



# BMJ Open Trends and patterns of inequalities in using facility delivery among reproductive-age women in Bangladesh: a decomposition analysis of 2007–2017 Demographic and Health Survey data

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## ABSTRACT

**Objectives** The prime objectives of the study were to measure the prevalence of facility delivery, assess socioeconomic inequalities and determine potential associated factors in the use of facility delivery in Bangladesh.

### Design

Cross-sectional.

**Setting** The study involved investigation of nationally representative secondary data from the Bangladesh Demographic and Health Survey between 2007 and 2017–2018.

**Participants** The participants of this study were 30 940 (weighted) Bangladeshi women between the ages of 15 and 49.

**Methods** Decomposition analysis and multivariable logistic regression were both used to analyse data to achieve the study objectives.

**Results** The prevalence of using facility delivery in Bangladesh has increased from 14.48% in 2007 to 49.26% in 2017–2018. The concentration index for facility delivery utilisation was 0.308 with respect to household wealth status ( $p < 0.001$ ), indicating that use of facility delivery was more concentrated among the rich group of people. Decomposition analysis also indicated that wealth quintiles (18.31%), mothers' education (8.78%), place of residence (7.75%), birth order (5.56%), partners' education (4.30%) and antenatal care (ANC) seeking (8.51%) were the major contributors to the prorich socioeconomic inequalities in the use of facility delivery. This study found that women from urban areas, were overweight, had any level of education, from wealthier families, had ANC, and whose partners had any level of education and involved in business were more likely to have facility births compared with their respective counterparts.

**Conclusions** This study found a prorich inequality in the use of facility delivery in Bangladesh. The socioeconomic disparities in facility delivery must be addressed if facility delivery usage is to increase in Bangladesh.

## STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ This study used data from four nationally representative surveys with appropriate statistical technique to estimate the prevalence of using facility delivery and its associated factors, as well as the inequalities in using facility delivery over socioeconomic determinants; therefore, the study results could be generalisable across the country.
- ⇒ Our capacity to infer causality was constrained by the inherent drawbacks of a cross-sectional study design.
- ⇒ Some important factors related to the health of the respondents were not included due to unavailability and missing information of those variables in the Bangladesh Demographic and Health Survey data.
- ⇒ Using the robust technique concentration index, a relative measure of inequality was employed to quantify wealth-related inequalities in facility delivery utilisation.
- ⇒ Cluster effect and sample weighting were taken into consideration in the analysis of the present study.

## INTRODUCTION

Maternal mortality ratio (MMR) is still a major health concern around the world, particularly in developing nations like Bangladesh. Maternal mortality, according to the WHO, is defined as a 'woman's death while pregnant or within 42 days of delivery or termination of pregnancy from any cause linked to, or aggravated by, pregnancy or its management, but excludes deaths from incidental or unintentional causes'.<sup>1</sup> Globally, in 2010, there were reportedly 287 000 maternal deaths, with low-income and middle-income countries (LMICs) accounting for majority of these deaths.<sup>2</sup> In 2017, approximately 295 000 women died both during and after pregnancy and delivery, with 94% of these

deaths happening in low-resource settings and with the vast majority of these deaths preventable.<sup>3</sup> In 2017, MMR in low-income countries was 462 per 100 000 live births vs 11 per 100 000 live births in high-income countries.<sup>3</sup> This high number of maternal deaths in some areas of the world reflects inequalities in access to quality health services and highlights the gap between the rich and the poor.

Reducing maternal mortality has long been a top global health concern. It is a Millennium Development Goal (MDG) target and a key component of the United Nations Secretary-General's Global Strategy for Women's and Children's Health, which was unveiled in September 2010.<sup>4,5</sup> The MDGs (1990–2015) underlined the significance of reducing mother and infant mortality by 75% and promoting a global MMR reduction of 38%.<sup>6</sup> According to Sustainable Development Goal 3, MMR will be reduced to less than 70 deaths per 100 000 live births by 2030. Bangladesh, Nepal and Pakistan have all made significant progress in reducing MMR during the last few decades. Between 2010 and 2017, Bangladesh's MMR dropped to 173 per 100 000 live births, Nepal to 186 per 100 000 and Pakistan to 140 per 100 000.<sup>2</sup> In comparison with other LMICs around the world, MMR rates in these nations are still extremely high. Bangladesh is a developing country with eight administrative regions (Dhaka, Chittagong, Rajshahi, Khulna, Barishal, Sylhet, Rangpur, Mymensingh) and a total of more than 168 million people; data were collected from these eight regions using multistage cluster sampling.

To reduce maternal mortality, the factors behind these deaths have to be identified. Majority of these deaths are attributable to pregnancy-related delivery complications that are largely preventable by moving childbirth from home to a healthcare facility.<sup>7–10</sup> Other disorders that might have existed before pregnancy which are not treated as part of a woman's treatment may become more severe during pregnancy. Previous research has identified a number of key factors that contribute to low healthcare utilisation, including poor health-seeking behaviour, weak health systems, low socioeconomic status, cultural and personal health beliefs, lack of access to appropriate health services, high costs, long distances, lack of transportation options and poor quality of treatment.<sup>11,12</sup> In South Asia, women who give birth at home are more likely to be exposed to unsafe and unclean conditions, putting the lives of the mothers and their newborns in danger.<sup>13</sup> Several studies have found that using facility-based delivery services, family planning, and antenatal and postnatal care enable reductions in maternal deaths.<sup>8,14</sup>

The main rationale of this article is to analyse the socioeconomic inequalities in the utilisation of facility delivery in Bangladesh over time, based on its context using four rounds of data set to measure trends and contributing factors. Investigating the extent to which socioeconomic inequalities exist in facility delivery can aid in identifying the underlying causes of these disparities, thereby informing appropriate parties on how to address them.

There are a few research that have analysed the socioeconomic factors of maternal health inequalities in Bangladesh using demographic and health survey data over a period of time. The prime objectives of this study are threefold: (1) to analyse the factors associated with facility delivery in Bangladesh using the Bangladesh Demographic and Health Survey (BDHS) data from 2007 to 2017–2018 in order to estimate the prevalence and trends of using facility delivery over time using four rounds of data set; (2) to measure socioeconomic inequalities in the use of facility delivery; and (3) to identify the primary components that explain socioeconomic inequalities in facility delivery over a period of time through a decomposition analysis.

## METHODS

### Data sources

Secondary data from BDHS were used in this study (BDHS 2007, 2011, 2014 and 2017–2018). Demographic and health surveys are undertaken on a regular basis to determine the health status of the population. Demographic and health surveys provide a comprehensive picture of the study population, covering overall maternal and child health, as well as a range of other healthcare subject areas. The data set has been made freely available on the internet for academics and researchers to use. Survey strategy, methodology, sampling and questionnaires are all detailed in the final report.

### Outcome variable

The outcome variable in our study was the place of delivery (0=home, 1=facility). If a woman gave birth in a hospital run by the government, a district hospital, a maternal and child welfare centre, an upazila health complex, a health and family welfare centre, a private hospital or clinic, a private medical college or hospital, a rural health centre, a basic health unit, a primary healthcare centre, an outreach clinic, or a clinic run by a family planning association, the location of the birth was considered a 'facility'. If a woman gave birth at the respondent's, a relative's or a neighbour's home, it was regarded as a 'home delivery'.

### Explanatory variables

The following variables were chosen based on literature review<sup>15–22</sup>: place of residence, division, mother's age, mother's education, mother's employment status, number of antenatal care (ANC) visits, husband's education, husband's occupation and household wealth status; health-related characteristics, mother's body mass index, age at first birth and ANC seeking were coded if the mother had taken at least four or more ANC during their last pregnancy. New division was generated using two divisions, Mymensingh and Rangpur, because these were not created during the earlier surveys in 2007 and 2011.

### Statistical analysis

Data were weighted using an appropriate method suggested by the demographic and health survey platform;

we used the `svy` command. The background characteristics of the study populations are described using descriptive statistics, and weighted prevalence with 95% CI is reported. The association between predictor variable and delivery location was investigated using  $\chi^2$  testing. Multivariable logistic regression was used to estimate the net influence of predictor variables on the outcome variable after confounding variables were removed. We adjusted the multivariable and decomposition models based on  $p$  values  $<0.05$ . In the adjusted model, the factors that were statistically significant at the  $p<0.05$  level in the univariate analysis were taken into consideration for final adjustment in the multivariate model. Unadjusted/crude OR (UOR) and adjusted OR (AOR) are presented in this article; however, only adjusted results are interpreted in the main text. All analyses were carried out using Stata/MP V.16.

### Inequality measurement

The concentration curve (CC) and the concentration index (CIX) were employed in their relative formulations (with no corrections) to study the inequalities in facility utilisation across analysable socioeconomic factors of the population (women).<sup>23</sup> The CIX in this study represents horizontal inequity because each woman in the study was assumed to have the same need for a facility birth. The CC was calculated by plotting the cumulative proportion of women ranked by their wealth index score (poorest first) against the cumulative proportion of facility deliveries on the  $y$ -axis. Absolute equality was shown by a 45° slope from the origin. The use of institutional delivery is equal among women if the CC intersects with the line of equality. If, on the other hand, the CC subtends the line of equality below (above), then there is inequality in the use of institutional delivery, which is skewed against women from low (high) socioeconomic backgrounds. Further, the greater the degree of inequality, the more the CC deviates from the line of equality. The CIX was calculated to estimate the level of wealth-related inequality. The CIX is widened as twice the region between the line of equality and the CC.<sup>23</sup>

The following are some of the benefits of adopting the CIX as a measure of healthcare inequality: it considers the socioeconomic dimension of healthcare inequalities because individuals are classified based on their socioeconomic status rather than their health status; it captures the experience of the entire population; and it is sensitive to changes in population distribution across socioeconomic groups. The CIX takes a value between  $-1$  and  $+1$ . When institutional delivery is evenly spread across socioeconomic categories, the CIX equals 0. The usage of institutional delivery is concentrated among the upper socioeconomic classes if the CIX has a positive value (prorich). A negative CIX score, on the other hand, indicates that institutional delivery is mostly used by the poor (propoor).<sup>24</sup> The CIX was calculated using the ‘convenient covariance’ formula provided by Wagstaff *et al*,<sup>23</sup> as shown in the following equation:

$$CIX = \frac{2}{\mu} \text{cov}(h, r)$$

Here CIX is the Concentration Index,  $h$  is the health factor variable (place of delivery),  $\mu$  is the weighted mean of factor variable (place of delivery),  $r$  is the fractional rank of individual in the distribution of wealth index, and  $\text{cov}(h, r)$  represents the covariance between  $h$  and  $r$ . The user-written STATA commands ‘Lorenz’<sup>25</sup> and ‘conindex’<sup>26</sup> were used to produce the CC and measure the CIX, respectively.

### Decomposition of CIX

The relative CIX was decomposed to identify the proportion of inequality due to underlying determinant inequality. The findings were evaluated and interpreted using the Wagstaff *et al*<sup>23</sup> and O’Donnell *et al*<sup>26</sup> approach. The contribution of each determinant of facility delivery to overall wealth-related inequality is determined as the product of the determinant’s sensitivity to facility delivery (elasticity) and the degree of wealth-related inequality in that determinant (CIX of determinant). The residual is the portion of the CIX that is not explained by the determinants.

The ‘elasticity’ column indicates the change in the dependent variable (socioeconomic disparity in facility delivery) resulting from a one-unit change in the explanatory factors. A positive or negative elasticity score indicates an upward or downward trend in facility delivery in response to a favourable change in the determinants.

### Patient and public involvement

No patients were involved.

## RESULTS

### Background characteristics of the study participants

Table 1 displays the socioeconomic and demographic characteristics of women aged 15–49. The table displays the results produced from 30 940 observations recorded in 2007, 2011, 2014 and 2017–2018, as well as the overall results derived from the data for all the years considered.

From overall data, we can conclude that majority of women (67%) resided in rural areas, with the majority hailing from Chattogram (19%) and Dhaka (17%). Of the women, 22% belonged to the poorest group and 19.80% to the poorer group. The highest proportion of women was aged 15–24 years (49%), 43% had secondary education, 98% had improved water and 58% had improved sanitation, and only 25% were employed. In addition, 59% of women had normal BMI and 37% have already given birth. Among the mothers, 68% did not have ANC, yet majority (81%) had a normal last birth. In addition, majority of partners had a primary education (31%) and were primarily employed in non-agricultural occupations (52%).

### Prevalence of facility delivery

Table 2 shows that, in 2007, 17% of women had facility delivery, which increased over the years. In 2017–2018, the

**Table 1** Background characteristics of the study participants

Variables	Frequency	Percentage
Total	30 940	100.00
Surveyed year		
2007	6032	19.50
2011	8573	27.71
2014	7761	25.08
2017–2018	8574	27.71
Place of residence		
Urban	10 116	32.70
Rural	20 824	67.30
Division		
Barishal	3522	11.38
Chattogram	5842	18.88
Dhaka	5333	17.24
Khulna	3403	11.00
Rajshahi	3961	12.80
Sylhet	4017	12.98
New division	4862	15.71
Age of the mother (years)		
15–24	15 101	48.81
25–34	13 138	42.46
35–49	2701	8.73
Mother's BMI		
<18.50 (underweight)	7226	23.71
18.51–24.99 (normal)	18 027	59.14
≥25.0 (overweight/obese)	5229	17.15
Mother's education		
No education	5134	16.60
Primary	9183	29.68
Secondary	13 273	42.90
Higher	3347	10.82
Mothers' working status		
No work	23 197	74.98
Working	7741	25.02
Partner's education		
No education	7750	25.17
Primary	9442	30.67
Secondary	9044	29.38
Higher	4550	14.78
Partner's occupation		
Agricultural and farming	7375	24.05
Non-agricultural	15 909	51.87
Business	6793	22.15
No work	594	1.94
Birth order		
First child	11 528	37.26
Second child	9106	29.43

Continued

**Table 1** Continued

Variables	Frequency	Percentage
Third child	5094	16.46
Fourth child or later	5212	16.85
Sanitation facilities		
Improved sanitation	16 072	57.76
Unimproved sanitation	10 787	38.77
Open defecation (no facility/bush/field)	967	3.48
ANC visit		
No ANC	14 676	68.28
Any ANC	6819	31.72
Improved water		
Improved source	27 151	97.54
Unimproved source	685	2.46
Household wealth status		
Poorest	6706	21.67
Poorer	6126	19.80
Middle	5788	18.71
Richer	6096	19.70
Richest	6224	20.12

ANC, antenatal care; BMI, body mass index.

percentage of facility delivery was 50%. Most women who were underweight went through home delivery (81%), while those who were overweight were more likely to have facility births (60%). Among women who had no ANC, 79% had home delivery and 60% had facility delivery who had any number of ANC. With regard to birth orders, home delivery was found to be more frequent in all categories and increased with increasing number of births, whereas the possibility of a facility birth was highest during the first birth but decreased with increasing number of births. However, women who had their last birth by caesarean section showed a high percentage (98%) of facility birth. The percentage of home delivery was found to be greater than facility birth in both urban (53%) and rural (76%) areas of Bangladesh. However, urban areas (47%) had more facility births than rural areas (24%). The percentage of home delivery was found to be higher than facility birth even when the observations were categorised according to divisions, with Khulna division found to have more facility births (46%) compared with other divisions. Facility births were also found to be more common among the wealthiest families (62%), while in all the other groups home delivery was found to be more frequent. Women and partners with higher education are more likely to have facility births, at 75% and 67%, respectively. Women's working status and improved sanitation and water facilities do not seem to increase the rate of facility births; in all these cases, the percentage of home delivery was found to be higher. Moreover, the prevalence rates in [table 2](#) show that women residing in

**Table 2** Prevalence of using facility delivery across different socioeconomic variables

Variables	Dependent variables		P value	Weighted prevalence (95% CI)
	Home delivery, n (%)	Facility birth, n (%)		
Survey year			<0.001	
2007	5021 (83.24)	1011 (16.76)		14.48 (13.60 to 15.39)
2011	6267 (73.10)	2306 (26.90)		24.49 (23.59 to 25.41)
2014	2842 (61.04)	1814 (38.96)		37.45 (36.09 to 38.82)
2017–2018	2616 (50.49)	2565 (49.51)		49.26 (47.90 to 50.62)
Place of residence			<0.001	
Urban	4182 (52.74)	3748 (47.26)		48.89 (47.60 to 50.19)
Rural	12564 (76.09)	3948 (23.91)		24.03 (23.43 to 24.65)
Divisions			<0.001	
Barishal	2109 (74.55)	720 (25.45)		22.55 (20.45 to 24.79)
Chattogram	3427 (72.84)	1278 (27.16)		26.49 (25.33 to 27.68)
Dhaka	2831 (66.16)	1448 (33.84)		32.50 (31.46 to 33.57)
Khulna	1492 (54.35)	1253 (45.65)		42.53 (40.49 to 44.61)
Rajshahi	2199 (68.80)	997 (31.20)		24.22 (22.80 to 25.70)
Sylhet	2360 (71.97)	919 (28.03)		28.84 (27.09 to 30.64)
New division	2328 (68.29)	1081 (31.71)		30.83 (28.89 to 32.85)
Age of the mother (years)			<0.001	
15–24	8538 (67.93)	4030 (32.07)		30.88 (30.08 to 31.68)
25–34	6748 (68.13)	3156 (31.87)		29.75 (28.86 to 30.66)
35–49	1460 (74.11)	510 (25.89)		23.54 (21.68 to 25.51)
Mother's BMI			<0.001	
<18.50 (underweight)	5046 (81.41)	1152 (18.59)		17.70 (16.77 to 18.67)
18.51–24.99 (normal)	10064 (69.97)	4320 (30.03)		28.65 (27.92 to 29.39)
≥25.0 (overweight/obese)	1377 (39.55)	2105 (60.45)		57.49 (55.81 to 59.16)
Mother's education			<0.001	
No education	3887 (91.29)	371 (8.71)		08.59 (7.80 to 09.56)
Primary	5890 (81.19)	1365 (18.81)		18.23 (17.36 to 19.12)
Secondary	6326 (61.06)	4035 (38.94)		37.53 (36.60 to 38.46)
Higher	640 (24.95)	1925 (75.05)		72.08 (70.22 to 73.87)
Mother's working status			<0.001	
No work	13048 (67.96)	6152 (32.04)		30.48 (29.83 to 31.13)
Working	3697 (70.55)	1543 (29.45)		27.73 (26.56 to 28.93)
Partner's education			<0.001	
No education	5501 (87.54)	783 (12.46)		15.85 (14.98 to 16.76)
Primary	5633 (76.50)	1730 (23.50)		33.36 (32.53 to 34.19)
Secondary	4392 (61.26)	2778 (38.74)		38.43 (37.11 to 39.77)
Higher	1177 (33.13)	2376 (66.87)		32.69 (28.66 to 36.98)
Partner's occupation			<0.001	
Agriculture	4887 (82.69)	1023 (17.31)		15.85 (14.98 to 16.76)
Non-agriculture	8200 (65.67)	4287 (34.33)		33.36 (32.53 to 34.19)
Business	3227 (59.91)	2159 (40.09)		38.43 (37.11 to 39.77)
No work	327 (66.87)	162 (33.13)		32.69 (28.66 to 36.98)
ANC visit			<0.001	
No ANC	11524 (78.52)	3152 (21.48)		20.78 (20.14 to 21.43)
Any ANC	2746 (40.28)	4071 (59.72)		57.97 (56.76 to 59.16)

Continued

**Table 2** Continued

Variables	Dependent variables		P value	Weighted prevalence (95% CI)
	Home delivery, n (%)	Facility birth, n (%)		
Birth order			<0.001	
First child	5213 (57.42)	3866 (42.58)		40.75 (39.75 to 41.76)
Second child	4745 (67.01)	2336 (32.99)		31.02 (29.96 to 32.10)
Third child	3042 (75.19)	1004 (24.81)		23.57 (22.29 to 24.89)
Fourth child or later	3746 (88.43)	490 (11.57)		10.43 (9.54 to 11.39)
Sanitation facilities			<0.001	
Improved sanitation	7110 (58.71)	5000 (41.29)		39.56 (38.68 to 40.45)
Unimproved	7284 (82.15)	1583 (17.85)		17.72 (16.95 to 18.56)
Open defecation	760 (90.05)	84 (9.95)		7.95 (6.40 to 9.76)
Improved water			<0.001	
Improved source	14 696 (69.03)	6593 (30.97)		29.31 (28.71 to 29.99)
Unimproved source	464 (86.25)	74 (13.75)		13.25 (10.37 to 16.79)
Household wealth status			<0.001	
Poorest	4556 (87.20)	669 (12.80)		12.00 (11.17 to 12.89)
Poorer	4001 (81.97)	880 (18.03)		17.98 (16.94 to 19.06)
Middle	3350 (73.03)	1237 (26.97)		26.23 (25.00 to 27.50)
Richer	2972 (61.88)	1831 (38.12)		37.47 (36.11 to 38.85)
Richest	1867 (37.75)	3079 (62.25)		61.09 (59.65 to 62.51)

ANC, antenatal care; BMI, body mass index.

urban areas (49%), women with higher education (72%), women whose last birth was by caesarean section (98%) and women richest in wealth index (61%) were more likely to have facility delivery compared with their counterparts. **Figure 1** shows that facility births have become more prevalent over time from 2007 (14%) to 2017–2018 (49%).

#### Factors associated with facility delivery (regression model)

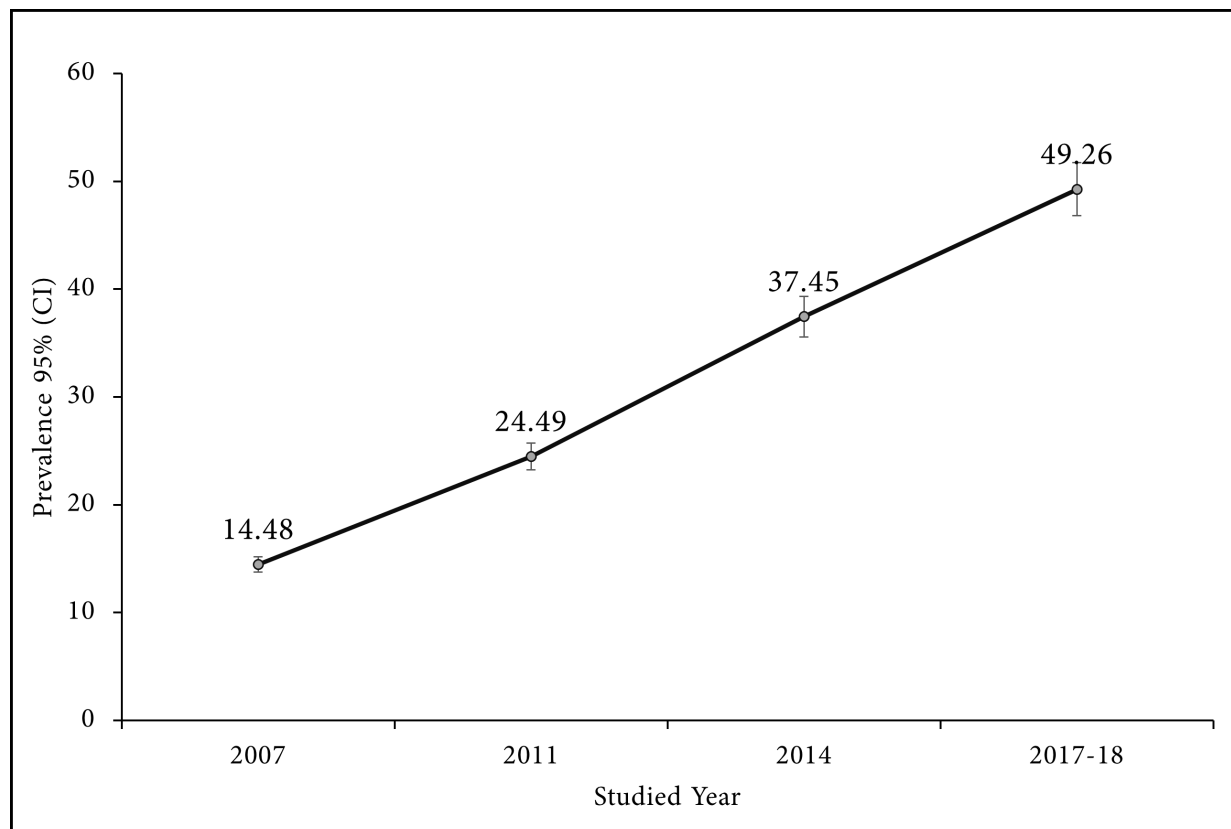
The CIs for the bivariate and multivariate regression models at 95% are presented in **table 3** as UOR and AOR, respectively. The analyses showed that in all 3 years (2011, 2014, 2017–2018), facility births increased compared with 2007 as the reference category, where in 2017 it was about four times higher. In both bivariate and multivariate analyses, it was found that women living in urban areas, from Dhaka and Khulna divisions, were overweight, had any level of education, belonged to wealthier families, had ANC, and whose partners had any level of education and were involved in business were more likely to have facility births compared with their respective counterparts. On the other hand, women from divisions other than Dhaka and Khulna, belonged to age groups 25–34 years and 35–49 years, were underweight, were employed, had any number of children, had improved water and sanitation, and whose partners were involved in agricultural or non-agricultural works were found to have lower odds of facility birth.

The analysis shows that women in the age group 25–34 years were about 1.54 times (CI 1.39 to 1.71) and in the

age group 35–49 years about 2.43 times (CI 2.01 to 2.93) more likely to have facility birth compared with the age group 15–24 years. Women residing in urban areas were 1.44 times (CI 1.32 to 1.58) more likely to have facility birth. Overweight women were found to be 1.84 times (CI 1.66 to 2.04) more likely to have facility birth, whereas underweight women were 0.83 times (CI 0.75 to 0.91) less likely. Women who had any number of ANC were 2.38 times (CI 2.20 to 2.58) more likely to have facility births, but this tends to decrease with having more children over time. Education played a great role in the uptake of facility delivery, where findings show that with the increase in the level of education, more women tend to receive facility births. Similar result was found with the increase in the level of education of partners. In terms of wealth status, AOR was observed to increase as wealth status increased.

#### Decomposition of CIX for facility delivery

**Table 4** illustrates the effects of key socioeconomic and demographic characteristics on facility utilisation and the disparities. The column labelled ‘Elasticity’ represents the amount of change in the dependent variable (socioeconomic inequality in facility delivery) caused by a one-unit change in the explanatory factors. Elasticity with a positive or negative sign indicates a rising or falling trend in the facility’s output in conjunction with a positive change in the factor.<sup>27 28</sup> This study indicates that the value of the CIX for facility delivery was 0.30846363 (p<0.001) among Bangladeshi households with a higher socioeconomic status, indicating socioeconomic inequality in facility



**Figure 1** Prevalence of using facility delivery over time in Bangladesh (weighted).

delivery in favour of the wealthy. The column ‘CIX’ displays the distribution of the determinants in terms of wealth quintiles. The positive or negative direction of the CI indicates whether the factors were more prevalent in the wealthy or poor group. The percentage contribution indicates how much each variable in the model contributes to socioeconomic disparities as a whole. A positive percentage contribution indicates that a factor contributes to the increase in observed socioeconomic gaps in the provision of healthcare facilities. A negative percentage contribution, on the other hand, indicates a component that is anticipated to reduce socioeconomic inequalities connected to facility delivery. Wealth quintiles (18.31%), mother’s education (8.78%), place of residence (7.75%), birth order (5.56%) and partner’s education (4.30%), as well as ANC seeking (8.51%), were the significant contributors to the prorch socioeconomic inequalities in facility delivery.

**Figure 1** depicts the overall prevalence of the likelihood of using facility delivery during the course of the year. With the passage of time, it is apparent that facility delivery has increased. In 2007, the prevalence was only 14.48%, but climbed by at least 10-fold in 2011 (24.49%). In 2017–2018, nearly half of all women used facility delivery with skilled birth attendants (SBAs).

Using a Lorenz curve (CC), **figure 2** also shows the disparities in facility delivery among the 4 distinct years. We can see that all four CCs fell below the line of equality, suggesting that facility delivery is more common among

women from affluent households. Nevertheless, it seemed as though the CC was moving in the direction of equality. The difference between the line of equality and the CC was found to be at its widest in 2007, but narrowed in 2017.

## DISCUSSION

The current study examined the socioeconomic inequalities associated with facility births among the Bangladeshi population using the most recent demographic and health survey data. An essential instrument for influencing policy choices that are influenced by inequalities is now analysis of socioeconomic inequality. Facility delivery is more common and concentrated among the richest Bangladeshis living in metropolitan areas, although it has substantially declined since the previous round of research. Household financial status, women’s education, ANC seeking, birth order, partners’ education and living in urban regions all had a substantial impact on the prorch socioeconomic inequalities in facility delivery.

Using four consecutive nationally representative BDHS data, this study revealed that there exist numerous socioeconomic inequalities in using facility delivery. The level of socioeconomic inequalities in facility births in Bangladesh is one of the uppermost among the South and East Asian countries.<sup>29</sup> The results of our study show that rural areas had the maximum number of respondents (67.30%) and most of the women in these areas had normal last

**Table 3** Factors associated with facility delivery in Bangladesh

Variables	Dependent variable		UOR (95% CI)	AOR (95% CI)
	Home	Facility		
Year of survey				
2007 (RC)	5021	1011		
2011	6267	2306	1.82 (1.68 to 1.99)	1.79 (1.60 to 2.02)
2014	2842	1814	3.16 (2.89 to 3.46)	3.08 (2.72 to 3.50)
2017	2616	2565	4.87 (4.46 to 5.31)	4.31 (3.79 to 4.91)
Place of residence				
Urban	4182	3748	2.85 (2.69 to 3.01)	1.44 (1.32 to 1.58)
Rural (RC)	12564	3948		
Divisions				
Barishal	2109	720	0.74 (0.66 to 0.82)	0.76 (0.65 to 0.89)
Chattogram	3427	1278	0.80 (0.72 to 0.89)	0.80 (0.70 to 0.92)
Dhaka	2831	1448	1.10 (1.00 to 1.21)	1.01 (0.88 to 1.17)
Khulna	1492	1253	1.80 (1.62 to 2.00)	1.74 (1.49 to 2.00)
Rajshahi	2199	997	0.98 (0.89 to 1.08)	1.18 (1.01 to 1.36)
Sylhet	2360	919	0.83 (0.75 to 0.93)	1.12 (0.96 to 1.29)
New division (RC)	2328	1081		
Age of the mother (years)				
15–24	8538	4030	0.99 (0.93 to 1.04)	1.54 (1.39 to 1.71)
25–34	6748	3156	0.74 (0.66 to 0.82)	2.43 (2.01 to 2.93)
35–49 (RC)	1460	510		
Mother's BMI				
<18.50 (underweight)	5046	1152	0.53 (0.49 to 0.58)	0.83 (0.75 to 0.91)
18.51–24.99 (normal) (RC)	10064	4320		
≥25.0 (overweight/obese)	1377	2105	3.57 (3.29 to 3.85)	1.84 (1.66 to 2.04)
Mother's education				
No education (RC)	3887	371		
Primary	5890	1365	2.42 (2.14 to 2.74)	1.33 (1.14 to 1.54)
Secondary	6326	4035	6.68 (5.96 to 7.48)	1.84 (1.58 to 2.15)
Higher	640	1925	31.51 (27.42 to 36.21)	2.90 (2.37 to 3.56)
Mother's working status				
Not working (RC)	13048	6152		
Working	3697	1543	0.88 (0.82 to 0.94)	0.75 (0.67 to 0.81)
Partner's education				
No education (RC)	5501	783		
Primary	5633	1730	2.16 (1.97 to 2.37)	1.07 (0.95 to 1.20)
Secondary	4392	2778	4.44 (4.07 to 4.86)	1.24 (1.09 to 1.41)
Higher	1177	2376	14.18 (12.80 to 15.71)	1.76 (1.49 to 2.06)
Partner's occupation				
Agricultural and farming	4887	1023	0.42 (0.34 to 0.51)	0.80 (0.61 to 1.05)
Non-agricultural	8200	4287	1.06 (0.87 to 1.28)	0.90 (0.70 to 1.17)
Business	3227	2159	1.35 (1.11 to 1.64)	1.02 (0.78 to 1.32)
No work (RC)	327	162		
ANC visit				
No ANC (RC)	11524	3152		
Any ANC	2746	4071	5.42 (5.09 to 5.77)	2.38 (2.20 to 2.58)

Continued



Table 3 Continued

Variables	Dependent variable			
	Home	Facility	UOR (95% CI)	AOR (95% CI)
Birth order				
First child (RC)	5213	3866		
Second child	4745	2336	0.66 (0.622 to 0.70)	0.54 (0.49 to 0.59)
Third child	3042	1004	0.44 (0.40 to 0.48)	0.40 (0.35 to 0.46)
Fourth child or later	3746	490	0.17 (0.16 to 0.19)	0.24 (0.20 to 0.29)
Sanitation facilities				
Improved sanitation facility (RC)	7110	5000		
Unimproved sanitation facility	7284	1583	0.30 (0.28 to 0.32)	0.86 (0.79 to 0.95)
Open defecation (no facility/bush/field)	760	84	0.16 (0.12 to 0.19)	0.92 (0.70 to 1.22)
Improved water				
Improved source (RC)	14 696	6593		
Unimproved source	464	74	0.36 (0.27 to 0.46)	0.56 (0.41 to 0.76)
Household wealth status				
Poorest (RC)	4556	669		
Poorer	4001	880	1.49 (1.34 to 1.67)	1.09 (0.95 to 1.25)
Middle	3350	1237	2.51 (2.27 to 2.79)	1.40 (1.23 to 1.62)
Richer	2972	1831	4.19 (3.79 to 4.66)	1.79 (1.55 to 2.06)
Richest	1867	3079	11.23 (10.17 to 12.40)	2.81 (2.38 to 3.30)

ANC, antenatal care; AOR, adjusted OR; BMI, body mass index; RC, reference category; UOR, unadjusted OR.

births (81.04%). Rural areas also had lower (23.91%) facility births than urban areas (47.26%). The results of this study also indicate that respondents from the lower age group (15–24 years) and who were overweight had more facility deliveries. Moreover, respondents from the wealthiest families and from the Khulna division were found to be more occupied with facility births. During the last 10 years, starting from 2007 to 2017–2018, the percentage of facility delivery has increased from 16.76% to 50.49%, although this is still low.<sup>18</sup> This study showed that the respondents in 2017 had a higher likelihood of having facility births than the respondents in 2007, but this is still not sufficient. Facility birth is increasing, but at a slower rate, and several studies have shown similar results.<sup>17 30 31</sup> Regional differences in using facilities are observed in this study and indicate that respondents from the Khulna and Dhaka divisions were more likely to have facility births than respondents from the new division. Regional differences and inequalities in using facility delivery are common, and results similar to our study exist.<sup>31 32</sup> Young-aged respondents have higher likelihood of having a facility delivery than respondents from a higher age group. Several studies also showed the same results, and this may be because older women consider home delivery convenient and not risky.<sup>31 33</sup> Also, there is a big difference between younger and older women in their knowledge and healthcare facility-seeking behaviour. Younger women are more interested in seeking knowledge and healthcare facilities.<sup>33</sup> Women from urban areas

were more likely to use facility births in comparison with respondents from rural areas in developing countries like Bangladesh.<sup>15–17 31 34</sup> Moreover, overweight respondents have a higher likelihood of having facility delivery compared with respondents of normal weight. Existing studies show that respondents with non-normal weight have a higher likelihood of having facility delivery.<sup>35–37</sup> A respondent may have more complicity due to being overweight; consequently, overweight respondents tend to use more facility delivery.

Education is another significant factor influencing inequalities in using facility delivery. Respondents with a primary, secondary or higher level of education were more likely to receive facility births than respondents with no education. Education plays a key role in making a woman independent and autonomous in making her own healthcare decisions as she becomes more concerned about her health. This behaviour eventually enhanced women's concern about facility delivery.<sup>22 33 38</sup> Surprisingly, employed respondents were less likely to have the chance to use facility delivery than those who were not working.<sup>36 37</sup> Employed respondents may experience time constraints, decreasing their opportunity to receive facility delivery.<sup>32 39</sup>

Again, respondents with educated partners have higher odds of using facility delivery than respondents with uneducated partners. There are similar results about existing inequalities in receiving facility delivery being influenced by education of the respondent and

**Table 4** Decomposition of concentration index for measuring socioeconomic inequalities

Variables	Elasticity	CIX	Contribution to overall CIX=0.30846363 (p<0.001)	
			Absolute contribution	Percentage contribution
Year of survey				
2007 (RC)				
2011	0.04996	-0.01743	-0.00087	-0.28225
2014	0.09074	0.00994	0.00090	0.29238
2017	0.12860	0.01957	0.00252	0.81592
Subtotal			0.00255	0.82605
Divisions				
Barishal	-0.00542	-0.19839	0.00108	0.34856
Chattogram	-0.01758	0.07951	-0.00140	-0.45309
Dhaka	-0.03364	0.11964	0.00402	-1.30471
Khulna	0.01602	0.05020	0.00080	0.26078
Rajshahi	0.00138	-0.13950	-0.00019	-0.06254
Sylhet	0.00478	-0.13677	-0.00065	-0.21211
New division (RC)				
Subtotal			0.00366	-1.42311
Place of residence				
Urban	0.05529	0.43257	0.02392	7.75364
Rural (RC)				
Age of the mother (years)				
15–24 (RC)				
25–34	0.04567	0.02065	0.00094	0.30579
35–49	0.01955	-0.05456	-0.00107	-0.34573
Subtotal			-0.00013	-0.03994
Mother's education				
No education (RC)				
Primary	0.04190	-0.18996	-0.00796	-2.58021
Secondary	0.10407	0.14406	0.01499	4.86050
Higher	0.03779	0.53015	0.02003	6.49471
Subtotal			0.02706	8.775
Birth order				
First child	0.16166	0.09870	0.01595	5.17229
Second child	0.07459	0.03847	0.00287	0.93024
Third child	0.02953	-0.05621	-0.00166	-0.53810
Fourth child or later (RC)				
Subtotal			0.01716	5.56443
Mother's BMI				
18.51–24.99 (normal) (RC)				
<18.50 (underweight)	-0.01096	-0.21452	0.00235	0.76229
≥25.0 (overweight/obese)	0.01821	0.35794	0.00652	2.11304
Subtotal			0.00887	2.87533
Mother's working status				
Not working (RC)				
Working	-0.01294	-0.10246	0.00133	0.42985
ANC visit				
No ANC (RC)				

Continued

**Table 4** Continued

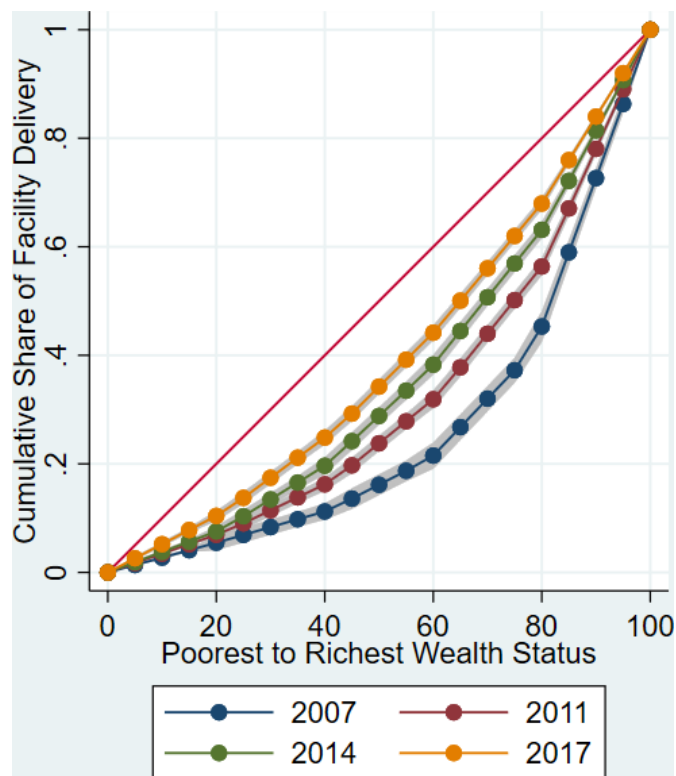
Variables	Elasticity	CIX	Contribution to overall CIX=0.30846363 (p<0.001)	
			Absolute contribution	Percentage contribution
Any ANC	0.10026	0.26187	0.02625	8.51151
Partner's education				
No education (RC)				
Primary	0.00327	-0.12889	-0.00042	-0.13665
Secondary	0.02011	0.19627	0.00395	1.27947
Higher	0.01948	0.49977	0.00974	3.15675
Subtotal			0.01327	4.29957
Partner's occupation				
Agricultural and farming	-0.04176	-0.31438	0.01313	4.25599
Non-agricultural	-0.05003	0.06158	-0.00308	-0.99866
Business	-0.01499	0.22144	-0.00332	-1.07585
No work (RC)				
Subtotal			0.00673	0.00673
Sanitation facilities				
Improved source (RC)				
Unimproved source	-0.01235	-0.25974	0.00321	1.03965
Open defecation (no facility/bush/field)	-0.00085	-0.56021	0.00048	0.15433
Improved water				
Improved source (RC)				
Unimproved source	-0.00609	-0.24382	0.00148	0.48111
Household wealth status				
Poorest (RC)				
Poorer	0.00623	-0.34487	-0.00215	-0.69619
Middle	0.01628	0.05059	0.00082	0.26691
Richer	0.03177	0.43868	0.01394	4.51757
Richest	0.05369	0.81707	0.04387	14.22174
Subtotal			0.05648	18.31003
Explained CIX			0.148	45.91
Residual CIX			0.160	54.09

ANC, antenatal care; BMI, body mass index; CIX, concentration index; RC, reference category.

the husband.<sup>15 40–43</sup> Education improves health awareness, and families with more education are more likely to use healthcare services. The socioeconomic disparities in facility delivery are also strongly influenced by the affluent position of the household. This study reveals that respondents from middle-class and affluent families were more likely to have facility delivery than those from low-income households. Clearly, educated respondents with educated partners have a greater likelihood of obtaining a high-paying job or earning more money and being able to afford maternal healthcare services such as delivery facilities.<sup>33 38</sup> This finding of education and wealth index influencing inequalities in receiving facility delivery is consistent with previous studies conducted in different countries.<sup>44–47</sup> These inequalities are influenced by different socioeconomic and demographic factors

and their interactions.<sup>15 30 48</sup> Moreover, majority of a low-income family's money is typically spent on food and everyday necessities, and the cost of healthcare facilities and education is a hardship for this population; hence, they use home-based facilities for delivery. Therefore, low-educated and underprivileged individuals are typically denied access to facilities.

Additionally, this study revealed that respondents with improved water supply and sanitation facilities have higher odds of using facility delivery compared with respondents without improved water supply and sanitation facilities, which is a match with previous studies.<sup>49</sup> Better sanitation and water facilities are primarily related to respondents' level of education and socioeconomic standing, demonstrating a direct correlation between the two variables. Compared with respondents with a second or higher



**Figure 2** Lorenz curve for inequality estimation.

birth order, first-time mothers are more likely to have facility delivery for their first child.<sup>44 50 51</sup> Also, similar to the results of other studies, this study showed that respondents with ANC have a higher likelihood of taking facility delivery than respondents with no ANC visit.<sup>36 52 53</sup> An ANC visit creates consciousness among the respondents about the danger signs of labour and pregnancy complications, leading them to use facility delivery.<sup>36</sup>

### Policy implications and specific recommendations

This research found a prорich inequality existing in Bangladeshi women's use of birthing facilities. Therefore, public health policies and interventions should be implemented to increase the number of births that take place in these settings, such as provision of birth centres, training and assurance of SBAs, use of mass media for health education and raising awareness, implementation of mandatory female education, and participation of men in pregnancy and childbirth. Despite Bangladesh having achieved commendable success in using facility delivery among reproductive-age women, it is undeniable that women with less education and poor wealth status are highly deprived of getting facility delivery. The following are therefore recommended:

- ▶ Immediate priority should be given to multisectoral interventions to upgrade facility delivery services covering the entire country, mostly the remote areas of Bangladesh.
- ▶ Women with poor health conditions, with less education and of poor financial status should be covered

with aiding facilities for using facility delivery services to motivate them as well as their families.

- ▶ This study finds that for the first child most women use facility delivery services, but this rate goes down as the number of births goes up; hence, policymakers can introduce incentives to mothers who use facility delivery for their second child.
- ▶ Further cohort study is recommended since a cross-sectional study has inherent limitations in establishing causality.
- ▶ The government can spend more on women's education and uplifting their positions to support the decision of availing facility delivery for every woman.
- ▶ Further study can be conducted on facility delivery improvement strategies that are being followed by different countries to suggest better specific action plans for Bangladesh.
- ▶ Identifying how women's and their partners' education helps improve the rate of facility delivery, as well as the far-reaching effect of education, should be beneficial for policymakers to be exact with their policies.

### Limitations and strengths

The study has some limitations that include some important factors related to the health of the respondents and the delivery facility occurred due to the unavailability and missing information, such as cost of facility or caesarean birth, insurance, distance, waiting time, healthcare practitioners' behaviour and availability of transportation facilities. Also, the cross-sectional nature of the study did not allow drawing a causal conclusion. Nonetheless, the study showed many strengths by using data from a large sample of a nationwide representative, population-based survey. Since this study was undertaken based on nationally representative consecutive data sets, the findings are more generalisable. Another strength of the study is the use of a more thorough decomposition analysis to determine the factors that influence socioeconomic inequalities in use of facility delivery. This is a robust method used to estimate health-related inequalities and is widely used in the public health literature. In addition, using the CIX as a measure of inequality index in healthcare has the following benefits: it captures the experience of the entire population; it takes into account the socioeconomic dimension of facility delivery because the classification of individuals is based on their socioeconomic status rather than their health status; and it is sensitive to changes in population distribution across socioeconomic groups.

### CONCLUSIONS

This study indicates that women from urban areas, were overweight, had any level of education, from wealthy households, had ANC, and whose partners had any level of education and were involved in business were more likely to deliver in a hospital. This study also found a

prorich inequality in facility delivery utilisation in Bangladesh, indicating that facility delivery utilisation was more prevalent among wealthier people. Existing socioeconomic inequalities in facility delivery must be addressed in order to boost the utilisation of facility delivery in Bangladesh. In light of these findings, it is essential to establish an intervention that targets these important linked factors in order to increase births in hospitals. Moreover, policy decision-making can prioritise the design and implementation of various poverty alleviation projects to eliminate socioeconomic disparities in facility delivery in Bangladesh.

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