	-	-	-	40,288 (97.68)	16.68****	9,946 (98.12)	17.28****
Others	288 (1.36)	18.95****	157 (1.32)	19.83****	-	-	-	-	957 (2.32)	19.11****	191 (1.88)	19.77****
Religion												
Islam	-	-	-	-	31,756 (87.49)	16.19****	6,406 (87.44)	16.68****	-	-	-	-
Hinduism	-	-	-	-	3,327 (9.17)	16.92****	749 (10.22)	17.79****	-	-	-	-
Buddhism	-	-	-	-	884 (2.44)	18.42****	139 (1.90)	19.55****	-	-	-	-
Christian	-	-	-	-	195 (0.54)	17.84****	27 (0.37)	19.78****	-	-	-	-
Others	-	-	-	-	133 (0.37)	17.60****	5 (0.07)	15.40****	-	-	-	-
Wealth index quantile												
Poorest	3,330 (15.67)	15.23****	428 (3.60)	15.18****	9,546 (26.30)	16.41****	899 (12.27)	16.45****	9,965 (24.16)	16.68****	757 (7.47)	16.87****
Poorer	4,764 (22.42)	15.36****	733 (6.16)	15.53****	8,565 (23.60)	15.98****	672 (9.17)	16.23****	9,923 (24.06)	16.43****	825 (8.14)	16.59****
Middle	5,281 (24.86)	15.64****	1,221 (10.26)	15.65****	7,795 (21.48)	16.16****	951 (12.98)	16.07****	9,312 (22.58)	16.58****	1,402 (13.83)	16.57****
Richer	5,378 (25.31)	16.21****	2,630 (22.11)	16.08****	6,675 (18.39)	16.46****	1,623 (22.15)	16.57****	7,932 (19.23)	16.93****	2,410 (23.77)	16.73****
Richest	2,493 (11.73)	16.86****	6,885 (57.87)	17.52****	3,714 (10.23)	17.01****	3,181 (43.42)	17.49****	4,113 (9.97)	17.63****	4,743 (46.79)	18.06****

Background Characteristics	2006				2012–2013				2019			
	Rural		Urban		Rural		Urban		Rural		Urban	
	N (%)	Mean	N (%)	Mean	N (%)	Mean	N (%)	Mean	N (%)	Mean	N (%)	Mean
Women's education												
None	17 (0.08)	14.47****	9 (0.08)	15.22****	12,177 (33.55)	16.01****	1,611 (21.99)	16.12****	7,865 (19.07)	16.50****	1,334 (13.16)	16.32****
Primary	10,827 (50.96)	15.03****	4,203 (35.33)	15.29****	10,720 (29.54)	15.95****	1,810 (24.71)	16.13****	11,012 (26.70)	16.22****	2,235 (22.05)	16.28****
Secondary (High school)	10,135 (47.70)	16.52****	6,852 (57.59)	17.14****	10,334 (28.47)	16.53****	2,222 (30.33)	16.44****	18,041 (43.74)	16.61****	4,265 (42.07)	16.73****
Higher Secondary (College/ University)	201 (0.95)	21.42****	816 (6.86)	21.84****	3,064 (8.44)	18.20****	1,683 (22.97)	18.90****	4,327 (10.49)	19.02****	2,303 (22.72)	20.03****
Non-standard curriculum	66 (0.31)	14.17****	17 (0.14)	15.00****	-	-	-	-	-	-	-	-

*Note: p value < 0.001****, 0.001 < p value < 0.01***, 0.01 < p value < .05**, 0.05 < p value < 0.1*