



Concise title: Maternal health service utilization

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ABSTRACT

Objectives: The objective of this study is to identify the determinants and measure the trends in maternal health-facility based utilization in Bangladesh. This research shows the importance of each variable and their role in utilizing maternity care in Bangladesh.

Materials and methods: In our study, we have analysed BDHS 2004, 2007, 2011 and 2014 data to measure the determinants and trends in maternal health services in Bangladesh, using the binary logistic regression model. **Results:** Our study revealed that the variable education of women, place of residence, wealth index, and husband's education have a significant association with the maternal health services utilization. Women who completed higher education were more likely to use antenatal care (AOR = 3.76, CI = 2.07–6.52), skilled birth attendants (AOR = 2.82, CI = 1.96–4.08) and postnatal care (AOR = 1.87, CI = 1.31–2.68). Women from urban areas were more likely to use ANC (AOR = 1.30, CI = 1.05–1.60), SBAs (AOR = 1.64, 9 CI = 1.40–1.92) and PNC services (AOR = 1.45, CI = 1.23–1.70) than women from rural areas. Women from the richest households were more likely to use ANC (AOR = 2.30, CI = 1.80–2.95), SBAs (AOR = 2.23, CI = 1.83–2.71) and PNC (AOR = 1.78, CI = 1.47–2.16) than poor women.

Conclusion: Maternal health service utilization should be more targeted towards the rural women in Bangladesh as there seems a high inconsistency in service utilization among urban and rural mothers. ANC is an essential entry point for the ensuing application of delivery and PNC services. So, it is recommended to promote women's education and empowerment with improved geographical access and strong ANC policies.

1. Introduction

In developing countries, a remarkable number of women experience life-threatening and other serious health problems related to pregnancy or childbirth as complications of pregnancy and childbirth cause more deaths and disability compared to other reproductive health problems.¹ Having around 10% of pregnancies are at high-risk, there are about 500 maternal deaths for every 100,000 live births and maternal mortality is on average 18 times higher in developing countries compared to developed countries.² Although by 2015, maternal mortality had decreased by over 40% from the 1990 levels, the utilization of health services is still far below any acceptable standard.^{1,4} To diminish maternal mortality ratio United Nations' (UN) Millennium Development Goals (MDGs) have set a target, also, to curtail maternal mortality ratio to less than 70 per 100,000 live births by 2030 one of the health goals of the UN's Sustainable Development Goals (SDGs) SDG 3.1 is intended.³

In spite of getting government's commitment to delivering health facilities to the doorsteps of common people through Essential Service Package (ESP), the situation is still worse in Bangladesh due to the lack

of accessibility in modern health service and poor utilization.⁴ It has one of the highest maternal mortality rates (MMR) in worlds i.e. 3/1000 live birth and the child and infant mortality is 52/1000 live births and 14/1000 children respectively.^{5,6} Each year in Bangladesh, about 6000 women die from pregnancy-related complications, on the other hand, about 194,000 women suffer from injuries or disabilities caused by complications during pregnancy and childbirth.^{7,8} Maternal mortality ratio (MMR) (170 per 100,000 live births) and neonatal mortality rate (NMR) (28 per 1000 live births) are still considerably high in Bangladesh although it has made remarkable progress in achieving the targets for Millennium Development Goals (MDGs) 4 and 5. Low utilization of maternal health services such as antenatal care (ANC), skilled birth attendance (SBA) at delivery and postnatal care (PNC) are one of the major reasons for these high mortality rates.^{8,9}

Currently, 71% of women worldwide utilize ANC services; and in industrialized countries, it is 95%, in South Asian countries it is 54% and in Sub Saharan African countries it is 64%.¹⁰ In Bangladesh, the proportion of women receiving at least one antenatal visit from a medically trained provider rose from 28% in the early 1990s to 64% in 2014 and approximately 1 in 3 women i.e. 31% currently receives the

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Table 1
The frequency table of different study variables.

Variables	Frequency	Percent (%)	Variables	Frequency	Percent (%)
Antenatal care			Wealth index		
No antenatal	2507	23.9	Poor	3400	32.4
ANC	7981	76.1	Middle	1873	17.9
Skilled birth attendant			Rich	5215	49.7
Unskilled	6004	57.2	Birth order number		
Skilled	4484	42.8	First birth	3746	35.7
Postnatal care			More than one	6742	64.3
No	3533	33.7	Age of respondent at first birth		
Yes	6955	66.3	≤ 19	1582	15.1
Type of place of residence			20–25	4083	38.9
Urban	4025	38.4	More than 25	4823	46.0
Rural	6463	61.6	Reading newspaper		
Region			No	8280	78.9
Barisal	1215	11.6	Yes	2208	21.1
Chittagong	2144	20.4	Listening radio		
Dhaka	1917	18.3	No	8880	84.7
Khulna	1350	12.9	Yes	1608	15.3
Rajshahi	1514	14.4	Watching television		
Rangpur	1587	15.1	No	3801	36.2
Sylhet	761	7.3	Yes	6687	63.8
Respondents education			Body mass index		
No education	1898	18.1	Under-weight	2619	25.0
Primary	2768	26.4	Normal	6142	58.6
Secondary	4472	42.6	Over-weight	1727	16.5
Higher	13.50	12.9	Person who take health decision		
Husbands education			Women, women with husbands or others	6445	61.5
No education	2541	24.2	Husband or others	4043	38.5
Primary	2768	26.4	Year of interview		
Secondary	3247	31.0	2004	931	8.9
Higher	1932	18.4	2007	3253	31.0
Respondents work status			2011	3352	32.0
Jobless	8461	80.7	2014	2952	28.1
Working	2027	19.3			

recommended four or more ANC visits.¹¹ To minimize maternal deaths significantly, birth attendance by SBAs is regarded as an important factor because, in Bangladesh, the application of SBAs at birth is entirely shallow.^{12,13} Here, only one is performed by SBAs among the five deliveries and the portion even gets lower especially in the slum and tribal areas.^{14,15}

Furthermore, Timely and adequate postnatal care (PNC) during this critical period can potentially make a significant difference in their survival rate because almost maximum maternal deaths happen in the first week after delivery.^{16–18} Although it is recommended by the World Health Organization (WHO) that all women where they deliver receive PNC in the first 24 h, the first two days are frequently identified as the ideal time for postnatal checking.¹⁹

It is shown in developing countries that the use of health care services is not only related to the availability, quality and cost of services but also the social structure, health beliefs and personal characteristics of the users.²⁰ The objectives of this research are to identify factors that affect the utilization of Antenatal Care (ANC), use of Skilled Birth Attendants (SBAs) and Postnatal Care (PNC) services in Bangladesh; determine the impact of influencing factors on antenatal care, skilled delivery, and postnatal care services and find out the adjusted odds ratio to observe which maternity stages were given importance in Bangladesh through logistic regression.

2. Materials & methods

2.1. Data source

The data that have been used in this research was extracted from the Bangladesh Demographic and Health Survey (BDHS 2004, 2007, 2007, 2014).^{21–24}

2.2. Variables of the study

2.2.1. Dependent variables

Antenatal Care (0 = No antenatal care, 1 = Received antenatal care) is the routine health control of presumed healthy pregnant women without symptoms, to diagnose diseases or complicating obstetric conditions without symptoms, and to provide information regarding lifestyle, pregnancy, and delivery.²⁵

For Skilled Birth Attendance we have taken into account place of delivery [0 = Unskilled (Home/Relatives home, 1 = skilled (Hospital/clinic/private NGO/community clinic))] as our dependent variable. The emergence of a skilled birth attendant at delivery is monumental in averting maternal and neonatal mortality and morbidity. It has currently shown that even well-learned traditional birth attendants (TBAs) cannot, in most cases, save women's lives successfully because they are unable to treat complexity, and are often unable to prescribe.²⁶

Postnatal Care (0 = Not received, 1 = Received postnatal care) begins immediately after the birth of a child as the mother's body, including hormone levels and uterus size, returns to a non-pregnant state. The terms puerperal period or immediate postpartum period are commonly used to refer to the first six weeks following childbirth.²⁷

2.2.2. Independent variables

A set of socioeconomic and demographic factors for the determination of place of delivery were purposively selected as independent variables based on previous literature. A test of association was conducted to check whether they were significantly associated with the dependent variable or not. Later on, only significantly associated variables were selected for logistic regression. Beginning with type of place of residence, remained same as they were in original datasets (1 = Urban, 2 = Rural). Respondent education and Husband's education also remained same as they were in original dataset (1 = Illiterate, 2 = Primary, 3 = Secondary, 4 = Higher). For the variable Wealth

Table 2
Percentage of women who had at least one birth in the five years preceding the survey who received ANC, skilled birth and PNC service by background characteristics.

Variables	Received SBAs	Received PNC	Received ANC
Types of places of residence			
Urban	57.8%	74.9%	86.5%
Rural	33.4%	60.9%	69.6%
Region			
Barisal	35.8%	62.8%	71.2%
Chittagong	36.2%	65.7%	76.1%
Dhaka	45.4%	65.8%	75.4%
Khulna	59.3%	76.1%	81.5%
Rajshahi	43.9%	66.1%	79.5%
Rangpur	33.9%	56.1%	71.5%
Sylhet	52.3%	79.2%	79.1%
Respondents education			
No education	13.2%	42.6%	47.8%
Primary	27.1%	56.1%	67.5%
Secondary	53.5%	75.6%	86.9%
Higher	80.6%	89.9%	97.6%
Husbands education			
No education	19.1%	48.3%	55.5%
Primary	32.5%	60.2%	70.5%
Secondary	51.1%	73.6%	85.7%
Higher	74.6%	86.5%	95.1%
Respondents work status			
Jobless	45.1%	67.4%	77.3%
Working	32.8%	61.6%	70.9%
Wealth index			
Poor	21.3%	51.9%	58.6%
Middle	34.9%	62.5%	72.5%
Rich	59.5%	77.1%	88.8%
Birth order number			
First birth	58.8%	77.9%	86.2%
More than one	33.8%	59.8%	70.5%
Age of respondent at first birth			
Less than equal 19	46.4%	71.4%	79.7%
20–25	44.5%	68.3%	79.1%
More than 25	40.1%	62.9%	72.4%
Reading newspaper			
No	36.4%	62.0%	71.4%
Yes	66.6%	82.6%	93.6%
Listening radio			
No	44.7%	66.5%	76.3%
Yes	32.2%	65.5%	75.0%
Watching television			
No	23.1%	52.0%	59.9%
Yes	53.9%	74.4%	85.3%
Body mass index			
Under-weight	27.6%	56.1%	66.1%
Normal	41.1%	65.6%	76.0%
Over-weight	71.6%	84.2%	91.8%
Person who take health decision			
Women, women with husbands and others	45.3%	67.1%	78.2%
Husband only or others	38.6%	65.1%	72.8%
Year of interview			
2004	64.9%	71.3%	87.9%
2007	57.5%	72.9%	88.8%
2011	39.0%	66.8%	76.0%
2014	23.8%	57.0%	58.5%

Index, poorest and poorer constructed poor = 1, category middle as middle = 2 and the rest other categories constituted rich = 3. Categories for birth order were 1st order with one birth = 1 and rest birth orders formed other order = 2. Age of respondent at first birth is categorized as less than or equal 19 = 1, 20–25 = 2, more than 25 = 3. Reading newspaper, Watching TV and Listening ration variable are categories in to two categories Yes = 1, and No = 2. Respondent's work status (1 = Jobless, 2 = Working) and Region's (Barisal = 1, Chittagong = 2, Dhaka = 3, Khulna = 4, Rajshahi = 5, Rangpur = 6, Sylhet = 7) categories remain same as the original data set. Person who

take health decision is categorized as Women, women with husbands or others = 1, and Husband or others = 2 and the variable Year of interview as 2004 = 1, 2007 = 2, 2011 = 3, 2014 = 4. Finally for *body mass index*, worldwide commonly accepted BMI ranges are: underweight = 2 (under 18.5 kg/m²), normal weight = 1 (18.5–25 kg/m²), over weight = 3 (over 25 kg/m²).

2.3. Binary logistic regression

Bivariate analysis (Pearson's χ^2) was performed to assess the relationship between the dependent and independent variables. In order to find the influencing factors for utilizing maternal healthcare services among pregnant women, we used logistic regression.²⁸ As we categorize the outcome variable into two categories, binary logistic regression (BLR) is used to estimate the association to provide a clearer idea about how intensely different factors influence the outcome. Logistic regression generates the coefficients (and its standard errors and significance levels) of a formula to predict a logit transformation of the probability of presence of the characteristic of interest:

$$\text{logit}(p) = b_0 + b_1X_1 + b_2X_2 + \dots + b_kX_k$$

where, p is the probability of presence of the characteristic of interest. The logit transformation is defined as the logged odds:

$$\text{Odds} = \frac{p}{1-p} = \frac{\text{Probability of presence of characteristic}}{\text{Probability of absence of characteristic}}$$

And

$$\text{logit}(p) = \text{loglog}\left(\frac{p}{1-p}\right)$$

Rather than choosing parameters that minimize the sum of squared errors (like in ordinary regression) estimation in logistic regression chooses parameters that maximize the likelihood of observing the sample values.

3. Results

From Table 1 we find that, among the respondents, 76.1% had at least one ANC visit, Only 42.8% of the respondent had skilled birth attendant and 66.3% of the respondents had PNC visits after their delivery. Among the respondents, 61.6% was from rural areas and 38.4% lived in urban areas. Chittagong having the highest respondent 20.4%, Dhaka was the second highest region with 18.3% respondent whereas only 7.3% was from Sylhet. We can see from the table that, most of the respondents had completed their secondary educational level, numerically 42.6% but only 12.9% had higher education and 18.1% women were illiterate. On the contrary, 24.2% of the husbands of respondents were illiterate and 31% and 18.4% had secondary and higher educational background respectively.

Majority of the women being jobless (80.7%), 32.4% women were from poor family and 64.3% respondents have more than one child. The table shows that, 46% respondent aged more than 25 years at the time of their first pregnancy, 38.9% of the respondents aged between 20 and 25 years. The practice of reading newspaper watching TV and listening to radio is 21.1%, 63.8% and 15.3% respectively. Majority of the respondent having normal weight (58.6%) and 61.5% of the women used to take the health care decisions about themselves or with their husbands. Again in Table 2 we can see the independent variables categories within dependent variable.

From Table 3, it is revealed that in case of the variable listening to radio, the p-value is 0.480 for ANC and for PNC it is 0.263 which indicate that it is not strongly associated. But except this one, for the remaining indicators, the p-values showed strong associations with dependent variables.

From Table 4 we can say that the women's place of residence is significantly associated with the practice of receiving ANC, PNC and

Table 3
The association between dependent variables and independent variables.

Variables	SBA	P-Value	PNC	P-Value	ANC	P-Value
	χ^2 test		χ^2 test		χ^2 test	
Types of places of residence	605.279	.000	217.151	.000	389.346	.000
Year of interview	929.394	.000	188.291	.000	862.830	.000
Region	297.053	.000	195.297	.000	70.037	.000
Respondents education	1954.280	.000	1115.759	.000	1575.897	.000
Husbands education	1594.987	.000	845.092	.000	1187.296	.000
Respondents work status	101.565	.000	24.801	.000	36.696	.000
Wealth index	1285.367	.000	602.180	.000	1049.054	.000
Birth order number	611.741	.000	353.198	.000	328.672	.000
Age of respondent at first birth	27.061	.000	50.728	.000	67.229	.000
Reading newspaper	648.506	.000	332.433	.000	469.394	.000
Listening radio	86.199	.000	.500	.480	1.255	.263
Watching television	943.456	.000	543.817	.000	856.404	.000
Body mass index	839.602	.000	370.883	.000	380.421	.000
Person who take health decision	45.606	.000	4.339	.037	40.078	.000

SBA services. Women in rural areas were 35.8% less likely to use skilled birth attendants than the women from the urban area. Women of 2014 were 288.7%, 744.8% 261.1% more likely to use ANC, PNC and SBAs respectively compared to the women from 2004. Compared with the respondents with no educational background, the ones with primary to higher education were more likely to take all the facilities and among them, respondents who completed higher education were 710% more likely to take ANC visits than illiterate ones and for receiving SBA and PNC, it was 464.9% and 277.8% higher respectively than women with no education. Husband's education also showed similar results except, husbands with primary education showed an insignificant association with the use of PNC visits of their wives. Surprisingly, the working women were 32.8% less likely to utilize skilled birth attendance and were found insignificant for receiving ANC and PNC. The rich respondents were more likely to receive ANC and SBA facilities than the poor ones and middle class showed insignificant associations. Respondents who gave birth to more than one child were less likely to receive the facilities than their first time. Age of the respondent at their first birth was found significant only for taking skilled birth attendant and respondents who aged more than 25 years were 26.5% more likely to take skilled birth attendance than the ones who aged 19 years or less. Regarding the use of ANC visits, respondents who read newspapers were 54.5% more likely to receive this facility than women who did not read the newspaper. The three facilities were more likely to be taken by the women who watched television than the ones who did not. Compared to normal weighed women, under-weighted women were less likely and over-weighted women were more likely to receive the facilities. When the health care decisions were taken by husbands only or others, they were less likely in support of their wives, taking ANC and SBA facilities than decisions taken by women only or along with their husbands and others.

4. Discussion

Findings of our study showed how equity in maternal healthcare utilization has changed in last decade and whether the patterns are different in urban and rural areas. It is observed that while the urban poor are increasingly availing of health facilities for antenatal care, skilled birth attendants and postnatal care, the rural poor are still lagging behind.^{29,31} A study by Mohammad Hajizade and colleagues found that there was also visible variation in different regions in Bangladesh which is similar to our study.³⁰ Here, it is clearly depicted that there is always a significant association between educated women and access of utilization in health services as higher educated women always lead in getting ANC, SBA and PNC services compared to those who have no education or even if having primary or secondary education. Though

the effect of maternal education level is stronger than husband's education, husbands' knowledge and involvement is related to women's access in all the three services.³² Since husbands are key decision-makers in households, especially in developing countries, health care decisions for their wives taken by them alone are less likely than decisions taken by their wives only or along with him/family in support of taking ANC, SBA and PNC facilities.³³ Respondent who take their health care utilization decision alone or with their husband are more likely to access in ANC, SBA and PNC facilities compared to others which is supported with other studies.^{34,35} Our study is consistent with the result in Uganda and Nepal that women from poor family background are less likely to take maternal health care services compare to women from rich family background.^{34–36} Women who give birth to more than one child are less likely to get extra facilities than those who give birth for the first time. This may be due to the fact that women who have higher parity gain more confidence to stay at home for delivery and less interested to take the skilled birth attendant's help. Other similar studies found that as the number of children born increased there occurs low likelihood of having health facility.³⁷ This study found that for the first birth whose age are 25 or more are more likely to get skilled birth attendant facility than the respondents who are 19 or lower that is older women are more likely to seek maternal health-care services than younger women.³⁸ There is a remarkable effect of BMI on health utilization. This study found that compared to normal weighted women, under-weighted women are less likely and overweight women are more likely to receive those facilities. A study in the USA found that women with an obese BMI accessed care 0.2 weeks later than women with a recommended BMI and similar to our findings.^{39,40} The awareness of people on maternal health and other issues could be increased by using public media sources like watching television and reading newspapers. In case of using ANC, women who read newspapers regularly are willing to get ANC facility compared to those who don't have this habit. Similarly, the respondents who watch television are more likely to receive all three facilities. A Nigeria-based study found that there is a strong association between community media and maternal health service utilization.⁴¹

5. Conclusion

This study made an attempt to find out the factors associated with maternal health care services in Bangladesh. We have found that the utilization of maternal health care services have increased over the last decade. It is revealed that women and their husband's education, wealth index are the most important determinants of the use of maternal health services. Moreover, the inequalities of facilities/services are clearly shown in this research for urban and rural people. The women from

Table 4
Adjusted odds ratios and 95% confidence intervals for receiving ANC, SBAs and PNC services in Bangladesh.

Variables	Received ANC		Take SBAs		Use of PNC	
	Adjusted OR (95% CI)	P-value	Adjusted OR (95% CI)	P-value	Adjusted OR (95% CI)	P-value
Types of places of residence						
Urban	1.00		1.00		1.00	
Rural	.624	.551–.707	.000	.642	.579–.712	.000
Year of Interview						
2004 (ref.)	1.00		1.00		1.00	
2007	.725	.567–.927	.010	.430	.357–.518	.000
2011	1.832	1.39–2.42	.000	1.069	.886–1.29	.487
2014	3.887	2.79–5.42	.000	3.611	2.76–4.72	.000
Region						
Barisal	1.00		1.00		1.00	
Chittagong	1.134	.944–1.36	.179	.885	.743–1.06	.173
Dhaka	1.135	.939–1.372	.190	1.425	1.19–1.71	.000
Khulna	1.391	1.129–1.713	.002	2.562	2.12–3.09	.000
Rajshahi	1.717	1.404–2.099	.000	1.510	1.25–1.82	.000
Rangpur	1.377	1.139–1.664	.001	1.223	1.01–1.48	.035
Sylhet	1.442	1.130–1.840	.003	2.041	1.64–2.55	.000
Respondents education						
No education	1.00		1.00		1.00	
Primary	1.759	1.539–2.010	.000	1.752	1.47–2.08	.000
Secondary	3.124	2.664–3.663	.000	3.282	2.75–3.92	.000
Higher	8.100	5.342–12.282	.000	5.649	4.41–7.25	.000
Husbands education						
No education	1.00		1.00		1.00	
Primary	1.165	1.025–1.323	.019	1.178	1.02–1.36	.027
Secondary	1.663	1.427–1.937	.000	1.474	1.27–1.72	.000
Higher	2.158	1.650–2.823	.000	2.163	1.78–2.63	.000
Respondents work status						
Jobless	1.00		1.00		1.00	
Working	.920	.811–1.043	.194	.672	.592–.76	.000
Wealth Index						
Poor	1.00		1.00		1.00	
Middle	1.085	.946–1.246	.245	1.109	.959–1.28	.162
Rich	1.498	1.292–1.737	.000	1.393	1.21–1.60	.000
Birth order number						
First birth	1.00		1.00		1.00	
More than one	.648	.557–.752	.000	.433	.383–.49	.000
Age of respondent at first birth						
≤ 19	1.00		1.00		1.00	
20–25	1.058	.890–1.258	.524	1.044	.904–1.21	.557
≥ 25	1.045	.859–1.270	.662	1.265	1.06–1.50	.008
Reading newspaper						
No	1.00		1.00		1.00	
Yes	1.544	1.261–1.889	.000	1.102	.967–1.26	.144
Watching television						
No	1.00		1.00		1.00	
Yes	1.544	1.374–1.736	.000	1.574	1.40–1.77	.000
Body Mass Index						
Normal	1.00		1.00		1.00	
Under-weight	.882	.788–.988	.029	.762	.679–.856	.000
Over-weight	1.798	1.473–2.195	.000	2.280	1.990–2.611	.000
Person who take health decision						
Women + - Husband	1.00		1.00		1.00	
Husband only or others	.868	.783–.963	.008	.893	.811–.984	.022

urban areas are highly educated and economically stable and they are likely to receive proper antenatal care as well as trained personnel during their delivery and also proper guideline during the postpartum period so we need to give more focus on rural part. Another interesting factor is to access to mass media i.e. television, radio, newspaper because urban women have enough time to access these rather than rural women and this initiated them to receive proper health care.

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Declaration of competing interest

The authors declare no conflicts of interests.

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