Antenatal Care and Skilled Birth Attendance in Bangladesh are influenced by female education and family affordability: BDHS 2014

Abstract

Objectives

Antenatal care (ANC) during pregnancy and skilled birth attendance (SBA) during delivery are important policy concerns to reduce maternal deaths. Bangladesh is one of the developing countries which has made remarkable progress in both services during the last couple of decades by improving the SBA service rate from 16% in 2004 to 43% in 2014. However, this rate remains below the targeted level (50%) of the Health Population and Nutrition Sector Development Program set by the Ministry of the Health and Family Welfare of Bangladesh. This paper explored the sociodemographic factors associated with the ANC and SBA service attainment. Furthermore, the possible implication of using ANC on SBA was also investigated.

Study design

The study followed a cross-sectional design using Bangladesh demographic and health survey (BDHS) 2014, with a sample of size 4603 women with at least one live-birth three years preceding the survey.

Methods

Following a bivariate analysis, linear mixed effect models were used to assess the relationship between sociodemographic factors and the outcome indicators (ANC and SBA). Finally, association between SBA and ANC were evaluated through another mixed effect model.

Results

Wealth index, participation in household decisions, partner's and respondent's education were significant predictors of ANC; whereas, residence, age at first birth, wealth index, working status, participation in household decisions, partner and respondent's education were significant for skilled birth attendance. Female education and household affordability were the strongest predictors for both ANC and SBA. ANC showed significant association with SBA as women accessing essential ANC during delivery seemed to be 4 times more likely (95% CI: 3.05 - 5.93) to avail SBA services.

Discussion

Overall, four factors were significant: residence, wealth index, education and ANC access. Women residing in urban areas, having higher financial solvency, completing higher education, and accessing ANC by skilled personnel were more likely to receive SBA at delivery than their counterparts. Accessibility to skilled care during pregnancy leads to increased professional care during delivery. Thus, policies to encourage women and heads of families to seek skilled care during pregnancy would be beneficial to reach the maternal health care targets of Bangladesh.

Keywords: Maternal health, Bangladesh, Education, Sociodemographic factors, Heath services, Health policy

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Introduction

During the last couple of decades, Bangladesh has experienced remarkable success in public health sector despite being a low-income country (1; 2; 3). Bangladesh also performed well with the targets of Millennium Development Goals (MDG) 2015, particularly in reduction of maternal and child mortality. For example, the maternal mortality ratio (MMR) and infant mortality rate per 100,000 live births declined from 507 and 149 in 1990 to 209 and 53 in 2010 respectively (4). As such, the country is also believed to be on the track to achieve the Sustainable Development Goals (SDGs) (5; 6; 7; 8). One of the objectives of Bangladesh National Strategy for Maternal Health 2014-2024 is to bring down the current MMR of 176 per 100,000 live births to 50 by 2024 (9; 10). However, according to the recent MDG progress report, Bangladesh performed poorly with scoring below the median point (36 on a scale from 0 to 100; details in Lim et al. (2016)) in SBA service performance (11).

It is well-known that a part of the maternal service utilization is access to antenatal care (ANC) and skilled birth assistants during delivery (12). Delivery assisted by a skilled birth attendant (SBA) is aimed to reduce MMR and any other complication that could occur during delivery. Multiple public and non-governmental programs are currently active to train traditional birth attendants and increase the awareness of mass population (13; 14; 15; 16). Bearing in mind that these training programs are running for decades, this study aimed to explore the sociodemographic factors associated with the attainment of these services in Bangladesh, which would help identify the vulnerable cohorts of women that require greater attention. The contribution of ANC in accessing SBA would be evaluated as well.

Skilled birth attendants generally refer to health professionals, particularly doctors, nurses, and midwives, who are trained to provide health care to mothers and new born babies prior to and during delivery to manage normal deliveries and diagnose, manage or refer obstetric complications (17; 18; 19; 20). Antenatal care refers to the care given prior to delivery including medical interventions and advices to mothers during pregnancy (21; 22). In Bangladesh, the nurse and midwives who typically have four years of training through government or non-governmental organizations and instructed to provide skilled obstetric care including management of normal labor, medical treatment of problem pregnancies and neonatal care are referred to as SBAs, besides the qualified doctors and Gynecologists, who also provide these services (23). According to the report of Bangladesh Demographic Health Survey (BDHS) 2014, a qualified doctor, nurse, midwife, paramedic, family welfare visitor (FWV), community skilled birth attendant (CSBA), or sub-assistant community medical officer (SACMO) is considered as a qualified carer, which was considered as the definition of SBA in this study as well (24). Contrarily, orthodox village doctors without academic qualifications, uncertified community workers, and untrained conventional midwives are considered as traditional birth attendants (TBAs).

The health care system in a developing country like Bangladesh is compromised in multiple sectors, particularly for women who have limited physical and financial access to health facilities, small window for personal opinion and decision-making authority in the family, and almost no education or health awareness (25; 26; 27). In developing countries, most of the women still have deliveries at home with the aid of uncertified TBAs (28). Similar situation persists in Bangladesh where the rate is below the target (50%) set by the Ministry of the Health and Family Welfare (MOHFW) of Bangladesh Government (29). The latest BDHS 2014 revealed that the percentage of deliveries attended by SBA in Bangladesh increased from 16% in 2004 to 42% in 2014 (24). However, the coverage varied across different population groups; for example, the rural women were disadvantaged from maternal health services due to financial hardship and lack of education (12; 30). There were solicited multiple stipend programs, both to educate mothers and train new SBAs, in rural Bangladesh (31; 32; 15). However, there were multiple controversies regarding the effectiveness of these training programs and skill-set of the providers of ANC and SBAs (e.g., competence of SBAs in practical field, lack of community involvement) (33; 13). Even then, SBAs are considered effective assets to reduce maternal mortality rate in Bangladesh (10; 9).

The deployment of SBAs at delivery is low in Bangladesh. This study aimed to analyze factors

affecting utilization of ANC and SBA services during delivery in Bangladesh using the information from BDHS 2014. Limited number of studies assessed the sociodemographic determinants of delivery by SBAs, and subsequent effect of ANC on SBA services in Bangladesh. For example, Islam et al. (2014) found that women's occupation, household income, antenatal care (ANC) by SBAs, and complication during pregnancy have significant association with the delivery by SBA using a cohort from a sub-district of Narsingdi district in Bangladesh (34). A review of the existing literature on the subject also reveals a growing research focus on examining the factors that affect maternal health care-seeking behavior (35), with previous studies indicating that such behavior is influenced by various personal, sociocultural and environmental factors, such as individual perceptions of health, self-efficacy, motivation, social values and belief systems (36; 37; 38). Another study noted that women's education, religion, and household economic backgrounds are important predictors for SBAs service uptake (39). Residence and educational status are key factors as well for SBA service uptake. This study noted that women living in urban areas and having higher education with greater financial capacity are more likely to access SBA services (40). Besides the effects of these socioeconomic factors, SBA services are further affected by the shortage of work force in the health sector, with approximately five physicians and two nurses per 10,000 population in Bangladesh, whereas countries like Australia and Germany have 120-140 nurses for similar population ratio (41; 9; 42).

With the aim of addressing the individual, fertility, and contextual variables that could affect the service delivery of ANC and SBAs all over Bangladesh, this study warranted an evaluation of the most vulnerable households that lack the services of ANC providers and SBAs. Findings from this study should help to improve the health policy to achieve the goal of 50% of deliveries through SBAs set by Bangladesh and also to take Bangladesh one step closer to achieving the maternal mortality target of the United Nations' SDGs (29).

Materials and Methods

Data Overview

Bangladesh demographic and health survey (BDHS), a nationally representative cross-sectional survey, has been conducted in Bangladesh since 1993 collaborating with Demographic and Health Survey (DHS), operated by Measure DHS+ (43; 24). A list of enumeration areas (EAs) from the census is used as the sampling frame (24). Two-stage stratified cluster sampling techniques

are used for this survey. In the first stage, 600 EAs (or clusters) are selected using probability proportional to size (PPS) sampling method. In the second stage, an equal probability systematic sampling method is applied to draw an average of 30 households from each cluster. This study used the most recent BDHS of 2014, where only the females were considered as respondents and the temporary (de jure) residents were excluded in the sample. Of 17863 women of reproductive health age group (15-49 years) surveyed in 2014, 4603 had at least one live-birth three years preceding the survey.

Outcome and exposure variables

This study assessed predictors of ANC and SBA in Bangladesh. Both outcomes were binary. In grouping the service providers as to skilled and other providers, Bangladesh's DHS 2014 report as well as DHS VI standard recode manual were followed (43). As explained earlier, qualified doctor, nurse, midwife, paramedic, FWV, MA and SACMO were considered as skilled ANC providers and SBAs. Based on previous literature and pre-analysis, the selected sociodemographic factors were age at first cohabitation (years); age at first birth (years); number of living children (numeric); number of children that died (numeric); residence (urban, rural); wealth index (poorest, poorest, middle, richer, richest); working status (yes, no); participation in family decisions (yes, no); education of both respondent and her partner (none, primary, secondary, higher); birth order of children. 'Participation in family decisions' was based on four questions asked during interviews: whether the woman participates in decisions on how to spend respondent's earnings, respondent's health care, large household purchases and visits to family or relatives. A participant who did not take any one of these decisions was considered that she did not participate in family decisions ('No') and rest who decided these herself or together with her husband was considered as participated in family decisions ('Yes').

Statistical analysis

In computing antenatal care and skilled birth attendance services indicators, multiple responses were managed by considering one provider for each indicator. In this regard, the one with the highest qualification was considered for those who reported more than one attendant during the course of their pregnancy and/or during delivery. Models were adjusted by the cluster-wise effects (44).

As both outcomes (ANC and SBA services) were binary, a regression model with binomial family of distributions would be suitable. As BDHS data were collected from 600 clusters, there is a requirement to adjust these for generalization of the outcomes. A mixed effect model where clusters were adjusted using random effect would be acceptable, which is used to assess applied research on DHS data sets (45). This model is a common approach to fit multivariate distributions for non-normal data incorporating random effects into the linear predictors (46). To express the basic model, let $\boldsymbol{Y}$ be the observed data vector and, conditional on the random effects, $\boldsymbol{u}$, assume that the elements of $\boldsymbol{Y}$ are independent and drawn from a distribution in the exponential family; assuming a distribution for $\boldsymbol{u}$ depending on parameters, $\boldsymbol{D}$ (47):

$$\boldsymbol{f_{(y_i|u)}(y|u,\beta,\phi) = exp\{(y\eta_i - c(\eta_i))/a(\phi) + d(y,\phi)\}u \sim f_u(u|D)} \quad (1)$$

Here, $\boldsymbol{\eta_i = x_i'\beta + z_i'u}$, with $\boldsymbol{x_i'}$ represents ith row of the fixed effect $\boldsymbol{X}$ and $\boldsymbol{z_i'}$ is the same for random effect $\boldsymbol{Z}$. The mixed effect models were fitted using $R - package\ glmer(lme4)$.

Linear mixed effect model with binary outcome variable was used to assess the significance of the relationships between the sociodemographic factors and outcome indicators (ANC and SBA services). Following the mixed effect models, association between SBA services and ANC was evaluated again through a mixed effect model. All computations were conducted in SPSS (version 23) and R (3.5.0).

Results

Descriptive analysis

Table 1 shows the distribution of the women during their reproductive age across different sociodemographic factors. Among the 17863 women with at least one-live birth five years preceding the survey, the average age of the participants was 31 years (SD=9.2) whereas average age at first marriage and first birth was 16 years (SD=3) and 18 years (SD=3.4) respectively. The mean number of living and deceased children per woman was 2.2 and 0.22 respectively. Table 2 presents distribution of skilled birth attendance by different groups corresponding to the socio-demographic variables. More than two-third of the study participants (71%) resided in rural area. With regard to wealth index, there was nearly equal distribution of participants across each quintile as designed by the survey through principal component analysis (PCA) (43), ranging between 18.8% (poorest)

and 21.1% (richest).

The distribution of women participated in the survey and who had at least one live-birth three years preceding the survey across the six divisions (regions) ranged from 12% both in Barisal and Sylhet to 17% in Dhaka (Table 2). Only 22% of women responded that they participated in all four major family management decisions regarding respondent's earnings, respondent's health care, large household purchases and visits to family or relatives. Education status of participants and their partners showed that while about 74% of women succeeded in completing primary school, about 72% of the husbands achieved the same level of education. About 80% of Bangladesh women participated in the survey were multipara, having more than one live birth and having twins.

Table 1: The distribution of the women aged 15-49 and those who had a live-birth in the three years preceding the survey across the selected sociodemographic variables (continuous)

	All women 15-49 years		**Women with live-birth**	
Sociodemographic variables	N	Mean (SD)	N	Mean (SD)
Respondent's current age	17,863	30.8 (15.0)	4603	24.6 (8.0)
Age at first cohabitation	17,863	15.8 (3.0)	4603	16.3 (4.0)
Age of respondent at 1st birth	16,153	17.9 (3.0)	4603	18.3 (4.0)
Husband's Age	16,840	39.5 (18.0)	4538	32.9 (9.0)
Number of living children	17,863	2.3 (2.0)	4603	2.0 (2.0)
Number of deceased children	17,863	0.22 (0.0)	4603	0.15 (0.0)

Table 2: The distribution skilled antenatal care and skilled birth attendance (for the most recent birth) by sociodemographic factors (categorical), among women aged 15-49 who had a live birth in the three years preceding the survey, BDHS 2014

Sociodemographic variables	**Group**	**N (%) of all study participants**	**N (%) of women with live-birth**	**% of skilled Antenatal care**	**% of skilled delivery**
Residence	Rural	12816 (71.1)	3302 (65.5)	63.0	36.3
	Urban	5047 (28.3)	1201 (34.5)	82.1	61.3
Wealth index	Poorest	3359 (18.8)	998 (18.2)	39.8	18
	Poorer	3408 (19.1)	870 (18.8)	60.1	30.1
	Middle	3560 (19.9)	880 (20.3)	69.6	39.3
	Richer	3758 (21.0)	949 (21.1)	78.8	52.8
	Richest	3778 (21.1)	906 (21.6)	92.3	75.2
Division	Barisal	1111 (6.2)	268 (12.0)	65.2	36.9
	Chittagong	3301 (18.5)	1007 (16.0)	69.1	43.3
	Dhaka	6223 (34.8)	1626 (17.3)	68.7	45.2
	Khulna	1838 (10.3)	369 (14.5)	80.4	58.8
	Rajshahi	2103 (11.8)	463 (14.1)	68.9	41.9
	Rangpur	2056 (11.5)	443 (14.2)	66.7	38.6
	Sylhet	1232 (6.9)	427 (12.0)	54.9	27.6
Working status	No	11950 (66.9)	3517 (76.4)	61.6	45.5
	Yes	5912 (33.1)	1086 (23.6)	70.1	34.1
Participated in household decisions	No	9000 (77.6)	2537 (70.6)	71.8	41.9
	Yes	2600 (22.4)	502 (29.4)	58.2	41.5
Respondent's education	None	4455 (24.9)	652 (23.6)	43.5	17.5
	Primary	5209 (29.2)	1286 (29.3)	55.5	29.9
	Secondary	6679 (37.4)	2194 (37.6)	76.8	50.1
	Higher	1520 (8.5)	471 (9.6)	93.3	79.6
Husband/partner's education	None	5189 (29.1)	1097 (28.3)	48.6	21.9
	Primary	4879 (27.3)	1383 (27.2)	59.3	33.2
	Secondary	5325 (29.8)	1456 (29.5)	79.8	51.8
	Higher	2467 (13.8)	664 (15.0)	90.9	77.6
Order of Birth	First	3960 (22.2)	1837 (22.3)	74.7	53.1
	Second	4746 (26.6)	1388 (26.4)	70.3	44.5
	Third	3392 (19.0)	743 (18.6)	64.0	34.5
	Forth and above	5764 (32.3)	635 (32.7)	48.9	18.9
ANC	No	1415 (31.9)	1407 (31.9)		17.5
	Yes	3015 (68.1)	3000 (68.1)		55.2

Although ANC and SBA service in Bangladesh reached 68% and 43% of those with live births three years preceding the survey respectively, the coverage significantly varied across different background variables. While 82% and 61% of urban dwellers received these services respectively, only 63% and 36% of rural residents had access to these services. The highest improvement in the services uptake was observed across increasing educational status and wealth index of the

participant. Even though only 10% women completed higher education, 93% of them received ANC and 77% of them received assisted delivery service, while only 18% of those with no education accessed SBA service. Similarly, the coverage increased significantly from the lower quartile to upper quintile from below 40% to over 75%. Over 68% women had at least one antenatal care service from skilled provider during the course of their pregnancy and the coverage of skilled delivery among those was 55%. However, only 17% of the pregnant women who never received antenatal care service were attended by skilled personnel during delivery.

Mixed effect model

The association of each sociodemographic variable with ANC and SBA services are presented in Table 3. Wealth index, participation in household decisions, partner and respondent's education were significant for antenatal care; however, residence, age at first birth, wealth index, working status, participation in household decisions, partner and respondent's education were significant for skilled birth attendance. Women living in urban areas had higher likelihood to attain SBA services (1.69 times) compared to rural residents, as expected. Similarly, a greater age at child birth lead to skilled medical attendance. The richest households had 5.08- and 4.31-times greater odds of seeking ANC and SBA respectively in reference to the poorest households. However, both ANC and SBA services showed a negative association with women's participation in household decisions. Education of the women was observed as a significant positive indicator with women who received higher education were over 3 times more likely to attain these services (Table 3). Similarly, husband or partner's education was not significant for attaining ANC and SBA services.

Table 3: Mixed effect model fitted with antenatal care and skilled birth attendance to the sociodemographic factors, where cluster-wise variations were considered as random effect.

	Antenatal care		**Skilled birth attendance**	
Sociodemographic factors	Odds (95% CI)	P-value	Odds (95% CI)	P-value
Random effect (variance)	1.914		1.789	
Residence (ref: Rural)				
Urban	1.10 (0.86, 1.42)	0.439	1.69 (1.35, 2.11)	<0.001
Age at first cohabitation	0.98 (0.94, 1.03)	0.467	0.96 (0.92, 1.00)	0.061
Age at first birth	1.05 (1.01, 1.09)	0.027	1.09 (1.05, 1.13)	<0.001
Wealth Index (ref: Poorest)				
Poorer	1.52 (1.21, 1.90)	<0.001	1.47 (1.14, 1.91)	0.003
Middle	2.04 (1.59, 2.60)	<0.001	1.91 (1.47, 2.49)	<0.001
Richer	2.61 (1.98, 3.42)	<0.001	2.46 (1.87, 3.24)	<0.001
Richest	5.08 (3.50, 7.38)	<0.001	4.31 (3.13, 5.93)	<0.001
Number of living children	0.88 (0.75, 1.02)	0.095	0.83 (0.66, 1.03)	0.093
Number of children died	1.00 (0.81, 1.24)	0.992	0.98 (0.74, 1.28)	0.861
Working status (ref: No)				
Yes	0.92 (0.76, 1.11)	0.377	0.76 (0.63, 0.92)	0.004
Participation in household decisions (ref: No)				
Yes	0.81 (0.68, 0.96)	0.015	0.78 (0.66, 0.93)	0.005
Respondents education (ref: None)				
Primary	1.30 (1.02, 1.66)	0.035	1.33 (1.00, 1.77)	0.051
Secondary	1.98 (1.52, 2.58)	<0.001	1.87 (1.40, 2.51)	<0.001
Higher	3.45 (2.05, 5.83)	<0.001	3.33 (2.20, 5.04)	<0.001
Partners education (ref: None)				
Primary	1.04 (0.85, 1.28)	0.699	1.20 (0.96, 1.50)	0.118
Secondary	1.74 (1.37, 2.21)	<0.001	1.48 (1.17, 1.89)	0.001
Higher	2.81 (1.87, 4.23)	<0.001	2.52 (1.82, 3.50)	<0.001
Order of Birth (ref: First)				
Second	1.15 (0.78, 1.69)	0.482	1.04 (0.65, 1.67)	0.862
Third	1.03 (0.63, 1.70)	0.894	0.93 (0.49, 1.76)	0.817
Fourth	1.08 (0.57, 2.01)	0.821	1.00 (0.43, 2.32)	0.999

Association between SBA service and ANC

As ANC is acquired by women after pregnancy and before delivery, there is a natural expectation that women who seek SBA might already have received ANC services. As the 2x2 Table 4 shows, women who attained ANC, almost 56% of them had SBAs during delivery. Both ANC and SBA had a significance association (χ^2 (1) = 561.93, p< 0.001). It was interesting to find a cohort of 249 women with live-birth who received SBA services but not the skilled ANC. A further analysis on the distribution of this cohort showed that the mean age of the participants (mean=24.7, SD=6.1) was about eight years lower than the overall study participants - women

with live-birth three years preceding the survey; however, their age at first marriage (mean=18.7, SD=3.1) was one year higher than the overall participants (Table A and B in supplementary file). Among the participants in this cohort, most of the women resided in rural areas (78.1%) and were reported not being engaged in any paid work (73.6%). 43% of this sample had no education or only attained primary education and were part of the poor quarter in the wealth index.

Table 4: 2x2 table for SBA and ANC with chi-square test of association

		Skilled birth attendance		**p-value (χ^2(1) test)**
		No	Yes	
Antenatal care	No	1158 (82.3%)	249 (17.7%)	<0.001
	Yes	1331 (44.4%)	1670 (55.6%)	

To test the association between ANC and SBA services, another mixed effect model (cluster as random effect), where ANC was a covariate fitted to SBAs, and the model was adjusted by previous significant sociodemographic factors (Table 5). ANC showed significant association with SBAs, as mothers who availed appropriate ANC seemed to be 4 times more likely to opt for SBAs, which indicated the possible roll-out of skilled care from pregnancy to delivery.

Table 5: Mixed effect model fitted skilled birth attendance to ANC adjusted by other sociodemographic factors, where cluster-wise variations were considered as random effect.

Sociodemographic factors	Odds (95% CI)	P-value
Random effect (variance)	1.441	
Residence (ref: Rural)		
Urban	1.68 (1.23, 2.31)	0.001
Age at first birth	1.05 (1.00, 1.10)	0.037
Working status (ref: No)		
Yes	0.73 (0.52, 1.01)	0.056
Wealth Index (ref: Poorest)		
Poorer	1.39 (0.88, 2.20)	0.155
Middle	1.90 (1.21, 2.97)	0.005
Richer	2.26 (1.43, 3.55)	<0.001
Richest	3.58 (2.17, 5.91)	<0.001
Participation in household decisions (ref: No)		
Yes	0.73 (0.54, 0.97)	0.030
Respondents education (ref: None)		
Primary	0.86 (0.50, 1.48)	0.588
Secondary	1.28 (0.76, 2.15)	0.357
Higher	2.91 (1.45, 5.81)	0.002
Partners education (ref: None)		
Primary	0.73 (0.43, 1.27)	0.269
Secondary	1.15 (0.70, 1.88)	0.582
Higher	0.76 (0.46, 1.26)	0.285
Antenatal care (ref: No)		
Yes	4.25 (3.05, 5.93)	<0.001

Discussion

It is well established that maternal mortality ratio (MMR) and utilization of skilled birth attendant services are two of the most important metrics of weighing the progress towards the achievement of the maternal goals of SDG. Bangladesh registered great headway with the target of MDG, particularly as the countrywide coverage of SBAs increased from 5% in 1991 to 42.1% in 2014 (3; 48). However, despite such advancement, the coverage is still lagging behind the target fixed by the Ministry of Health (39; 38). Furthermore, in a recent MDG assessment (11), Bangladesh scored only 36 out of 100 in SBA performance, which demands more attention on

SBAs. Part of the maternal health care target as MDG assessment is also to provide ANC to pregnant women all over the nation (49). The presence of SBAs is crucial in childbirth to reduce the MMR and to achieve the maternal mortality target of the United Nations' SDG.

The concept of SBA is not new in Bangladesh, in fact it was introduced back in 2004 (33; 50). However, the application of SBA seems to be limited to the privileged and informed part of the society. The results of this study ascertain the point that women belonging to the richer households and with higher education (along with educated partner) were more likely to access SBAs. Furthermore, those of who already received ANC from skilled personnel were more likely to receive SBA service during delivery. Therefore, the sociodemographic variables are required to assess the overall public health scenario of Bangladesh to identify and understand the reasons behind vulnerable households' lack of access to essential delivery service through SBA.

Household economic condition is one of the primary factors contributing to the access of various health services in Bangladesh. The households belonging to the lower wealth quintile do not have the capacity to bear the cost of services like ANC and SBA. Two different mindsets generally bar these families from accessing SBA; firstly, they do not admit to hospitals or access any means of health care as it would be a financial trade-off for basic necessities like food and clothing. These compel them to use services from TBAs providing cheap service in the locality for a long time. TBAs are often referred by friends and neighbors, encouraging them to choose the cheaper unprofessional service (51; 39; 52; 50). Secondly, with limited trained professionals working in the distant villages (rural and remote areas) of Bangladesh, the SBAs would prefer to serve those households where they are paid handsomely (10). All these add to the travel cost to access SBA services, which again is cheaper through home delivery by a TBA (53). Thus, the gap is filled by traditional birth attendants and the poor cohort remains devoid of essential delivery care.

Another important factor associated with awareness of health services is education, both women and their husband/partner's. Women, who completed their secondary and higher education, are generally well-informed of the various health issues, particularly the problems of seeking traditional unscientific cheap treatments (31; 54; 55). It compels them to rethink before availing the same service their ancestors did, a time when modern medical services were rare in rural Bangladesh (39). Further awareness from the household head or the husband/partner is important because in the patriarchal society of Bangladesh, a man usually makes most of the decisions for the family, particularly in circumstances that involve spending money. Hence, a highly educated partner

would be aware of the risk from an unskilled carer or TBA and comprehend the worth of spending the money on ANC and SBA services (54; 56; 57). It takes a highly educated family to rise above the long-established mindset of the community and go against the flow to seek modern medical help (58).

The results of this study also revealed that ANC from a skilled professional during the period of pregnancy increased the likelihood of seeking delivery from an SBA. Al Kibria et al. (2017) reasonably argues that the duration of pregnancy is the perfect intervention period for skilled delivery services as the medical personnel could explain the complexities associated with a delivery and the consequence of inefficient deliveries by TBAs (29). A high number of complications following delivery are found to be associated with traditional delivery services at home (59). However, a trained provider of ANC could be an intervention to encourage the women and their families to access the modern services in a health facility (60). As of BHDS 2014 report (24), 37% of the births are delivered in a health facility, which is an increasing trend (12%, 17% and 29% in 2004, 2007 and 2011 respectively). These results support the necessity of reaching appropriate ANC and SBA visits throughout the period of pregnancy to ensure essential assistance for delivery and postnatal cares.

This study analyzed the latest available nationwide health data on Bangladesh and identified the most vulnerable households, where women still lack skilled delivery assistance. However, this study was limited by few factors. Firstly, although the geographical clusters were adjusted, it is limited by district-wise data. A spatial analysis would have identified the most compromised regions of the country and a follow up policy intervention on these areas could be discussed. Secondly, some qualitative analyses could have portrayed women's opinion regarding their position to choose TBA or SBA during delivery. These would have verified whether there is a causal relationship between patriarchy and access to health service. Thirdly, as the data were cross-sectional, the study could only reflect on the association of the factors, it should not be interpreted in a causal manner. Further studies with SBA interventions in a controlled environment (e.g., different training schemes for SBAs and community engagement programs) could warrant the validation of the findings. Future studies can also investigate the cohort of 249 individuals who received no ANC but availed SBA services, which could potentially decipher issues like lack of community engagement of ANCs or insufficient ANC services in the locality.

Conclusion

During last two decades, the financial development in Bangladesh has led to an improved public health scenario including ANC and SBA services. Foreign aid and locally active Non-Governmental Organizations patronized by Bangladesh Government are continuously strengthening this sector. These resulted in increased setup of local health facilities and consequently more trained SBAs in local communities. This study analyzed the most recent BDHS 2014 data to investigate the determinants of ANC and SBA service utilization at delivery including wealth index, education of women and their participation in household decision making. The findings demonstrate that interventions are required for the poor and uneducated women. Several intervention strategies are warranted to ensure Bangladesh attains the targets of the Sustainable Development Goals (SDGs) set by United Nations. This study concludes that focusing on women's education, increasing affordability by poverty reduction, minimizing the gaps of the SBA services between rich and poor, and increasing ANC services for smoother access to SBAs, with particular attention to rural and poor communities, could substantially contribute to the national maternal health services during delivery, which would enhance the national mortality prevention programs.

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