Socioeconomic Inequalities in Utilizing Facility Delivery in Bangladesh: A Decomposition Analysis Using Nationwide 2017- 2018 Demographic and Health Survey Data

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Abstract

Background

In many low- and middle-income countries (LMICs), including Bangladesh, socioeconomic inequality in access to maternity care remains a substantial public health concern. As there is a paucity of research, we sought to determine the factors affecting the facility delivery, quantify wealth-related inequality, and find potential components that explain the inequality.

Methods

The current study made use of the most recent Bangladesh Demographic and Health Survey (BDHS 2017-18) data. We used logistic regression to examine the associated factors of facility delivery. To examine the inequality in-facility delivery, the concentration curves (CC), concentration index (CIX) and decomposition of CIX techniques were used.

Results

Women living in the urban area, age at first birth after (18–24 years $\geq$ 25 years), being Overweight/Obese, having secondary and higher-level education of the women and their husband, seeking four or more ANC, from more affluent households and women with high enlightenment were significant determinants of facility delivery. The concentration curve was below the line of equality, and the relative concentration index (RCIX) was 0.205 ($p < 0.001$), indicating that facility delivery was disproportionately more prevalent among women from rich groups. The decomposition analysis reveals that wealth status of women (57.40%), age at first birth (10.24%), husband's education (8.96%), husband's occupation (7.35%), education of women (7.13%), women's enlightenment (6.15%), residence (8.64%) and ANC visit (6.84%) are mainly contributed to the inequality in utilizing facility delivery.

Conclusion

The study demonstrates that there is a certain disparity in the use of facility delivery among women in Bangladesh; hence, immediate action is required to reduce the inequality, with a special emphasis on the contributing factors.

Background

Every day, an estimated 810 maternal deaths occur globally, of which most deaths 94% occurred in low- and -middle-income nations (LMICs), though these are avoidable in some cases. The maternal mortality ratio (MMR or the number of maternal deaths per 100,000 live births) has decreased by roughly 38% between 2000 and 2017 globally[1]. In 2017, South Asia and Sub-Saharan Africa together accounted for

86% (254,000) of all maternal deaths, while South Asia alone accounted for almost one-fifth (58,000) of all deaths. However, since 2000, remarkable improvement has been made. South Asia achieved the biggest overall percentage drop in MMR between 2000 and 2017, with a reduction of 59% (from 395 to 163 maternal deaths per 100,000 live births) and Sub-Saharan Africa reduced maternal mortality by 39% throughout this period[2, 3].

The Millennium Development Goals (MDGs) 1990–2015 emphasized the critical need of halving maternal and child mortality. By 2015, this has resulted in a considerable decrease in the global maternal mortality rate (MMR) to 38%[1]. By 2030, Sustainable Development Goal 3 (SDG 3) aims to reduce MMR mortality to less than 70 per 100,000 live births. Setting this lofty SDGs aim is a good rallying cry for all nations, yet the MDG era's agendas remain incomplete. Such progress made during the MDGs era has not been dispersed uniformly throughout the world. Bangladesh, Nepal, and Pakistan have made commendable strides in reducing MMR over the last few decades. MMR decreased to 173/100,000 live births in Bangladesh, 186/100,000 in Nepal, and 140/100,000 in Pakistan between 2010 and 2017[4]. Nevertheless, MMR rates in these nations remain extremely high in comparison to rates in other LMICs globally.

In 2017, 295,000 women died due to pregnancy related complications, low rates of facility-based delivery and shortage of skilled birth attendants (SBAs) during either pregnancy or childbirth which are the key reasons for high maternal death rates in these regions that can possibly be averted by shifting birth to a health facility[5–7]. Previous studies pointed out that the majority of maternal deaths occur when mothers do not receive professional treatment during home birth to handle hemorrhage, sepsis, botched abortion, obstructed labor, or hypertensive problems[8–11].

In addition, unsafe home delivery practices are the cause of 35% of all antepartum, intrapartum and postpartum hemorrhage[6, 12, 13]. A large number of women in LMICs countries continue to receive inadequate care throughout pregnancy and childbirth period[11] but 80% of MMR from LMICs can be avoided by utilizing SBA and facility delivery[8, 11]. Family planning, prenatal, and postnatal care, as well as the use of facility-based delivery services may aid to the reduction of maternal mortality[12, 14, 15]. However, a variety of issues limit the use of facility delivery and associated services during the pregnancy to postnatal period. Poor health seeking behavior, inadequately developed health systems, low socioeconomic status, cultural and personal health beliefs, lack of appropriate health services, high cost, long distance of service centers, lack of transportation facilities, and poor quality of treatments have been identified as the critical barriers to low health care utilization[8, 16]. In Bangladesh, women who deliver at home are more likely to be affected by unhygienic environment, putting the lives of mothers and newborns at risk of dangerous conditions[11, 13].

Investigating to what extent the socioeconomic inequalities exist in facility delivery might help in identifying the primary causes of these lower utilization and thus guide relevant stakeholders on how to alleviate these inequalities. Additionally, it is essential to examine the determinants of such inequality so that policymakers can develop evidence-based policy interventions. Few research analyzes the

socioeconomic factors of inequalities in utilizing facility delivery among women in Bangladesh using a nationally representative sample from the 2017–2018 Bangladesh Demographic and Health Survey (BDHS) data. The principal objectives of this study are three-fold: (i) to analyze the factors of facility delivery in Bangladesh using the most recent round nationally representative survey; (ii) to measure the socio-economic inequality in the use of facility delivery; (iii) to identify the primary components that explain socioeconomic inequality in facility delivery through decomposition analysis.

Methods

Data sources

The study utilized secondary data from the most recent Demographic and Health Surveys (DHS) (BDHS 2017-18). Demographic and Health Surveys are periodic surveys conducted to ascertain the population's health status. A DHS survey provides a comprehensive picture of the study population including the overall status of mother and child health as well as a variety of other health care theme areas. The dataset has been kept free to access for the academics and researchers for their use from the internet. All protocols for DHS surveys were ethically approved by the Institutional Review Board and country-specific review bodies. The final report contains a full overview of the survey strategy, methodology, sampling, and questionnaires[17].

Outcome variable

Place of delivery (0 = Home, 1 = Facility) was the outcome variable in our analyses. The place of delivery was considered 'facility' if a woman gave birth in a government hospital, district hospital, maternal and child welfare center (MCWC), Upazila health complex, health and family welfare center, private hospital/clinic, private medical college/hospital, rural health center, basic health unit, primary health care center and outreach clinic, or in a clinic run by family planning association. It was considered 'home delivery' if a woman gave birth at the respondent's own or relative's/neighbor's home.

Explanatory variables

A systematic literature search was performed to identify the predictor variables. The decision-making power was measured from a list of data (respondent involvement in deciding on her healthcare, decision on large household purchases, and decision on visits to family or relatives). Mothers' enlightenment level was measured using: educational attainment, reading newspaper/magazines, listening to the radio, and watching television and wife beating was measured by aggregating responses from women and categorised into low and high. The following items were used: "beating justified if wife goes out of home without telling husband", "beating justified if wife neglects the children", "beating justified if wife argues with husband", "beating justified if wife refuses to have sex with husband", and "beating justified if wife burns the food". Using Principal Component Analysis (PCA), the factors were distilled into a more generalised set of weights that score "women's enlightenment" and "decision making power" between 0

and 100. The standardised z-scores were used to disentangle the overall assigned scores to low, medium, and high [18–20].

Insert Table 1. Description of the explanation variables along with their categories

Statistical analysis

The background characteristics of the study population were summarized using descriptive statistics while weighted prevalence with 95% CI was presented. Chi-square tests were used to determine the relationship between the predictor variable and the delivery location. After controlling for confounding variables, multivariate logistic regression was used to determine the net influence of predictor variables on the outcome variable (facility delivery vs. home delivery). The findings section presents the factors that are statistically significant at 0.05 level in the adjusted model. This article presents both unadjusted/crude odds ratios (cOR) and adjusted odds ratios (AOR). The statistical program Stata/MP 16 (StataCorp, College Station, Texas, USA) and SPSS.25 were used to conduct all analyses.

Inequality measurement

The concentration curve (CC) and concentration index (CIX) in their relative formulation (with no correction), were used to investigate the inequality in terms of utilizing facility delivery across analyzable socio-economic characteristics of the population (women)[21]. The CIX in this study represents horizontal inequity, as each woman in the study was presumed to have an equal requirement for facility delivery. While constructing CC, the cumulative proportion of women ranked according to their wealth index score (poorest first) was plotted against the cumulative proportion of facility deliveries on the y-axis. The 45-degree slope from the origin revealed perfect equality. If the CC overlaps with the line of equality, utilization of institutional delivery is equal among women. However, if the CC subtends the line of equality below (above), then inequality in the use of institutional delivery exists and is slanted towards women belonging to low (high) socioeconomic background. The further the CC subtends from the line of equality, the greater the degree of inequality. To evaluate the extent of wealth-related inequality, CIX was determined. CIX is widened as twice the region between the line of equality and CC[21].

The following are the advantages of using CIX as a measure of inequality index in healthcare: it takes socio-economic dimension of healthcare inequalities into account since the classification of individuals is according to the socio-economic status, instead of their health status; it captures the experience of the whole population and; it is sensitive towards the changes in population distribution across socio-economic groups (15). The CIX takes a value between - 1 and + 1. When the institutional delivery is equally distributed across socio-economic groups, CIX takes the value of 0. A positive value of CIX implies that the use of institutional delivery is concentrated among the higher socio-economic groups (pro-rich). Conversely, a negative value of CIX suggests that the use of institutional delivery is concentrated among the lower socio-economic groups (pro-poor). The following are some of the benefits of utilizing CIX as a proxy for inequality in healthcare: It considers the socioeconomic dimension of healthcare inequalities because individuals are classified according to their socioeconomic status rather

than their health status; it captures the collective experience of the population; and it is sensitive to changes in population distribution across socioeconomic groups (15). The CIX accepts values between -1 and +1. When facility delivery is distributed equally across socioeconomic classes, CIX takes the value of 0. A positive value of CIX indicates that facility delivery is more prevalent among the more affluent socioeconomic categories (pro-rich). In contrast, a negative value of CIX indicates that facility delivery is more prevalent among the lower socioeconomic categories (pro-poor). The following are some of the benefits of utilizing CIX as a proxy for inequality in healthcare: It considers the socioeconomic dimension of healthcare inequalities because individuals are classified according to their socioeconomic status rather than their health status; it captures the collective experience of the population; and it is sensitive to changes in population distribution across socioeconomic groups[22]. The CIX accepts values between one and one. When institutional delivery is distributed equally across socioeconomic classes, CIX equals zero. A positive number for CIX indicates that institutional delivery is more prevalent among the more affluent socioeconomic categories (pro-rich). In contrast, a negative value of CIX indicates that institutional delivery is primarily used by lower socioeconomic groups (pro-poor). The calculation of CIX was done by using “convenient covariance” formula described by O'Donnell et al. [21], as shown in the Eq. 1 below.

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

Here h is the health sector variable, μ is its mean, and $r = i/N$ is the fractional rank of individual i in the living standards distribution, with $i = 1$ for the poorest and $i = N$ for the richest. The user-written STATA commands `Lorenz`[23] and `conindex`[24] were used to produce CC and measure CIX, respectively.

Decomposition of CIX

The relative CIX was decomposed to determine the portion of inequality owing to the inequality in the underlying determinants. The findings were analyzed and interpreted using the technique described by Wagstaff et al. (33) and O'Donnell et al. (30). 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.

Ethical approval

The current study incorporated publicly available data sources that had already been ethically approved for primary investigations in each nation, and so it did not require further additional ethical approval. The ethical consent of the subjects was obtained.

Results

Table 2 represents the distribution of utilizing facility birth by household wealth quintiles of reproductive aged women in Bangladesh. In the present study, Khulna (62.2%) had the highest percent of women who utilize facility delivery followed by Dhaka (60.3%), while the least was found in Sylhet (41.8%). We also observed that, for all categories, women with a secondary level of education mostly utilize facility delivery (50.8%) while women with no education utilize the least amount of it, the only exceptions here are higher educated women with age ≥ 25 years (65.5%), and whose husbands also had a higher level of education (63.2%). Also, women who visited ANC (≥ 4) utilize more facility delivery (66.1%) than who didn't seek any ANC.

Insert Table 2. Distribution of utilizing facility birth by analyzable reproductive aged women in Bangladesh: BDHS 2017-18

Table 3 represents the association between dependent and independent variables of interest. All of the independent variables, except the age of the mother, and her decision-making power, were found significantly associated with the utilization of facility delivery variable at $p < 0.001$ level of significance.

Insert Table 3. Bivariate association test between facility delivery and explanatory variables

Results from regression analysis show that women living in urban areas were (AOR=1.18, 95% CI=1.01-1.37) 1.18 times more likely to utilize facility delivery than women living in the rural areas of Bangladesh. Facility delivery were found (AOR=3.40, 95% CI=2.68-4.31) 3.40 times higher for those who attained ≥ 4 ANC visits, compared to those who didn't seek any ANC during their last pregnancy. With the increase of husband's education, the odds of utilizing facility delivery were also seen to be higher compared to husbands with no education. Household wealth status was seen to have a positive association with utilizing facility delivery. Middle, richer and richest class were found more likely to utilize facility delivery than women from poorest households. Women with high enlightenment were observed to utilize (AOR=1.56, 95% CI=1.32-1.85) 1.56 times higher facility delivery compared to women with low enlightenment.

Insert Table 4. Regression results factors associated with facility birth: BDHS 2017-18

Insert Table 5. Decomposition of concentration index for measuring socioeconomic inequalities in utilizing facility delivery in Bangladesh

Results from the measures of inequality

The average facility delivery per household wealth category is shown in Figure 1. An estimated one-quarter (26.44% 95% CI: 23.83-29.24) of women in the lowest-wealth quintile gave birth in a health facility, compared to nearly one-third of those who were the richest (79.33% of those who gave birth in hospitals, 95% CI: 76.53-81.88). The graph also shows that the level of facility delivery steadily rises in women as one move from the poorest to the richest quintile. While Figure 2 illustrates the inequalities in facility delivery based on one's wealth status. Due to the fact that the concentration curve is above the line of equality, facility delivery was disproportionately higher among women from affluent groups. The relative

CIX value for facility delivery is shown in Table 5. A positive estimated CIX in suggests that facility delivery was more concentrated among wealthy women than among poorer women[25].

Insert

Figure 1. Facility delivery by household wealth rank

Insert

Figure 2. Concentration curve for facility delivery against household wealth category

Discussion

This study found several socioeconomic inequalities in utilizing facility delivery using nationally representative surveys in Bangladesh. From our analysis, we can see that women with a higher level of education mostly utilize facility delivery while women with no education utilize the least amount of it. This link between education and facility delivery seems intuitive, as educated people are more aware of personal health issues, have stronger self-efficacy, and adhere to self-care[26].

Besides educational attainment, our study also found that women living in urban areas of Bangladesh are more likely to utilize facility delivery than women living in the rural areas. The plausible explanations might be urban women are more likely to be educated and hence more health-conscious and have better access to health care services than rural women. This would be the cause of increasing number of ANC visits that might further facilitate institutional deliveries. Women from rural areas, on the other hand, were more likely to birth at home owing to low economic status and poor number of ANC visits. However, due to multiple initiatives taken by the governments and different stakeholders which include financial and other incentives as well as the construction of rural birth centers, disparity in using of facility delivery is decreasing noticeably[17,27,28]. We also found a significant influence of household wealth status on socioeconomic inequalities in utilizing facility delivery where rich and middle-class women are more likely to utilize facility delivery than the poor class. Poverty could be a strong predictor of population health status, and its impact is even more pronounced in the case of women's general and reproductive health outcomes.

It might be explained by the very fact that low-income households usually spend the lion's share of their budget on food and consequently encounter difficult trade-offs regarding spending on education and health care. The poor class and even those falling within the middle-income bracket cannot afford the cost of delivery at the government hospitals let alone at private clinic. As a result, women do not have other choice but to give birth at home with the help of a Traditional Birth Attendant(TBA)[29]. Specifically, it was found that women whose husbands were engaged in job or any service had a higher likelihood of delivering at a health facility compared to any other professions. As occupation type is related to both education and income, it is a useful predictor of financial access to vital healthcare treatments. Therefore, national policies targeting income generation and poverty reduction are likely to have beneficial effects

on improving the utilization of facility delivery in Bangladesh. Decision-making power is an important factor for maternal health related issues. From the previous studies[30,31], we can see that husband's decision-making power is a strong predictor influencing health facility delivery in Pakistan. Men particularly in the South Asian societies are not actively involved in pregnancy and birthing matters, believing those to be exclusively of the women's responsibilities[10,32]. This is mostly because of the existing cultural differences, religions, personal beliefs that may cause inequity in decision-making power in this region[33,34].

However, several studies reported that joint decision or effective communication between partners boost facility delivery usage rather than individual decisions[35]. Results revealed that highly enlightened mothers are more likely to use facility delivery than others. Other studies also described how educational status influences care seeking from hospitals[36–38]. Particularly women with more education are more likely to go for facility delivery. Again, the working women were less likely to use a facility birth, in contrast to earlier studies in which working women had more self-sufficiency and thus possessed more decision-making authority over reproductive care and ANC visits[10,35] that lead to facility delivery. The working women also enjoy better financial stability, which helps them handle the costs of facility delivery. Therefore, furthering facility delivery and improving women's health requires more than just education which includes the issues of women's empowerment and economic security.

However, with only 39.7% of deliveries taking place in hospitals[39], underutilization of hospital-based interventions is unpreventable in Bangladesh. Traditional attitudes, religious misconceptions, restricted decision-making power of women in the family, and difficulty of transportation to reach the nearest health facility are the most common reasons for preferring home delivery with a TBA in Bangladesh[40]. Additionally, many Bangladeshis prefer home delivery because of having inadequate knowledge regarding service delivery points, getting afraid of caesarean delivery at the hospital, and a lack of female doctors in healthcare facilities[40]. The facilities in high-end health sector are not sufficient. Though staff training is required to make the health service providers technically more competent, in-service trainings are entirely inadequate. Hence there is a need for more investment in human resources[41,42].

The strengths and limitations of this study acknowledged cautiously. Firstly, this study used the recent round nationally representative survey data thus the findings could be generalisable to the total Bangladeshi population. Secondly, appropriate statistical techniques to estimate the prevalence and the decomposition of inequality measure using standard techniques have been used. The inherent limitations of a cross-sectional study design limited our ability to infer causality and some potential factors such as distance to the nearest institution with a birthing facility, cost (direct or indirect) of facility delivery, waiting time, behavior of the healthcare practitioners, and the availability of transportation facilities and awareness of the importance of safe delivery were excluded from this analysis due to their absence from the original DHS data that might influence the study findings.

Conclusions

The level of facility delivery in Bangladesh is low yet a significant number of women is still giving birth at their homes. The inequalities of the utilization of facility delivery exist in urban and rural areas in Bangladesh and in between the household's wealth status. This finding indicates revising strategies and programs to close the disparities and at the same time to improve facility delivery service utilization. Educational attainment, number of ANC visits, place of residence, women's decision-making power for health-related issues, and household economic status are significantly associated factors with facility delivery. Based on these insights, the health policymakers need to consider implementing special intervention programs aiming to reduce inequality and improve the utilization of facility delivery in Bangladesh, which would tremendously contribute to achieving Sustainable Development Goals (SDGs) in line with the government's own visions.

Declarations

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- **Competing interest:** The authors have no conflicts of interest to declare.
- **Ethics approval:** Not applicable

Author's Contribution

MAR conceptualised the research idea and study design. MAR and SK explored the data and performed the formal analysis. MAR, SK, MHH checked and validated the results. MAR, HOR, HHS and MAI drafted the manuscript. MHH, BK, SK, MMR critically reviewed the manuscript for scientific coherence. MAR supervised the whole study. All authors read and approved the final version for submission.

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Tables

Table 1. Description of the explanation variables along with their categories

SL. No.	Variables	Construction
1	Place of Residence	Rural, Urban
2	Division	Barishal, Chattogram, Dhaka, Khulna, Mymensingh, Rajshahi, Rangpur, Sylhet
3	Age of the mother	15-24, 25-34, 35-49
4	Age at first Birth	<18, 18-24, ≥25
5	Mother's BMI	Underweight, Normal, Overweight/Obese
6	Mother's Education	No education, Primary, Secondary, Higher
7	Mother's Employment status	Working, Not Working
8	Number of ANC Visits	Nil, 1-3, ≥4
9	Decision-Making Power	Low, High
10	Mother's Enlightenment	Low, Medium, High
11	Wife Beating	Low, High
12	Husband's Education	No education, Primary, Secondary, Higher
13	Husband's Occupation	Agricultural, Business, Job/Services, Others
14	Household Wealth Status	Poorest, Poor, Middle, Richer, Richest

Table 2. Distribution of utilizing facility birth by analyzable reproductive aged women in Bangladesh: BDHS 2017-18

	Total (n/%)	Facility birth (%)	Poorest	Poorer	Middle	Richer	Richest
Divisions							
Barishal	518 (10.8)	41.9	8.5	5.4	6.2	3.9	2.1
Chattogram	796 (16.5)	46.5	10.7	13.1	21.8	20.9	23.4
Dhaka	672 (14.0)	60.3	11.9	13.7	22.1	32.6	44.3
Khulna	495 (10.3)	62.2	8.5	12.6	15.0	10.9	8.7
Mymensingh	589 (12.2)	42.4	9.6	12.1	6.6	6.3	3.6
Rajshahi	497 (10.3)	55.9	15.9	20.4	13.5	13.2	5.7
Rangpur	550 (11.4)	52.0	27.4	15.5	10.3	6.3	5.6
Sylhet	697 (14.5)	41.8	7.4	7.2	4.5	5.9	6.6
Place of Residence							
Urban	1610 (33.4)	62.5	2.7	5.1	10.6	25.4	56.2
Rural	3204 (66.6)	43.6	15.4	20.6	23.8	24.2	16.0
Age of the mother							
15-24	2563 (53.2)	51.1	64.3	63.2	54.4	55.9	47.9
25-34	1974 (41.0)	49.1	32.3	33.3	39.6	40.4	46.9
35-49	277 (5.8)	45.1	3.3	3.5	6.0	3.7	5.3
Age at First Birth							
<18	2685 (55.8)	41.5	65.2	59.5	51.5	44.5	35.9
18-24	1865 (38.7)	57.5	31.1	36.7	41.2	47.2	51.6
≥25	264 (5.5)	82.6	3.7	3.8	7.3	8.3	12.6
Mother's BMI							
Underweight	762 (15.8)	39.8	21.9	17.5	12.7	10.8	6.6
Normal	3005 (62.4)	46.1	68.1	70.7	60.9	60.8	44.3
Overweight/Obese	1047 (21.7)	68.4	10.0	11.8	26.4	28.3	49.1
Mother's Education							
No education	312 (6.5)	3.2	7.4	4.3	4.3	2.2	1.7
Primary	1337 (27.8)	17.8	39.6	27.1	16.1	15.1	7.3
Secondary	2308 (47.9)	50.8	45.6	58.4	60.2	53.8	44.8
Higher	857 (17.8)	28.3	7.4	10.2	19.5	28.9	46.2
Mother's employment status							
Not Working	3046 (63.3)	55.2	52.6	60.1	67.8	71.3	82.5
Working	1768 (36.7)	40.9	47.4	39.9	32.2	28.7	17.5
Number of ANC Visits							
Nil	570 (11.8)	23.2	6.7	9.4	5.4	4.6	3.9
1-3 visit	2009 (41.7)	39.6	50.4	46.4	39.1	34.3	19.0
≥ 4 visits	2235 (46.4)	66.1	43.0	44.2	55.6	61.1	77.1
Husband's Education							
No education	676 (14.0)	29.4	23.0	13.9	8.8	5.6	2.0
Primary	1637 (34.0)	38.5	46.7	43.2	27.5	23.2	10.6
Secondary	1592 (33.1)	54.1	22.6	30.6	42.3	44.7	36.8
Higher	909 (18.9)	78.5	7.8	12.3	21.5	26.4	50.6
Husband's Occupation							
Agricultural	911 (18.9)	33.5	31.1	25.5	16.7	9.0	2.3
Business	1051 (21.8)	56.4	8.5	14.7	23.6	26.0	34.7
Job/Services	2268 (47.1)	57.1	38.1	48.8	52.1	57.0	58.4
Others	584 (12.1)	36.3	22.2	11.0	7.5	8.0	4.6
Mother's Empowerment							

Decision-Making Power								
	Low	2625 (54.5)	50.6	27.0	56.7	52.8	51.1	54.9
	High	2189 (45.5)	49.2	26.5	43.3	47.2	48.9	45.1
Mother's Enlightenment								
	Low	1870 (38.8)	31.3	61.1	66.3	44.4	21.5	13.4
	Medium	818 (17.0)	46.3	29.6	18.1	17.7	21.0	17.5
	High	2126 (44.2)	67.7	12.7	15.6	37.9	57.5	69.1
Wife Beating								
	Low	3946 (82.0)	51.7	26.3	83.3	81.2	80.7	84.2
	High	868 (18.0)	42.1	29.5	16.7	18.8	19.3	15.8

Table 3. Bivariate association test between facility delivery and explanatory variables

		Utilization of facility birth			
		Total (n/%)	Facility birth	Home birth	P-value
Divisions					<0.001
	Barishal	518 (10.8)	41.9	58.1	39.32(33.75-45.17)
	Chattogram	796 (16.5)	46.5	53.5	45.49(42.46-48.55)
	Dhaka	672 (14.0)	60.3	39.7	58.27(55.43-61.05)
	Khulna	495 (10.3)	62.2	37.8	60.03(55.38-64.51)
	Mymensingh	589 (12.2)	42.4	57.6	39.14(34.57-43.91)
	Rajshahi	497 (10.3)	55.9	44.1	53.71(49.57-57.81)
	Rangpur	550 (11.4)	52.0	48.2	48.5(44.26-52.77)
	Sylhet	697 (14.5)	41.8	58.2	38.0(33.33-42.90)
Place of Residence					<0.001
	Urban	1610 (33.4)	62.5	37.5	63.37(60.65-66.01)
	Rural	3204 (66.6)	43.6	56.4	44.99(43.36-46.62)
Age of the mother					0.106
	15-24	2563 (53.2)	51.1	48.9	51.42(49.48-53.34)
	25-34	1974 (41.0)	49.1	50.9	48.48(46.29-50.69)
	35-49	277 (5.8)	45.1	54.9	42.08(36.20-48.18)
Age at First Birth					<0.001
	<18	2685 (55.8)	41.5	58.5	41.80(39.97-43.66)
	18-24	1865 (38.7)	57.5	42.5	57.53(55.25-59.78)
	≥25	264 (5.5)	82.6	17.4	80.67(75.19-85.18)
Mother's BMI					<0.001
	Underweight	762 (15.8)	39.8	60.2	40.27(36.76-43.88)
	Normal	3005 (62.4)	46.1	53.9	46.02(44.26-47.80)
	Overweight/Obese	1047 (21.7)	68.4	31.6	66.87(63.96-69.64)
Mother's Education					<0.001
	No education	312 (6.5)	24.4	75.6	26.01(21.44-31.7)
	Primary	1337 (27.8)	31.9	68.1	31.99(29.53-34.56)
	Secondary	2308 (47.9)	52.9	47.1	52.81(50.80-54.82)
	Higher	857 (17.8)	79.5	20.5	78.41(75.45-81.10)
Mother's Employment Status					<0.001
	Not Working	3046 (63.3)	55.2	44.8	54.86(53.09-56.62)
	Working	1768 (36.7)	40.9	59.1	40.76(38.49-43.07)
Number of ANC Visits					<0.001
	Nil	570 (11.8)	23.2	76.8	23.53(20.21-27.21)
	1-3 visit	2009 (41.7)	39.6	60.4	40.07(37.97-42.20)
	≥ 4 visits	2235 (46.4)	66.1	33.9	65.46(63.45-67.42)
Husband's Education					<0.001
	No education	676 (14)	29.4	70.6	30.03(26.68-33.61)
	Primary	1637 (34)	38.5	61.5	38.05(35.73-40.42)
	Secondary	1592 (33.1)	54.1	45.9	54.61(52.19-57.01)
	Higher	909 (18.9)	78.5	21.5	77.69(74.80-80.33)
Husband's Occupation					<0.001
	Agricultural	911 (18.9)	33.5	66.5	34.48(31.52-37.57)
	Business	1051 (21.8)	56.4	43.6	57.41(54.35-60.42)
	Job/Services	2268 (47.1)	57.1	42.9	56.44(54.39-58.48)
	Others	584 (12.1)	36.3	63.7	35.42(31.70-39.31)
Household Wealth Status					<0.001
	Poorest	1061(22.04)	11.35	32.71	26.44(23.83-29.24)

	Poorer	996(20.69)	15.34	26.03		37.04(34.11-40.07)
	Middle	875(18.18)	18.21	18.14		49.92(46.72-53.12)
	Richer	958(19.90)	24.03	15.77		60.06(56.96-63.08)
	Richest	924(19.19)	31.06	7.35		79.33(76.53-81.88)
Mother's Empowerment						
Decision-Making Power					0.311	
	Low	2625 (54.5)	50.6	49.4		49.6(47.69-51.520)
	High	2189 (45.5)	49.2	50.8		49.83(47.75-51.91)
Mother's Enlightenment					<0.001	
	Low	1870 (38.8)	31.3	68.7		30.87(28.79-33.03)
	Medium	818 (17.0)	46.3	53.7		46.80(43.42-50.21)
	High	2126 (44.2)	67.7	32.3		66.67(64.66-68.63)
Wife Beating					<0.001	
	Low	3946 (82.0)	51.7	48.3		50.93(49.37-52.49)
	High	868 (18.0)	42.1	57.9		44.24(40.99-47.54)

Table 4. Regression results factors associated with facility birth: BDHS 2017-18					
Divisions		UOR (95% CI)	P-Value	AOR (95% CI)	P-Value
	Barishal (RC)	1.00		1.00	
	Chattogram	1.20 (0.96-1.51)	0.102	0.95 (0.73-1.23)	0.681
	Dhaka	2.10 (1.67-2.66)	<0.001	1.26 (0.95-1.65)	0.103
	Khulna	2.28 (1.78-2.94)	<0.001	1.78 (1.33-2.37)	<0.001
	Mymensingh	1.02 (0.81-1.30)	0.853	1.05 (0.80-1.39)	0.713
	Rajshahi	1.76 (1.37-2.26)	<0.001	1.63 (1.22-2.16)	0.001
	Rangpur	1.50 (1.18-1.91)	0.001	1.55 (1.17-2.06)	0.002
	Sylhet	0.99 (0.79-1.25)	0.961	1.02 (0.78-1.33)	0.911
Place of Residence					
	Urban	2.16 (1.91-2.44)	<0.001	1.18 (1.01-1.37)	0.037
	Rural (RC)	1.00		1.00	
Age of the mother					
	15-24(RC)	1.00		1.00	
	25-34	0.92 (0.82-1.04)	0.188	0.75 (0.65-0.86)	<0.001
	35-49	0.79 (0.61-1.01)	0.059	0.68 (0.49-0.92)	0.014
Age at First Birth					
	<18 (RC)	1.00		1.00	
	18-24	1.9 (1.69-2.15)	<0.001	1.42 (1.24-1.64)	<0.001
	≥25	6.67 (4.81-9.26)	<0.001	3.82 (2.62-5.59)	<0.001
Mother's BMI					
	Underweight (RC)	1.00		1.00	
	Normal	1.30 (1.10-1.52)	0.002	1.04 (0.86-1.25)	0.690
	Overweight/Obese	3.28 (2.70-3.98)	<0.001	1.77 (1.41-2.22)	<0.001
Mother's Education					
	No education	1.00		1.00	
	Primary	1.46 (1.10-1.93)	0.009	1.06 (0.77-1.46)	0.733
	Secondary	3.49 (2.66-4.57)	<0.001	1.50 (1.07-2.09)	0.016
	Higher	12.02 (8.84-16.33)	<0.001	2.16 (1.44-3.23)	<0.001
Mother's employment status					
	Not Working (RC)	1.00		1.00	
	Working	0.56 (0.50-0.63)	<0.001	0.67 (0.58-0.77)	<0.001
Number of ANC Visits					
	Nil (RC)	1.00		1.00	
	1-3 visit	2.17 (1.75-2.69)	<0.001	1.71 (1.36-2.17)	<0.001
	≥ 4 visits	6.48 (5.23-8.02)	<0.001	3.40 (2.68-4.31)	<0.001
Husband's Education					
	No education (RC)	1.00		1.00	
	Primary	1.50 (1.24-1.82)	<0.001	1.14 (0.92-1.41)	0.229
	Secondary	2.83 (2.33-3.43)	<0.001	1.32 (1.06-1.65)	0.014
	Higher	8.78 (6.98-11.04)	<0.001	2.23 (1.69-2.92)	<0.001
Husband's Occupation					
	Agricultural	0.88 (0.71-1.10)	0.263	0.96 (0.75-1.22)	0.741
	Business	2.27 (1.85-2.80)	<0.001	1.17 (0.92-1.48)	0.199
	Job/Services	2.34 (1.94-2.82)	<0.001	1.21 (0.97-1.49)	0.087
	Others (RC)	1.00		1.00	
Household Wealth Status					
	Poorest (RC)	1.00		1.00	
	Poorer	1.70(1.41-2.05)	<0.001	1.28(1.04-1.57)	0.021
	Middle	2.89(2.39-3.50)	<0.001	1.61(1.29-2.01)	<0.001

	Richer	4.39(3.63-3.30)	<0.001	2.00(1.58-2.53)	<0.001
	Richest	12.18(9.84-15.05)	<0.001	3.87(2.54-4.41)	<0.001
Decision Making Power					
	Low (RC)	1.00		1.00	
	High	0.94 (0.84-1.06)	0.309	0.90 (0.79-1.03)	0.128
Mother's Enlightenment					
	Low (RC)	1.00		1.00	
	Medium	1.89 (1.60-2.24)	<0.001	1.11 (0.92-1.34)	0.273
	High	4.60 (4.02-5.26)	<0.001	1.56 (1.32-1.85)	<0.001
Wife Beating					
	Low	1.47 (1.27-1.71)	<0.001	1.07 (0.9-1.27)	0.442
	High (RC)	1.00		1.00	
RC stands for Reference Category, ANC for Antenatal Care, BMI means to Body Mass Index, Divisions means Administrative Regions					

Table 5. Decomposition of concentration index for measuring socioeconomic inequalities in utilizing facility delivery in Bangladesh					
Variables		Elasticity	CIX	Contribution to overall CIX = 0.205 (p<0.001)	
				Absolute contribution	Percentage contribution
Divisions					
	Barishal (RC)				
	Chattogram	-0.012	0.075	-0.001	-0.450
	Dhaka	0.045	0.259	0.009	3.630
	Khulna	0.041	0.036	0.001	0.717
	Mymensingh	-0.003	-0.204	0.001	0.264
	Rajshahi	0.041	-0.072	-0.003	-1.419
	Rangpur	0.035	-0.302	-0.011	-6.202
	Sylhet	0.001	-0.111	-0.001	-0.005
	Subtotal			-0.005	-3.465
Place of Residence					
	Rural (RC)				
	Urban	0.029	0.376	0.011	4.246
	Subtotal			0.011	4.246
Age of the Mother					
	15-24 years (RC)				
	25-34 years	-0.083	0.022	-0.002	-0.880
	35-49 years	-0.015	-0.008	0.001	0.056
	Subtotal			-0.001	-0.824
Mother's Education					
	No education (RC)				
	Primary	-0.001	-0.259	0.002	0.906
	Secondary	0.110	0.040	0.004	2.163
	Higher	0.078	0.420	0.013	4.065
	Subtotal			0.019	7.134
Age at First Birth					
	<18 years (RC)				
	18-24 years	0.086	0.114	0.010	4.806
	≥ 25 years	0.044	0.343	0.015	5.436
	Subtotal			0.025	10.242
Mother's BMI					
	Normal (RC)				
	Underweight	-0.006	-0.195	0.001	0.546
	Overweight/Obese	0.062	0.293	0.012	5.628
	Subtotal			0.013	6.174
Mother's Employment					
	Not working (RC)				
	Working	-0.097	-0.171	0.017	5.096
	Subtotal			0.017	5.096
Number of ANC Visits					
	Nil (RC)				
	1-3 visit	0.188	-0.103	-0.019	-9.502
	≥ 4 visits	0.278	0.137	0.029	7.622
	Subtotal			0.010	-1.880
Husband's Education					
	No education (RC)				

	Primary	0.008	-0.199	-0.002	-0.803
	Secondary	0.041	0.123	0.005	2.456
	Higher	0.070	0.420	0.019	7.307
	Subtotal			0.022	8.960
Husband's Occupation					
	Others (RC)				
	Agricultural	0.004	-0.332	-0.001	-0.686
	Business	0.036	0.204	0.007	3.609
	Job/Services	0.083	0.109	0.009	4.429
	Subtotal			0.015	7.352
Household Wealth Status					
	Poorest (RC)				
	Poor	0.031	-0.368	-0.011	-5.561
	Middle	0.058	0.034	0.002	0.963
	Rich	0.095	0.431	0.035	13.028
	Richest	0.148	0.817	0.103	48.969
	Subtotal			0.129	57.399
Mother's Empowerment					
Decision-making Power					
	Low (RC)				
	High	-0.028	0.020	-0.001	-0.279
	Subtotal			-0.001	-0.279
Mother's Enlightenment					
	Low (RC)				
	Medium	0.021	0.014	0.001	0.139
	High	0.095	0.306	0.019	6.010
	Subtotal			0.020	6.149
Wife Beating					
	High (RC)				
	Low	-0.015	0.019	-0.001	-0.142
	Subtotal			-0.001	-0.142
Explained CI				0.273	106.162
Residual CI				-0.068	-6.162
CI: Concentration Index					

Figures

Figure 1

Facility delivery by household wealth rank

Figure 2

Concentration curve for facility delivery against household wealth category