



Research article

Exploring urban-rural inequalities of maternal healthcare utilization in Bangladesh

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ARTICLE INFO

Keywords:

Prenatal care
Facility-based delivery (FBD)
Skilled birth assistance (SBA)
Maternal health
Socioeconomic factors

ABSTRACT

Background: Bangladesh has made significant progress across various sectors, including healthcare. However, noticeable disparities persist in the healthcare sector, particularly in maternal healthcare between urban and rural areas. Despite substantial advancements in maternal healthcare services (MHCS), such as Antenatal care (ANC), Facility-Based Delivery (FBD), and Skilled Birth Attendants (SBA), utilization depends on various socioeconomic factors. This study aims to assess the impact of different factors and describe the urban-rural inequalities in maternal healthcare service utilization.

Methods & study design: This study's analysis is based on data extracted from the 2017-18 Bangladesh Demographic and Health Survey (BDHS), following STROBE guidelines. Descriptive statistics provide an overview of the factors, and multiple logistic regression analysis identifies important factors in MHCS. Additionally, the Wagstaff decomposition method measures the concentration index, elasticity, contribution, and percentage contributions of different factors.

Results: According to -BDHS 2017-18, this study found a 51.84 % utilization of ANC visits. Women with "Higher Education" had odds ratios of 3.04, 3.05, and 3.12 for ANC, FBD, and SBA, respectively, compared to the "No Education" group. Similarly, women with partners having "Higher Education" exhibited odds ratios of 3.04, 3.05, and 3.12 for ANC, FBD, and SBA, respectively. Rich families had odds ratios of 1.91, 2.42, and 2.5 compared to the "poor" group for ANC, FBD, and SBA, respectively. Mother's education contributed 28.62 %, 30.3 %, and 30.47 % for ANC, FBD, and SBA, respectively. The household wealth index contributed 26.16 %, 38.49 %, and 40.3 % for ANC, FBD, and SBA, respectively of the urban-rural difference.

Conclusion: Maternal healthcare services utilization shows a significant disparity, with rural areas reporting much lower rates compared to urban areas. To achieve the Sustainable Development

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<https://doi.org/10.1016/j.heliyon.2025.e41945>

Received 7 September 2023; Received in revised form 11 January 2025; Accepted 13 January 2025

Available online 15 January 2025

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Goal (SDG), this study's findings can help policymakers ensure equitable access to quality care for all women, irrespective of their socioeconomic background or geographical location.

1. Introduction

Maternal health continues to be an important public health challenge worldwide, particularly in low-resource areas. Globally, an estimated 295,000 women died in 2017 due to conditions related to pregnancy and childbirth as reported by the World Health Organization (WHO) — of these deaths, at least 94 % occurred in low-resource settings concentrated mainly in sub-Saharan Africa and Southern Asia [1–3]. This is particularly true for regions with high rates of maternal mortality like most other parts of SSA, largely because health services such as skilled birth attendance (SBA) and antenatal care (ANC) are inaccessible in these places [6]. The risks of maternal death that women face vary enormously between countries, and in some developing countries the lifetime risk is substantial; hundreds to thousands of deaths occur every year as a consequence of largely preventable complications [3,4].

Quality healthcare services throughout pregnancy are essential for promoting positive outcomes for both the mother and baby. These services involve creating care plans during face-to-face medical consultation and are linked to service utilization [8]. The availability of maternal health services plays a crucial role in ensuring safe childbirth, infants' survival, and overall community well-being [5]. Especially skilled birth attendance and ANC, as vital components of maternal healthcare services that reduce reproductive health problems, leading to lower mortality among women of childbearing age [7].

Despite significant progress in maternal health services globally, inequalities persist. In 2017, the WHO reported that approximately 810 women died daily from pregnancy-related complications, with 94 % of those occurring in developing countries [10]. Moreover, another study showed that approximately 287,000 maternal deaths occur annually worldwide, of which more than or equal to four-fifths occur in developing countries [11]. The disparity becomes even more pronounced in low-income settings, where inadequate maternal healthcare and obstetric services contribute to high maternal mortality ratios (MMRs) [10]. Furthermore, while the Millennium Development Goals (MDGs) called for a 75 % reduction in Maternal Mortality Ratio (MMR) from its 1990 levels by the year 2015 [12], wide disparities persist between developed and low-income countries.

However, Maternal healthcare in rural Bangladesh is less stable and still faces large health challenges. In ethnic rural and remote regions, the Neonatal Mortality Rate (NMR) is higher with MMRs of urban areas (despite the lower burden), while Under-5 Mortality (U5 MR) remains high at these locales against elsewhere [16]. In addition, existent socioeconomic disparities are amplified in the sphere of healthcare utilization with women from poorer households experiencing inferior maternal child well-being outcomes compared to their richer counterparts [17]. Cultural norms and limited access also hinder care for many underprivileged women [6]. Geographically northern and southwestern Bangladesh continues to have higher MMR, NMR, and U5MR compared with other parts of the country [16].

While Bangladesh has reduced maternal mortality to 245 deaths per 100,000 live births it remains high [16]. The government has introduced several initiatives to improve maternal health, including enhancing Essential Obstetric Care (EOC) services through district hospitals and Maternal and Family Welfare (M&FW) Centers at the peripheral level [19]. Maternal healthcare utilization is greatly influenced by several factors, including the wealth index, education levels, and socioeconomic profile of the urban population, even though urban areas benefit from a variety of maternal health interventions and healthcare facilities [6]. Despite urban areas benefiting from numerous maternal health interventions, access and service use are significantly lower in rural areas. According to the 2014 Bangladesh Demographic and Health Survey (BDHS) 2014, 74 % of women received ANC from qualified providers, in the three years prior to the survey, but disparities persist between high- and low-income households.

In the developing world, urban-rural disparities in maternal healthcare utilization are widespread. Women in urban areas generally have greater access to maternal healthcare services due to socioeconomic and educational differences. Research shows that urban women are three times more likely to receive antenatal care, with wealth and education being key influencing factors [9]. Similar patterns are seen in nations such as Tanzania, where access to maternal healthcare is significantly influenced by household wealth status [13]. The urban-rural divide has been reduced by other elements like media exposure and job opportunities [13].

In Bangladesh, 59 % of urban mothers receive at least four prenatal care visits compared to 42.8 % of rural mothers [14]. Rural women face major challenges, including lower facility delivery rates and inadequate prenatal care; only 14.5 % of rural women receive quality care, compared to 27.1 % in urban areas [14]. While programs like the Maternal Health Voucher Scheme (MHVS) show promise in reducing these inequalities, targeted interventions are necessary to overcome systemic barriers to equitable access to maternal healthcare services [15].

This study aims to investigate disparities in the utilization of SBA, ANC, and facility-based delivery between urban and rural communities in Bangladesh. It will also examine the economic and social structures that contribute to these differences, highlighting factors that affect maternal and child health based on geographical and socioeconomic contexts.

2. Methodology

This study followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guideline for a better observational cross-sectional study.

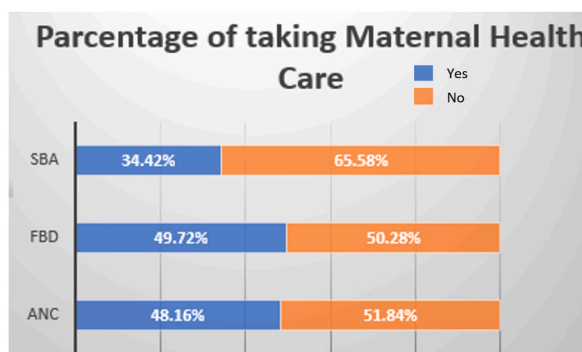


Fig. 1. Percentage of overall Maternal Health Care Service Utilization (SBA, FBD, ANC).

2.1. Data source

This study used data from the Bangladesh Demographic and Health Survey (BDHS) 2017–18, a representative sample of the nation’s non-institutional housing population [21]. The survey used a stratified two-stage sampling process to select 675 enumeration areas (EA) with a probability proportional to their size (425 rural and 250 urban) based on the most recent population census mapping [21]. In the second stage of sampling, each EA selected an average of 30 households to ensure statistically accurate estimates of the country’s key health and demographic characteristics [21]. Standardized questionnaires were used by professional interviewers, and sample weights were used to ensure accurate analysis [21]. This study included 5051 mothers with at least one living child three years before the survey date. Data from the most recent live births was used when a woman had multiple live births.

2.2. Outcome variable

The study’s findings are related to the utilization of Facility-Based Delivery (FBD), Antenatal Care (ANC), and Skilled Birth Attendance (SBA)—three crucial areas of maternal healthcare—during the most recent pregnancy and birth.

ANC: Antenatal Care (ANC) is a comprehensive strategy for monitoring pregnant women’s well-being, identifying issues, and ensuring secure childbirth [22]. This involves regular check-ups, diagnostic tests, and education on nutrition, physical activity, and childbirth preparation [23]. In our study, ANC is defined as having at least four prenatal visits with qualified healthcare providers, during pregnancy [6,24,25]. We assessed whether women received ANC from a qualified professional for their most recently born child in the three to four years prior to the survey. Respondents with at least four ANC visits were categorized as “Yes,” while those with fewer were categorized as “No”.

FBD: Facility-based delivery (FBD), involving childbirth in a healthcare facility that is equipped with essential resources to handle both uncomplicated and complicated childbirths [26]. This delivery approach involves comprehensive care provided to the woman and infant before, during, and after childbirth, under the supervision of experienced birth attendants [27]. The selection of the delivery location is crucial in reducing the risks related to maternal and newborn mortality [28]. The study focused on the most recently born children within the three years preceding the survey, categorizing respondents with a facility-based delivery place as “Yes” and “No” for the counterpart.

SBA: Skilled Birth Attendance (SBA) refers to the presence and support of highly competent healthcare professionals during the various stages of childbirth [29]. The trained delivery attendants have the necessary knowledge, and experience to provide complete care to both the mother and newborn [24,25,30]. Skilled Birth Attendants (SBAs) are crucial in delivering reproductive health care and greatly reducing the risk of problems during childbirth [29]. The study focused on the most recently born children within the three years preceding the survey, categorizing respondents with skilled birth attendance during the time of delivery as “Yes” and “No” for the counterpart.

2.3. Independent variable

An extensive literature review was conducted to identify the main independent variables relevant to the disparities between rural and urban populations’ utilization of health services for mothers as the focus of the study [6,7]. Maternal age has been categorized into three groups: 15 to 19, 20 to 24, and above 25 years. mothers’ maternal education is divided into “No Education,” “Primary,” “Secondary,” and “Higher Education”, The number of children is classified into two categories: “2 or less” and “more than two.” Respondents’ preferences categorize the desire for further children into three groups: “No More,” “Later,” and “Then.” The variable “Method Currently Used” categorizes the utilization of contraceptive methods as either “Yes” or “No”. Likewise, the respondent’s present employment status and media exposure are classified similarly. Birth order is categorized as “1,” “2,” and “3+” to represent families with one, two, and three or more children, respectively. The variable “Religion” is divided into two categories, namely “Islam” and “Other.” Respondents who practice religions other than Islam are classified under the “Other” category. The occupation of the Household Head is classified into four categories: “Not Working,” “Worker,” “Job Holder,” and “Other.” The education of partners is

Table 1
Socio-economic and demographic characteristics by Place of Resident.

Covariates	Place of Resident			p-value
	Urban n (%)	Rural n (%)	Total n (%)	
Mother age				
15–19	225(16.62)	679(18.38)	904(17.9)	
20–24	454(33.50)	1324(35.84)	1779(35.21)	0.074
25+	677(49.88)	1692(45.79)	2368(46.89)	
Number of children ever born				
2 or less	1031(76.03)	2557(69.21)	3589(71.04)	
More than 2	325(23.97)	1138(30.79)	1463(28.96)	<0.001
Wanted pregnancy				
then	1055(77.78)	2942(79.61)	3997(79.12)	
later	195(14.38)	456(12.34)	651(12.88)	0.216
no more	107(7.84)	298(8.05)	404(8.00)	
Method currently used				
No	942(69.48)	2544(68.85)	3486(69.01)	
yes	414 (31.15)	1151(31.15)	1565(30.99)	0.729
Birth order				
1	555(40.93)	1376(37.23)	1931(38.22)	
2	476(35.10)	1182(31.99)	1658(32.82)	<0.001
3+	325(23.97)	1138(30.79)	1463(28.96)	
Religion				
Islam	1260(92.91)	3380(91.46)	4640(91.85)	
Others	96(7.09)	315(8.54)	411(8.15)	0.409
Marital status				
Married	1335(98.47)	3653(98.85)	4988(98.74)	
No longer living together	21(1.53)	43(1.25)	63(1.26)	0.278
Household Head Sex				
Male	1224(90.26)	3163(85.59)	4387(86.84)	
Female	132(9.74)	533(14.41)	665(13.16)	<0.001
Household Head age				
15–29	266(16.64)	669(18.11)	936(18.52)	
30–44	610(44.98)	1423(38.51)	2033(40.25)	<0.001
45+	480(35.38)	1603(43.38)	2083(41.23)	
Partner's education				
No education	131(9.79)	522(16.08)	692(13.99)	
Primary	395(29.54)	1163(35.82)	1657(33.50)	
Secondary	459(34.37)	1076(33.14)	1635(33.06)	<0.001
Higher	349(26.14)	486(14.97)	962(19.45)	
Mother Education				
No education	88(6.46)	231(6.24)	318(6.30)	
Primary	340(25.11)	1054(28.54)	1395(27.62)	
Secondary	602(44.41)	1872(50.67)	2475(48.99)	<0.001
Higher	325.7(24.01)	538(14.55)	863(17.09)	
Currently Working				
Yes	392 (28.93)	1492 (40.38)	3167(62.69)	
No	964(71.07)	2203 (59.62)	1884(37.31)	<0.001
Household wealth index				
Poor	206(15.17)	1872(50.65)	207(41.13)	
Middle	164(12.11)	805(21.79)	969(19.19)	<0.001
Rich	986(72.72)	1018(27.56)	2005(39.68)	
Media				
No	515(38.01)	2422(65.54)	2937(58.15)	
Yes	841(61.99)	1273(34.46)	2114(41.85)	<0.001
Final says on woman's health care				
Woman alone	110(8.25)	260(7.12)	370(7.56)	
Woman and husband/partner	903(67.61)	2359(64.6)	3262(65.41)	
Only Husband/Partner	252(18.18)	758(20.76)	1010(20.25)	0.050
Someone else	70(5.26)	275(7.53)	345(6.92)	
Geographical Locations				
Barisal	47(3.49)	241(6.52)	288(5.7)	
Chittagong	253(18.65)	8148(22.14)	1071(21.2)	
Dhaka	633(46.69)	660(17.86)	1293(25.6)	
Khulna	108(7.95)	356(9.65)	464(9.19)	
Mymensingh	75(5.51)	356(9.65)	431(8.53)	<0.001
Rajshahi	107(7.88)	480(12.99)	587(111.62)	
Rangpur	76(5.59)	458(12.40)	534(10.57)	
Sylhet	57(4.24)	326(8.81)	383(7.59)	
Household head Occupation				
Farming/Agriculture	64(4.75)	884(24.28)	947(19.04)	
Worker	787(58.96)	1870(51.39)	2657(53.42)	

(continued on next page)

Table 1 (continued)

Covariates	Place of Resident			p-value
	Urban n (%)	Rural n (%)	Total n (%)	
Mother age				
Jobholder	473(35.43)	848(23.29)	1320(26.55)	<0.001
Others	12(0.86)	38(1.03)	49(0.99)	
Household Members				
Less than 5	775(57.14)	1804(48.82)	2579(51.05)	
Greater than 5	581(42.86)	1891(51.18)	2472(48.95)	<0.001

categorized into four levels: “No Education,” “Primary,” “Secondary,” and “Higher.” The marital status of a woman can be classified as “Married,” “Widowed,” “Divorced,” or “Separated.” The BDHS-2017-18 evaluates the wealth index of households by considering consumer items (such as television and bicycle) and housing features (such as drinking water supply and restroom facilities), where the wealth quintile was calculated separately for rural and urban households and then combined. The wealth index is categorized into three groups: poor, middle, and rich.

The selection of these variables was based on their empirical and theoretical significance in the context of mother and child healthcare, as supported by regional and international literature, and their inclusion in the BDHS dataset [8,10].

2.4. Statistical analysis and tools

We calculated the percentage distribution of demographic and socioeconomic characteristics in both urban and rural areas for the study sample. A chi-square test was conducted to examine the association between the categorical variable and the dependent variable. An arbitrary p-value of <0.20 was used to include the factors in the multivariable logistic regression model to account for confounding effects, with statistical significance defined as a p-value ≤ 0.05 [20]. We checked for multicollinearity by estimating the Variance Inflation Factor (VIF) with a threshold value of 4 [18,21]. All analysis was performed in Stata 17. AUROC curve and Sensitivity and Specificity vs probability cutoff have also been used.

2.4.1. Concentration index

We calculated (See equation i) the concentration index to evaluate the different levels of inequality in maternal healthcare utilization. This index is a measure of the degree of socioeconomic-related inequality in a health metric and has a scale of -1 to 1 . A value of 0 indicates complete equality, positive values suggest that access is more common among wealthier individuals, and negative values indicate that access is more common among less privileged individuals [31].

The concentration index approach for Wagstaff decomposition is used to measure health-related inequalities. Erreygers et al. addressed that in the case of measuring inequalities for ordinal health variables, the concentration index approach may not interpret outcomes correctly [32]. Ataguba et al. highlighted what challenges can be faced in assessing and interpreting the concentration index with binary health variables and also suggested that it not only depends on the sample size but also the sampling weight [33]. We followed some recent studies and used the corrected concentration index shown in the equation-ii [34,35].

The formula used to

$$C = \frac{2}{n\mu} \sum_{i=1}^n Y_i R_i - 1 \quad (i)$$

Where, C is the concentration index.

M is the mean of the variable being measured.

Y_i refers to the outcome variable index of the i th woman.

In the distribution of socioeconomic position, R_i is the fractional rank of the i th inmost [31].

Gudo's Corrected Concentration Index,

$$CC = \frac{4\mu}{(b-a)} C \quad (ii)$$

Where, μ is the mean of the health variable, a is the lower bound and b is the upper bound.

2.4.2. Decomposition

This study used the Wagstaff decomposition method to decompose the concentration index (CI) and to quantify the contribution of the covariates in explaining the urban-rural difference in MHCS utilization (see equation iii). The decomposition identifies the contributions of each socioeconomic and demographic variable to the overall inequality, including the distribution of determinants and the effects of the determinants on the outcome [31].

The equation for the Wagstaff decomposition is:

$$D = \sum_i (r_i - r) \left(\frac{C_s i}{C} \right) + \sum_j (b_i - b) \left(\frac{C_n j}{C} \right) \quad (iii)$$

Table 2
Descriptive characteristics of women utilizing ANC 4+, FBD, and SBA) by urban-rural status.

Covariates	Antenatal Care (ANC)			Facility Based Delivery (FBD)			Skilled Birth Assistance (SBA)		
	Urban n (%)	Rural n (%)	p-value	Urban n (%)	Rural n (%)	p-value	Urban n (%)	Rural n (%)	p-value
Mother Age									
15–19	154(15.13)	262(18.77)	0.010	153(14.09)	282(19.67)	<0.001	168(14.63)	301(19.70)	<0.001
20–24	349(34.28)	509(36.46)		356(32.78)	565(39.40)		385(33.54)	599(39.20)	
25+	515(50.59)	625(44.77)		577(53.13)	587(40.93)		595(51.83)	628(41.10)	
Number Of children ever born									
2 or less	810(79.57)	1057 (75.72)		866(79.74)	1128 (78.66)		913 (79.53)	1197 (78.34)	
More than 2	208(20.43)	339(24.28)	0.030	220(20.26)	306(21.34)	0.050	235(20.47)	331(21.66)	0.460
Wanted Pregnancy then									
then	832(81.73)	1153 (82.59)	0.710	865(80.39)	1199 (83.79)	0.060	924(80.49)	1274 (83.38)	0.120
later	133(13.06)	167(11.96)		144(13.38)	167(11.67)		152(13.24)	180(11.78)	
no more	53(5.21)	76(5.44)		67(6.23)	65(4.54)		72(6.27)	74(4.84)	
Method Currently used									
No	706(69.35)	938(67.19)	0.260	756(70.26)	1009 (70.51)	0.830	798(69.51)	1068 (69.90)	0.830
Yes	312(30.65)	458(32.81)		320(29.74)	422(29.49)		350(30.49)	460(30.10)	
Birth order									
1	463(45.87)	594(42.55)	0.100	486(45.17)	687(48.01)	0.030	524(45.64)	727(47.58)	0.520
2	343(33.69)	463(33.17)		374(34.76)	440(30.75)		389(33.89)	470(30.76)	
3+	151(14.83)	231(16.55)		152(14.13)	204(14.26)		165(14.37)	220(14.40)	
Religion									
Islam	933(91.65)	1246 (89.26)	0.050	980(91.08)	1268 (88.61)	0.040	1048(91.29)	1360 (89.01)	0.050
Others	85(8.35)	150(10.74)		96(8.92)	163(11.39)		100(8.71)	168(10.99)	
Marital Status									
married	1007(98.92)	1381 (98.93)	0.390	1066(99.07)	1413 (98.74)	0.220	1136(98.95)	1509 (98.76)	0.110
No longer living together	4(0.39)	4(0.29)		1(0.09)	1(0.07)		1(0.09)	3(0.20)	
Household Head sex									
Male	929(91.26)	1205 (86.32)	<0.001	967(89.87)	1229 (85.88)	<0.001	1034(90.07)	1312 (85.86)	<0.001
Female	89(8.74)	191(13.68)		109(10.13)	202(14.12)		114(9.93)	216(14.14)	
Household Head Age									
15–29	156(15.32)	232(16.62)	<0.001	169(15.56)	234(16.32)	<0.001	180(15.68)	250(16.36)	<0.001
30–44	478(46.95)	523(37.46)		508(46.78)	512(35.70)		537(46.78)	547(35.80)	
45+	384(37.72)	641(45.92)		409(37.66)	688(47.98)		431(37.54)	731(47.84)	
Partner's education level									
No education	61(6.06)	142(10.28)	<0.001	66(6.19)	126(8.92)	<0.001	71(6.25)	139(9.21)	<0.001
Primary	237(23.54)	400(28.96)		227(21.29)	405(28.66)		247(21.74)	436(28.89)	
Secondary	335(33.27)	514(37.22)		362(33.96)	532(37.65)		384(33.80)	570(37.77)	
Higher	374(37.14)	320(23.17)		410(38.46)	346(24.49)		433(38.12)	360(23.86)	
Mother Education									
No education	25(2.46)	38(2.72)	<0.001	34(3.16)	44(3.07)	<0.001	35(3.05)	50(3.27)	<0.001
Primary	168(16.50)	308(22.06)		163(15.15)	276(19.29)		175(15.24)	300(19.63)	
Secondary	480(47.15)	756(45.15)		487(45.26)	782(45.65)		529(46.08)	833(54.52)	
Higher	345(33.89)	294(21.06)		392(36.43)	329(22.99)		409(35.63)	345(22.58)	
Currently working									
No	729(71.61)	797(57.09)	<0.001	802(74.54)	928(64.85)	<0.001	849(73.95)	982(64.27)	<0.001
Yes	289(28.3)	599(42.91)		274(25.46)	503(35.15)		299(26.05)	546(35.73)	
Household Wealth index									
Poor	123(12.08)	597(42.77)	<0.001	108(9.94)	554(38.63)	<0.001	117(10.19)	595(38.94)	<0.001
Middle	117(11.49)	316(22.64)		120(11.05)	324(22.66)		133(11.59)	351(22.97)	
Rich	778(76.42)	483(34.60)		858(79.01)	555(38.70)		582(38.09)	898(78.22)	
Media									
No	322(31.63)	828(59.31)	<0.001	343(31.88)	835(58.35)	<0.001	372(32.40)	894(58.51)	<0.001
Yes	696(68.37)	586(40.69)		733(68.12)	596(41.65)		776(67.60)	634(41.49)	
Final says on Women's health care									
Women alone	73(7.25)	101(7.31)		89(8.35)	111(7.86)		98(8.63)	121(8.02)	
Women and Husband/ partner	715(71.00)	891(64.52)	<0.001	741(69.51)	898(63.55)	<0.001	785(61.10)	956(63.3)	<0.001
Husband/partner	168(16.68)	294(21.29)		183(17.17)	294(20.81)		199(17.52)	313(20.74)	
Someone else	51(5.06)	95(6.88)		53(4.97)	110(7.78)		54(4.75)	119(7.89)	
Geographical Location									
Barisal	82(8.06)	132(9.46)	<0.001	64(7.81)	136(9.50)	<0.001	95(8.28)	170(11.13)	<0.001
Chittagong	134(13.16)	204(14.61)		137(12.73)	260(18.71)		151(13.15)	282(18.46)	
Dhaka	263(25.83)	132(9.46)		282(26.21)	152(10.62)		304(26.48)	156(10.21)	

(continued on next page)

Table 2 (continued)

Covariates	Antenatal Care (ANC)			Facility Based Delivery (FBD)			Skilled Birth Assistance (SBA)		
	Urban n (%)	Rural n (%)	p-value	Urban n (%)	Rural n (%)	p-value	Urban n (%)	Rural n (%)	p-value
Khulna	136(13.36)	176(12.61)		138(12.83)	191(13.35)		146(12.72)	200(13.09)	
Mymensingh	90(8.84)	201(14.40)		96(8.92)	159(11.11)		102(8.89)	167(10.93)	
Rajshahi	105(10.31)	161(11.53)		110(10.22)	180(12.58)		114(9.93)	187(12.24)	
Rangpur	117(11.49)	227(16.26)		117(10.87)	169(11.81)		118(10.28)	177(11.58)	
Sylhet	91(8.94)	163(11.68)		112(10.41)	184(12.86)		118(10.28)	189(12.37)	
Household Head Occupation									
Farming/Agriculture	37(3.68)	298(21.64)	<0.001	37(3.45)	268(19.01)	<0.001	41(3.62)	289(19.24)	<0.001
Worker	520(51.69)	687(49.89)		543(50.56)	716(50.78)		575(50.71)	762 (50.73)	
Jobholder	442(43.94)	381(27.67)		485(45.16)	406(28.79)		509(44.89)	431(28.70)	
Others	7(0.70)	11(0.80)		9(0.84)	20(1.42)		9(0.79)	20(1.33)	
Household Members									
less equal 5	558(54.81)	685(49.07)	<0.001	601(56.17)	680(47.42)	<0.001	637(55.49)	724(47.38)	<0.001
greater 5	460(45.19)	711(50.93)		476(43.83)	754(52.58)		511(44.51)	804(52.62)	

Where:

D is the overall measure of health inequality

r_i and b_i represent the proportion of individuals in each income and non-income group, respectively.

R and b represent the overall proportions of individuals in the population.

C_{si} and C_{nj} represent the concentration indices for each income and non-income group.

C is the overall concentration index.

The initial component in the equation determines the extent to which income-related factors contribute to health inequality, whereas the second component measures the extent of contribution from non-income-related factors. The summation of these two components yields the overall measure of health inequality present within the population.

3. Results

The percentage of utilizing maternal healthcare overall is 34.42 %, 49.72 %, and 48.16 % respectively for SBA, FBD, and ANC [Figure-1].

Table 1 presents the descriptive statistics of socioeconomic and demographic factors by residence. Among respondents, 45.79 % in rural areas and 49.88 % in urban areas were 25 years or older. Additionally, 69.21 % of rural respondents and 76.03 % of urban respondents reported having two or fewer children. Regarding education, 44.41 % of urban respondents and 50.67 % of rural respondents had completed secondary education. Socioeconomic status also varied: 72.72 % of urban respondents came from wealthy families, compared to 50.65 % of rural respondents were from poor families.

Table 2 shows considerable inequalities in maternal healthcare service use across urban and rural women. In urban regions, 36.46 % of women accessed antenatal care (ANC) services, compared to 34.28 % in rural areas. Notably, higher-educated rural women used ANC at a lesser percentage (21.06 %) than their urban counterparts (33.89 %). In contrast, women with secondary education had greater use rates, with 47.15 % in urban areas and 45.15 % in rural areas. Wealthier women also used ANC more frequently, with 76.42 % in urban areas compared to 34.60 % in rural regions. Table 3 and Table 4 show the odds ratios and p-values for factors influencing maternal healthcare service usage by unadjusted and adjusted logistic regression models respectively. From the adjusted model we found that women with higher education were much more likely to use healthcare services than those with no formal education. The odds ratios were 3.04 [2.07–4.46] for antenatal care (ANC), 3.05 [2.06–4.53] for facility-based delivery (FBD), and 3.12 [2.10–4.61] for skilled birth attendance (SBA). Similarly, women from wealthier homes were more likely to use maternal healthcare services, with odds ratios of 1.91 [1.55–2.37] for ANC, 2.42 [1.95–3.01] for FBD, and 2.50 [2.01–3.11] for SBA, compared to those from poorer families. Media exposure also had a substantial impact, with odds ratios of 1.43 [1.22–1.68] for ANC, 1.31 [1.10–1.56] for FBD, and 1.35 [1.13–1.61] for SBA (Table 4). Fig. 2 illustrates the ROC curves as well as the AUROC value for ANC, FBD, and SBA of 0.73, 0.77, and 0.77. Furthermore, figure-3 represents the sensitivity and specificity vs probability cutoff curves for all three variables.

Table 5 presents the decomposition of disparities in maternal healthcare service utilization between urban and rural areas. The table displays essential measures such as elasticity, coefficient, concentration index (CI), contribution, and percentage contribution for three critical factors: antenatal care (ANC), facility-based delivery (FBD), and skilled birth attendance (SBA). Women with educated partners had utilization coefficients of 0.05 for both FBD and SBA and 0.06 for ANC. For FBD and SBA, the concentration index for maternal education was 0.09, whereas for ANC, it was 0.08. Regarding wealth, the coefficients were 0.06 for ANC and 0.10 for FBD and SBA. Elasticity values, which describe the percentage change in maternal healthcare usage caused by a 1 % change in a given characteristic, indicated that partner education had elasticity values of 0.21 for ANC, 0.17 for FBD, and 0.16 for SBA. Similarly, maternal education showed elasticity values of 0.31 for ANC, 0.29 for FBD, and 0.30 for SBA. The wealth index yielded elasticity values of 0.26 for ANC, 0.40 for FBD, and 0.39 for SBA.

The concentration index was used to evaluate differences in maternal healthcare service use. A positive concentration index indicates that service use is more common among people with higher levels of a specific attribute, whereas a negative index shows that it

Table 3
Unadjusted Logistic Regression among independent and exposure variable.

Characteristics	Antenatal Care (ANC)		Facility Based Delivery (FBD)		Skilled Birth Assistance (SBA)	
	Odd ratio (95 % CI)	p-value	Odd ratio (95 % CI)	p-value	Odd ratio (95 % CI)	p-value
Mother Age		0.980		0.050		0.010
15–19	ref		ref		ref	
20–24	0.99(0.82–1.2)	0.900	1.04(0.86–1.26)	0.690	1.03(0.85–1.24)	0.080
25+	0.98(0.82–1.18)	0.850	0.89(0.74–1.06)	0.190	0.84(0.70–1.01)	0.060
Number Of children ever born		<0.001		<0.001		<0.001
2 or less	ref		ref		ref	
More than 2	0.56(0.48–0.64)	<0.001	0.44(0.38–0.50)	<0.001	0.44(0.38–0.50)	<0.001
Wanted Pregnancy then		<0.001		<0.001		<0.001
later	0.8 (0.66–0.97)	0.020	0.81(0.67–0.97)	0.020	0.815 (0.67–0.99)	0.030
no more	0.46(0.37–0.58)	<0.001	0.41(0.32–0.53)	<0.001	0.43 (0.34–0.56)	<0.001
Method Currently used		0.860		<0.001		0.020
No	ref		ref		ref	
Yes	1.01(0.87–1.18)	0.860	0.81(0.71–0.93)	<0.001	0.85(0.74–0.97)	0.020
Birth order		<0.001		<0.001		<0.001
1	ref		ref		ref	
2	0.8(0.7–0.92)	0.010	0.64(0.54–0.75)	<0.001	0.6 (0.51–0.7)	<0.001
3+	0.50(0.43–0.59)	<0.001	0.35(0.3–0.41)	<0.001	0.34 (0.29–0.40)	<0.001
Length of preceding birth		<0.001		<0.001		<0.001
<24 months	ref		ref		ref	
24–59 months	1.17(0.88–1.57)	0.290	1.21 (0.89–1.64)	0.220	1.07 (0.8–1.44)	0.630
60+ months	1.5 (1.11–2.03)	<0.001	1.69 (1.26–2.27)	<0.001	1.493 (1.116–1.996)	<0.001
Religion		0.020		0.010		0.010
Others	ref		ref		ref	
Islam	0.69(0.52–0.93)	0.070	0.61(0.44–0.85)	<0.001	0.64(0.46–0.89)	<0.001
Marital Status		0.160		0.190		0.250
no longer living together/separated	ref		ref		ref	
Married	1.5(0.85–2.65)	0.160	1.45(0.83–2.53)	0.190	1.38(0.80–2.38)	0.250
Marital or cohabitation duration		<0.010		<0.001		<0.001
0–4	ref		ref		ref	
5–14	0.85 (0.74–0.98)	0.020	0.66(0.57–0.76)	<0.001	0.62 (0.54–0.72)	<0.001
15+	0.58 (0.48–0.71)	<0.001	0.45(0.37–0.54)	<0.001	0.44 (0.37–0.53)	<0.001
Household Head Sex		0.480		0.870		0.920
Female	Ref		ref		ref	
Male	1.08(0.87–1.33)	<0.480	0.98(0.81–1.20)	0.880	0.99(0.81–1.21)	0.920
Household Head Age		<0.001		0.010		0.010
15–29	ref		ref		ref	
30–44	1.24(1.04–1.48)	0.020	1.16(0.7–1.39)	0.100	1.17(0.97–1.39)	0.100
45+	1.40(1.17–1.69)	<0.001	1.44(1.22–1.71)	<0.001	1.46(1.24–1.74)	<0.001
Partner's education level		<0.001		<0.001		<0.001
No education	ref		Ref		ref	
Primary	1.39(1.10–1.75)	<0.001	1.46(1.16–1.83)	<0.001	1.47(1.18–1.84)	<0.001
Secondary	2.41(1.92–3.02)	<0.001	2.95(2.37–3.67)	<0.001	3.04(2.45–3.77)	<0.001
Higher	6.03(4.63–7.83)	<0.001	8.39(6.51–10.79)	<0.001	9.23(7.11–11.98)	<0.001
Type of toilet facility		<0.001		<0.001		<0.001
Unimproved	ref		ref		ref	
Improved	1.58(1.37–1.81)	<0.001	1.9(1.66–2.17)	<0.001	1.92(1.68–2.2)	<0.001
The primary Source of drinking water		0.053		0.070		0.100
Unproved	ref		ref		ref	
Improved	0.84(0.70–1.0)	0.050	0.85(0.71–1.01)	0.070	0.86(0.72–1.03)	<0.100
Mother's Education		<0.001		<0.001		<0.001
No education	ref		ref		ref	
Primary	2.12(1.53–2.93)	<0.001	1.31(0.96–1.78)	0.089	1.26(0.92–1.72)	0.150
Secondary	4.11(3.03–5.59)	<0.001	3.09(2.3–4.16)	<0.001	3.16(2.38–4.19)	<0.001
Higher	9.14(6.48–12.88)	<0.001	10.08(7.26–13.99)	<0.001	10.92(7.87–15.13)	<0.001
Currently working		0.180		<0.001		<0.001
No	ref		ref		ref	
Yes	0.91(0.78–1.05)	0.180	0.57(0.49–0.66)	<0.001	0.57(0.49–0.67)	<0.001
Household Wealth index		<0.001		<0.001		0.001
Poor	ref		ref		ref	
Middle	1.65(1.38–1.97)	<0.001	2.04(1.68–2.48)	0.001	2.15(1.76–2.61)	0.001
Rich	3.17(2.69–3.74)	<0.001	4.78(4.04–5.66)	<0.001	5.08(4.28–6.04)	<0.001
Media		<0.001		<0.001		<0.001
No	ref		ref		ref	
Yes	2.28(1.97–2.64)	<0.001	2.53(2.17–2.93)	<0.001	2.63(2.26–3.07)	<0.001
Final says on Women's health care		0.270		0.330		0.220
Women alone	ref		ref		ref	

(continued on next page)

Table 3 (continued)

Characteristics	Antenatal Care (ANC)		Facility Based Delivery (FBD)		Skilled Birth Assistance (SBA)	
	Odd ratio (95 % CI)	p-value	Odd ratio (95 % CI)	p-value	Odd ratio (95 % CI)	p-value
Women and husband	1.1(0.85–1.41)	0.470	0.84(0.64–1.09)	0.200	0.8(0.62–1.03)	0.070
Husband/partner	0.94(0.71–1.25)	0.690	0.76(0.56–1.031)	0.080	0.73 (0.54–0.99)	0.040
Someone else	0.96 (0.69–1.35)	0.830	0.91(0.64–1.30)	0.600	0.87 (0.61–1.25)	0.450
Area of residence						
Urban	1.91 (1.58–2.31)	<0.001	2.14 (1.772.58)	<0.001	2.31 (1.90–2.83)	<0.001
Rural	ref		ref		ref	
Geographical Location		<0.001		<0.001		<0.001
Barisal	ref		ref		ref	
Chittagong	1.03(0.72–1.46)	0.882	1.36(0.97–1.92)	0.070	1.16(0.81–1.64)	0.420
Dhaka	1.72(1.22–2.42)	0.002	2.10(1.51–2.92)	<0.001	1.68(1.20–2.37)	<0.001
Khulna	2.17(1.49–3.15)	<0.001	2.44(1.75–3.41)	<0.001	1.96(1.40–2.73)	<0.001
Mymensingh	1.36(0.95–1.95)	0.100	0.99(0.71–1.37)	0.950	0.78(0.56–1.09)	0.140
Rajshahi	1.50(1.03–2.2)	0.040	1.74(1.25–2.40)	<0.001	1.34(0.96–1.88)	0.080
Rangpur	2.38(1.62–3.49)	<0.001	1.41(0.96–2.070)	0.080	1.08(0.73–1.59)	0.710
Sylhet	0.86(0.58–1.29)	0.470	1.007(0.689–1.471)	0.970	0.75(0.51–1.11)	0.150
Household Head Occupation		<0.001		<0.001		<0.001
Not working	ref		ref		ref	
Worker	1.03(1.24–1.76)	<0.001	1.85(1.51–2.26)	<0.001	1.9(1.56–2.30)	<0.001
Jobholder	2.45(2.01–2.99)	<0.001	3.38(2.72–4.21)	<0.001	3.53(2.84–4.38)	<0.001
Others	1.05(0.57–1.94)	0.880	2.74(1.47–5.11)	<0.001	2.47(1.33–4.61)	<0.001
HH family members		0.270		0.310		0.670
less equal 5	ref		ref		ref	
greater 5	0.93(0.82–1.06)	0.270	0.93(0.814–1.07)	0.310	0.97(0.85–1.11)	0.670

is concentrated among people with lower levels. The concentration index for the partner's education was 0.04 across all three services (ANC, FBD, and SBA), showing few differences between rural and urban areas. The concentration indices for maternal education and wealth index were 0.02 and 0.06, respectively.

The contribution and percentage contribution indicate how much each characteristic contributes to the difference in maternal healthcare usage. In terms of antenatal care (ANC), household wealth accounted for 26.16 % of the difference between urban and rural locations, media exposure for 8.17 %, and maternal education for 28.62 %. In contrast, the number of children, wanted pregnancy and religion had negative contributions, implying that these characteristics reduced the gap. Specifically, the wanted pregnancy contributed –12.3 %.

For facility-based delivery (FBD), household wealth was responsible for 40.3 % of the gap, maternal education for 30.47 %, and partner education for 16.95 %. In contrast, the number of children and religion made negative contributions of 4.27 % and 16.83 %, respectively. The factors that contributed to skilled birth attendance (SBA) were partner's education (16.13 %), mother's education (30.3 %), and household wealth (38.49 %). Meanwhile, delivery order, religion, and wanting pregnancy all made negative contributions of 3.7 %, 13.68 %, and 6.76 %, respectively. Furthermore, the occupation of the household head accounted for 13.24 % of the variance in SBA utilization.

Overall, the models explained 95.82 % of the variation in ANC utilization, 87.87 % in FBD, and 82.39 % in SBA.

4. Discussion

Key contributors to the average urban-rural disparity in the use of all three healthcare services include household wealth index, maternal education, partner's education, geographic division, and birth order. Mothers and partners with lower levels of education are less inclined to participate in maternal healthcare services. Households lacking media exposure are also less likely to engage in maternal healthcare services. Mothers from families with a lower wealth index exhibit reduced participation in maternal healthcare services. Notably, the wealth index and mother's education emerge as the most influential factors contributing to the outcome variables of facility-based delivery (FBD), antenatal care (ANC), and skilled birth assistance (SBA). Our findings were aligned with the previous study [6,36].

In our study, we have seen that mothers with more than two children have taken less antenatal care than their counterparts who have more than two children. A similar pattern has been seen in the SBA, and FBD. In a study in rural India, they found that women with increasing birth order or increasing number of children are less likely to go for an antenatal visit which perfectly aligns with our study [37]. Our findings are aligned with the previous research [30,38–40].

Mother, who is from an Islamic family has less participation in the three variables antenatal care, FBD, and SBA. In a study conducted in Ghana, it was found that Moslem (Muslim) women face limited access to health facilities, resulting in a decreased likelihood of utilizing maternal health care services such as FBD, Antenatal care, and SBA compared to their counterparts [41]. These findings are similar to some previous research [39,42–44].

Both the partner's education level and the mother's education have been seen to affect FBD, ANC, and SBA. The higher the education level of both mothers and partners the more chance the mother has to go to an antenatal care visit. Mothers with a partner who has completed higher education have gone for almost more than two times more antenatal visits than those with a partner who has no

Table 4
Adjusted Multiple-logistic Regression among independent and exposure variables.

Characteristic	Antenatal Care (ANC)		Facility Based Delivery (FBD)		Skilled Birth Assistance (SBA)	
	Odds Ratio (95 % CI)	P-value	Odds Ratio (95 % CI)	P-value	Odds Ratio (95 % CI)	P-value
Mothers age						
15–19			ref		ref	
20–24			0.93(0.75–1.16)	0.51	0.91(0.73–1.14)	0.42
25+			1.03(0.82–1.3)	0.81	0.95(0.75–1.21)	0.67
Number of children ever born						
2 or less	ref		ref		ref	
More than 2	0.93(0.77–1.11)	0.390	0.71(0.58–0.87)	0.001	0.73(0.6–0.89)	0.002
Wanted Pregnancy						
Then	ref		ref		ref	
Later	0.74(0.61–0.91)	0.004	0.78(0.63–0.97)	0.03	0.79(0.63–0.99)	0.044
No more	0.61(0.47–0.79)	<0.001	0.69(0.52–0.91)	0.01	0.75(0.57–0.99)	0.042
Method currently used						
No			ref		ref	
Yes			0.75(0.65–0.87)	<0.001	0.79 (0.68–0.92)	0.003
Religion						
Others	ref		ref		ref	
Islam	0.83(0.62–1.10)	0.190	0.65(0.47–0.89)	0.010	0.68(0.5–0.92)	0.010
Household head age						
15–29	ref		ref		ref	
30–44	1.20(0.80–1.81)	0.050	1.17(0.94–1.45)	0.160	1.2(0.97–1.49)	0.090
45+	1.46(1.00–2.13)	0.030	1.18(0.97–1.43)	0.110	1.2(0.98–1.46)	0.080
Partner's education level						
No education	ref		ref		ref	
Primary	1.00(0.79–1.27)	0.980	1.03(0.8–1.34)	0.800	1.02(0.79–1.32)	0.853
Secondary	1.31(1.02–1.69)	0.040	1.32(1.02–1.71)	0.040	1.3(1.0–1.69)	0.049
Higher	2.22(1.62–3.31)	<0.001	2.09(1.53–2.86)	<0.001	2.19(1.6–3.0)	<0.001
Mother education						
No education	ref		ref		ref	
Primary	1.89(1.36–2.62)	<0.001	1.19(0.83–1.67)	0.340	1.12(0.79–1.59)	0.510
Secondary	2.55(1.86–3.50)	<0.001	1.83(1.29–2.59)	0.001	1.82(1.31–2.55)	<0.001
Higher	3.04(2.07–4.46)	<0.001	3.05(2.06–4.53)	<0.001	3.12(2.10–4.61)	<0.001
Currently working						
No			ref		ref	
Yes			0.73(0.63–0.86)	<0.001	0.76(0.65–0.89)	<0.001
Household wealth index						
Poor	ref		ref		ref	
Middle	1.24(1.03–1.50)	0.020	1.39(1.11–1.73)	0.004	1.42(1.14–1.77)	0.002
Rich	1.91(1.55–2.37)	<0.001	2.42(1.95–3.01)	<0.001	2.50(2.0–3.11)	<0.001
Media						
No	ref		ref		ref	
Yes	1.43(1.22–1.68)	<0.001	1.31(1.1–1.56)	0.003	1.35(1.13–1.61)	0.001
Division						
Barisal	ref		ref		ref	
Chittagong	0.77(0.55–1.07)	0.120	0.94(0.69–1.27)	0.670	0.76(0.55–1.04)	0.086
Dhaka	1.19(0.86–1.66)	0.290	1.34(0.99–1.82)	0.060	1.01(0.73–1.39)	0.964
Khulna	1.83(1.27–2.63)	<0.001	1.94(1.41–2.68)	<0.001	1.44(1.04–1.99)	0.027
Mymensingh	1.44(0.98–2.12)	0.060	1.05(0.75–1.46)	0.790	0.78(0.56–1.01)	0.130
Rajshahi	1.31(0.92–1.87)	0.140	1.62(1.2–2.19)	0.002	1.16(0.85–1.58)	0.354
Rangpur	2.79(1.89–4.11)	<0.001	1.60(1.14–2.26)	0.007	1.13(0.79–1.62)	0.493
Sylhet	0.91(0.62–1.35)	0.651	0.98(0.70–1.37)	0.920	0.7(0.49–0.99)	0.043
Household head occupation						
Not working	ref		ref		ref	
Worker	1.22(1.01–1.47)	0.030	1.25(1.01–1.55)	0.040	1.26(1.02–1.55)	0.030
Jobholder	1.32(1.05–1.66)	0.020	1.42(1.11–1.81)	0.010	1.44(1.13–1.82)	0.003
Others	0.69(0.36–1.33)	0.270	1.60(0.83–3.09)	0.160	1.38(0.70–2.69)	0.349
Place of residence						
Rural	ref		ref		ref	
Urban	1.31(0.07–1.61)	0.009	1.27(1.03–1.56)	0.020	1.38(1.11–1.71)	0.003

educational background. This type of increase has been also seen for SBA, and FBD. A respondent with a higher educational background has around two times more antenatal visits compared to uneducated mothers which is also fine for SBA, and FBD. In a Study in Uganda, they have shown that education can increase the utilization of maternal health significantly [45]. Similar results have been shown in several studies in the sub-Saharan region and Peru [30,40,46–49].

The household wealth index has a great impact on mothers taking antenatal care. Those who are from financially stable families have a high chance of visiting Antenatal care services, Skilled Birth Attendants (SBA), and Facility-Based Delivery (FBD). A mother from a rich financial background is 91.2 % more likely to take antenatal care services compared to the poor category. Our result has

ROC Curve Among ANC, FBD, SBA

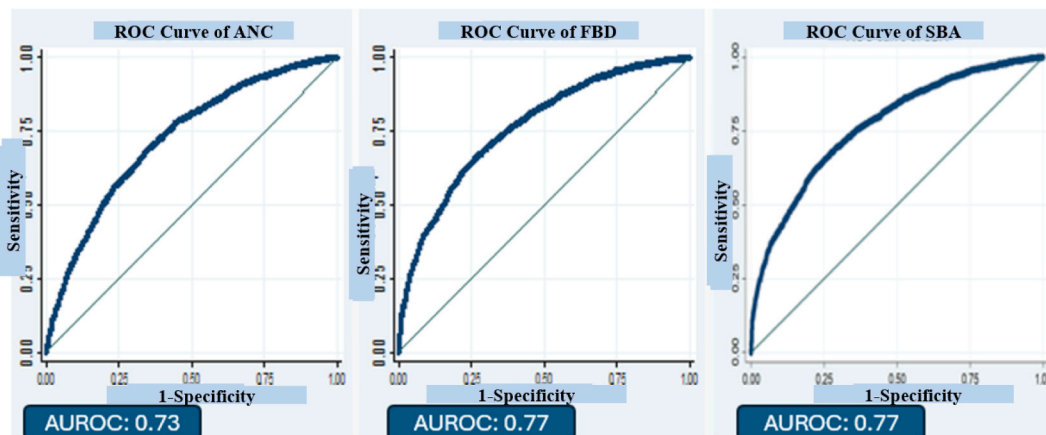


Fig. 2. ROC curve among ANC, FBD, SBA.

Sensitivity and Specificity versus probability cutoff curve among ANC, FBD, SBA

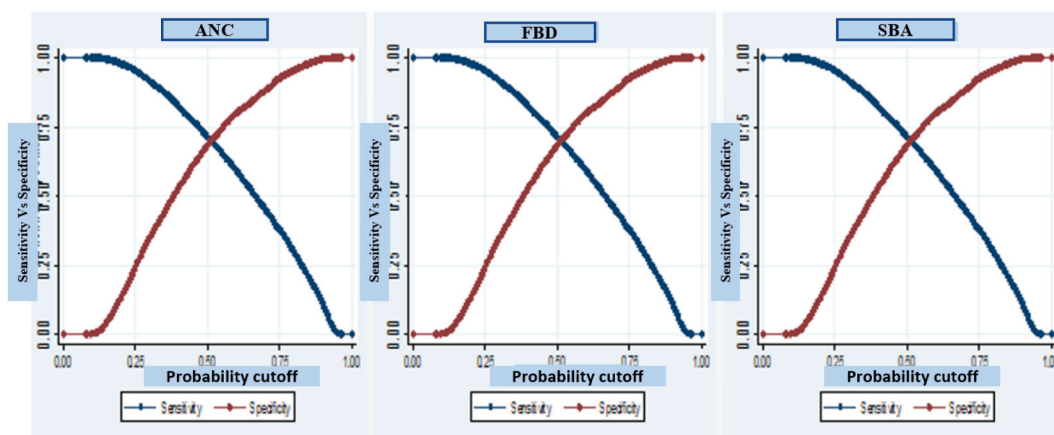


Fig. 3. Sensitivity and Specificity versus probability cutoff curve among ANC, FBD, SBA.

been perfectly aligned with research in South Asia (Nepal, India, and Sri Lanka). They found that increasing economic status has a positive impact on maternal healthcare services [50]. Other studies also support this [6,8,10].

The household with media has a higher chance of visiting FBD, ANC, and SBA compared to the counterpart. In a study in South Asia, they found a similar result for Bangladesh [36]. Mass media increases awareness among people so that they go for maternal health care services [10,18].

This study has found 8.7 % and 23.4 % less participation in antenatal visits compared to the reference group to the geographical location Sylhet and Chittagong, where Rangpur has 2.79 times more participation in antenatal care service. This result is aligned with the previous research on Bangladesh, where they found Sylhet has less participation in maternal health care services [48].

In the study, High participation in FBD, ANC, and SBA was seen from the household, whose household head's occupation is jobholders compared to the reference group of those who are not working. The household head's occupation can be said to be a reflection of the family's economic status. As the family is financially more stable, they participate in maternal health care services. A study in rural Bangladesh has similar findings to our study [8,51].

The most contributing factor to the antenatal care for mothers is the mother's education level which is 28.62 %. Education is the most important thing for any individual. So, the contribution of factor mother's education is obvious in antenatal care. Other contributing factors for antenatal care are Wealth Index, Partner's education level, and Division. Mother's and partner's education has a positive impact on antenatal care utilization [52]. A study on western rural China has found a Positive association of increasing income among families in antenatal care utilization. This finding is aligned with our findings the wealth index's contribution in the

Table 5
Decomposition of inequality in Maternal Health care utilization.

Characteristics	Antenatal Care (ANC)					Facility Based Delivery (FBD)					Skilled Birth Assistance (SBA)				
	Coff.	E	CI	C	%C	Coff.	E	CI	C	%C	Coff.	E	CI	C	%C
Mother's age	–	–	–	–	–	0.01 ^c	0.043	0.002	0.0001	4.3	0.001 ^c	0.003	0.002	0.0005	0.27
Number of Children	–0.02 ^c	–0.013	–0.031	0.0004	–1.25	–0.07 ^a	–0.043	–0.031	0.001	–4.27	–0.068 ^a	–0.037	–0.031	0.001	–3.7
Wanted Pregnancy	–0.045 ^a	–0.123	–0.005	0.0006	–12.3	–0.03 ^a	–0.087	–0.005	0.0004	–8.71	–0.028 ^b	–0.068	–0.005	0.0003	–6.76
Method Currently Used	–	–	–	–	–	–0.06 ^a	–0.037	–0.037	0.0002	–3.65	–0.047 ^a	–0.028	–0.005	0.00014	–2.75
Religion	–0.05 ^c	–0.09	0.001	–0.0001	–8.96	–0.09 ^a	–0.168	0.001	–0.00024	–16.83	–0.079 ^a	–0.137	0.001	–0.0002	–13.68
Household Head Age	0.02 ^b	0.087	0.003	0.0003	8.73	0.01 ^b	0.065	0.003	0.000215	6.54	0.016 ^c	0.066	0.003	0.0002	6.59
Partner's Education Level	0.06 ^a	0.209	0.035	0.0073	20.91	0.05 ^a	0.17	0.035	0.006	16.95	0.054 ^a	0.161	0.037	0.006	16.13
Mother's Education Level	0.08 ^a	0.286	0.023	0.007	28.62	0.09 ^a	0.305	0.023	0.007	30.47	0.091 ^a	0.303	0.023	0.007	30.3
Continued Work after mirage	–	–	–	–	–	–0.05 ^a	–0.038	–0.037	0.0014	–3.81	–0.044 ^a	–0.031	–0.037	0.001	–3.09
Wealth Index	0.062 ^a	0.262	0.059	0.016	26.16	0.1 ^a	0.403	0.059	0.024	40.3	0.103 ^a	0.385	0.059	0.023	38.49
Media	0.092 ^a	0.082	0.079	0.006	8.17	0.06 ^a	0.053	0.079	0.0042	5.31	0.067 ^a	0.053	0.079	0.004	5.33
Division	0.021 ^c	0.185	–0.012	–0.002	18.53	0.01 ^b	0.073	–0.012	–0.001	7.29	0.003 ^c	0.02	–0.012	–0.0002	2.04
Household Head Occupation	0.016 ^c	0.072	0.015	0.001	7.2	0.03 ^a	0.14	0.015	0.002	13.99	0.03 ^a	0.132	0.015	0.002	13.24

**a = p-value <0.001 **b = p-value<0.05 **c is p-value<0.1 Coff. = Coefficient E = Elasticity CI=Concentration Index C=Contribution %C= Percentage Contribution.

final model for ANC is significant [53].

For the FBD, the most contributing factor in this study is the Wealth Index. It contributes almost 40.3 % to the logistic regression model for the FBD. The second most contributing factor for the outcome variable FBD is the mother's education which contributes almost 30.47 % of the model. A study has been conducted in Odisha, India where they also find similar findings [54]. They found that both the partner's education and the mother's education have a significant impact on FBD [53,54].

Again, For the outcome variable SBA the most contributing factor is the Wealth Index which contributes almost 38.49 % of the overall factors. The other contributing factor to the model is the Partner's education level and the Mother's Education Level. Which is contributing almost 30.3 % and 16.13 %. This finding is aligned with some previous studies for SBA during the delivery [52,54,55].

5. Conclusions

This study investigated urban-rural maternal health disparities in Bangladesh, finding that maternal education, household wealth, partner's education, media exposure, and number of children affect antenatal care use. For the outcome, FBD, the household wealth index had the highest contribution to the urban-rural disparities, followed by the mother's education and the husband/partner's education. Exposure to media had a positive contribution, while the number of children showed a negative contribution. Interestingly, household head occupation also had a significant impact on the outcome of FBD. Finally, for SBA during delivery, the study found that the household wealth index had the highest contribution to the urban-rural difference, followed by maternal education and husband/partner education. Exposure to media also had a positive contribution, while childbirth order showed a negative contribution. Household head occupation also had a significant impact on professional assistance at delivery. The study showed that women from rural areas were less likely to receive MHCS than those in urban areas, and education, household wealth index, and media exposure were significant predictors of maternal healthcare utilization. Overall, the study emphasizes the need for policymakers and stakeholders to prioritize education and economic empowerment as key strategies for improving maternal health outcomes. Additionally, efforts should be made to ensure that all women have access to quality ANC and SBA, regardless of their economic status or level of education.

CRedit authorship contribution statement

A.T.M. Shariful Alam: Writing – review & editing, Writing – original draft, Visualization, Methodology, Formal analysis, Data curation, Conceptualization. **Shorful Alam:** Writing – review & editing, Writing – original draft, Methodology, Conceptualization. **Kashfia Mobasshira:** Writing – review & editing, Writing – original draft, Methodology, Conceptualization. **S.M. Nuruzzaman Anik:** Writing – review & editing, Writing – original draft, Conceptualization. **Mohammad Nayeem Hasan:** Writing – review & editing, Supervision, Methodology, Formal analysis, Data curation, Conceptualization. **Muhammad Abdul Baker Chowdhury:** Writing – review & editing, Supervision, Methodology, Conceptualization. **Md Jamal Uddin** Writing – review & editing, Supervision, Methodology, Conceptualization.

Ethical approval

Since the research was conducted using secondary data that is available in the public domain, no ethical approval was needed for this study.

Data accessibility

All data used for this study are freely available from <https://dhsprogram.com/data/>

Funding statement

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgment

The authors are entirely responsible for the consequences. Authors are also grateful to use BDHS 2017 datasets.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.heliyon.2025.e41945>.

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