

Association of Community Facilities with Skilled Antenatal Care Visits in Bangladesh: Evidence from BDHS Data 2017-18

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Abstract

For the well-being of expectant mothers as well as their children, receiving skilled antenatal care for reproductive women is crucial worldwide. To take an appropriate number of ANC visits, it is important to ensure physical accessibility to health services, along with the travel time needed to reach the health provider. In this study, several factors, including community facilities and socio-demographic characteristics, have been considered to explore the strength and association with the likelihood of women seeking ANC visits in Bangladesh. This study finds that the travel time and main access road types have a significant influence on receiving skilled ANC of reproductive women in Bangladesh.

Keywords: ANC, Community facilities, Sequential binary logistics regression.

I. Introduction

Antenatal care (ANC) is a fundamental component of maternal and child health, providing essential monitoring, education, and support to ensure safe and healthy pregnancies¹. ANC obtained from skilled providers helps with valuable information on nutrition, exercise, prenatal health, and empowering parents to make knowledgeable decisions^{2,3}. Skilled providers include qualified doctors, nurses, midwives, paramedics, family welfare visitors, community skilled birth attendants, and sub-assistant community medical officers. They help in the early detection of conditions such as gestational diabetes or preeclampsia that can help manage risk and improve the overall health of both mother and child. Several Sustainable Development Goals (SDGs) relate to antenatal care, which primarily focus on maternal and child health. Nowadays, ensuring proper ANC from skilled providers continues to be a major challenge in Bangladesh, although several government programs have been implemented to improve the situation. The biggest contributor in ensuring sound health of both mother and child after delivery depends vastly on proper skilled ANC visits of the mothers. It has been established that by implementing timely and appropriate evidence-based practices, skilled ANC can save lives⁴. In different studies, it was found that

demographic and socio-economic factors such as maternal education, husband's education, marital status, availability, cost, household income, women's employment, media exposure, having a history of obstetric complications etc. play an important role in influencing ANC of mothers during pregnancy⁴.

Numerous studies have been found that discuss the impact of communication services on mother and child health⁵. In order to safeguard and prevent health in underprivileged

communities, it is important to integrate community and facility-based initiatives with central government support. Conversely, community services are heavily reliant on numerous local factors as well as the degree of development such as the advancement of communication and health care. Lack of community facility and health facilities may discourage community members to make use of health facilities provided by the government or other private institutions. In a study conducted in western Kenya, it was found that increase in distance of residence from community clinic decreases the rate of clinic visit substantially⁶. Access to communication facilities can support the development of a daily market in the community and activities that generate income for households.

It is now well established that ANC is associated with different socio-economic, demographic, maternal and other health related factors^{7–12}. While the role of ANC taken from skilled providers remain mostly unexplored in Bangladesh to the best of our knowledge, we aim to explore this field to help attain the SDG 3 (Good health and well-being). In this paper, an attempt has been made is to examine how community facilities contribute to the skilled ANC intake of the mothers controlling demographic as well as socio-economic variables since this field remains unexplored. In this study, a mother is said to take ANC visits if she took at least 4 skilled ANC visits according to the WHO guideline as an indicator to sound health of both the mother and the child¹³. Main access road to the community and the time to reach the health facility variables are used as a proxy variable for community facilities.

II. Data and Variables

This research study is grounded in data sourced from the Bangladesh Demographic and Health Survey 2017-2018 (BDHS 17-18), chosen over more recent BDHS data from

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2022-2023 due to constraints in the availability of community facilities covariates¹⁴. The data collection methodology involved a meticulous two-stage stratified sampling process. In the first stage, a total of 675 clusters were meticulously selected, encompassing both rural (425 clusters) and urban areas (250 clusters) across the nation, within each enumeration area, an average systematic sample of 30 households was carefully chosen. The survey targeted around 20,100 ever-married women aged 15-49 to gather data on their live births history, including details like the sex of the child, months and years of each birth, survival status, age at the time of the survey or at death, along with various socio-economic and demographic variables.

Data related to community facilities was collected from a separate community dataset, focusing on aspects such as the most common type of transport, main access road to the community, primary economic activities, availability of electricity and telephone service, primary water source, presence of hospitals, doctors, pharmacies, and the time required to reach health facilities. For this study, specific attention was given to analyzing the main access road to the community and the time taken to reach health facilities. The Community Questionnaire was administered to a group of informants in each cluster, including local leaders like the chairman or members of the union council, the ward commissioner, village/mohalla heads, teachers, imams, and female opinion leaders during the household listing operation in BDHS 2017-18. The primary objective of this paper is to investigate the impact of community facilities on the utilization of skilled Antenatal Care (ANC) services by women in Bangladesh. The analysis specifically focuses on whether mothers attended at least 4 skilled ANC visits. A total of 4168 mothers were selected for analysis, considering their complete information on skilled ANC visits, along with various socio-economic and demographic characteristics, and the specific community facility variables considered in this study.

To take into account the association of covariates on skilled ANC visits, three different categories of covariates are considered based on literature reviews^{7-12,15-21}: community facilities, demographic, and socio-economic. Within community facilities covariates, the main access road to reach the health facility and the travel time to reach the health facility are taken into consideration. The main access road is classified into three categories: all-weather road, seasonal road, and other roads (waterway, path, and other). Regarding the time taken to reach the maternal healthcare, two categories are considered: mothers who required more than 1 hour, and mothers who needed 1 hour or less. The demographic covariates considered include the mother's age at the last birth, maternal education, desire for their last child, and birth order. Mother's age at the last birth is categorized into three groups: below 18, 18-35, and above 35. Maternal education is classified into categories of illiterate, primary education, secondary education, and higher education. The desire for the last child is defined as whether they wanted their last child (wanted then) or not (wanted later or wanted

no more). Birth order is divided into two categories: if the child is first or second born, or otherwise. In the socio-economic covariates, the wealth index and the mother's decision regarding healthcare visits are taken into account. The wealth index is classified into three categories: poor, middle, and rich. On the other hand, the mother's decision on healthcare visits is categorized into two groups: the mother who could make decisions on healthcare visits alone or jointly with her husband and others, while the mother who could not make decisions on healthcare visits.

III. Statistical Analysis

In this study, three main stages have been taken for analysis purposes. Each category's percentage distribution for the chosen variables is provided to illustrate the data trend on socioeconomic and demographic factors as well as community facilities. Next, the Chi-square test is run to determine potential unadjusted factors associated to skilled ANC visits of mothers. Finally, the sequential binary logistic regression models are fitted to the data to determine the adjusted effects of the covariates on skilled ANC visits of mothers. To analyze the data in this paper, SPSS and R software has been used and data are adjusted for sampling design including the sampling weights.

Let Y_i , $i = 1, 2, \dots, n$ be the binary response for the i th individual and $x_i = (x_{i1}, \dots, x_{ij}, \dots, x_{ip})'$ be a set of covariates associated with Y_i . Let $\beta = (\beta_1, \dots, \beta_j, \dots, \beta_p)'$ be the vector of regression parameters. The value $Y_i = 1$ indicates that the i th mother has taken at least 4 skilled ANC visits and $Y_i = 0$ otherwise. The probability of outcome event for the i th mother, $\Pr(Y_i = 1) = \mu_i$, can be modeled using logit link function as²²:

$$\begin{aligned} \text{logit}(\mu_i) &= \log \frac{\mu_i}{1 - \mu_i} \\ &= \beta_1 x_{i1} + \beta_2 x_{i2} + \beta_3 x_{i3} + \dots + \beta_p x_{ip} \end{aligned}$$

The maximum likelihood estimating method is used to estimate the parameters.

In this study, the outcome variable pertains to whether a mother attended at least 4 skilled ANC visits, categorized as a binary outcome: an expectant mother receiving at least 4 skilled ANC visits, while another attending 3 or fewer visits. A similar methodology for defining the outcome variable is employed in Kenya.

IV. Results

The percentage of selected community facilities, demographic, and socio-economic covariates, along with skilled ANC visits is reported in Table 1. Among reproductive women aged 15-49, 54.4% have received skilled antenatal care at least 4 times, while 45.6% have received it less than 4 times. In terms of community facilities covariates, 85.5% of respondents can travel using all-weather roads, 12% can use seasonal roads, and 2.5% use other types of roads. Additionally, 59.4% of mothers take 1

hour or less to reach the health facility, while 40.6% require more than 1 hour. Regarding demographic covariates, the percentages of reproductive women giving birth to their last child are 13% under 18, 83.6% between 18 and 35, and 3.4% above 35. Furthermore, 4.5% of mothers are illiterate, 24.1% have primary education, 50.2% have secondary education, and 21.2% have higher education. Moreover, 80.3% of mothers wanted their last child, while 19.7% did not. In

addition, 74.2% of mothers gave birth to at most 2 children, and 25.8% gave birth to at least 3 children. In terms of socio-economic covariates, 35.5% of women are from poor families, 18.5% from middle-class families, and 46% from rich families. 72.8% of mothers make their own healthcare decisions, while 27.2% cannot make decisions independently.

Table 1. Percentage of selected covariates with response variable.

Variables	Percentage	Count
Skilled ANC visits		
No	45.6	1899
Yes	54.4	2269
Main access road		
All weather	84.7	3532
Seasonal	12.9	536
Other	2.4	100
Time taken to reach		
1 hour or less	59.4	2430
More than 1 hour	40.6	1659
Mother's age at last birth		
Below 18	13.2	551
18-35	83.4	3476
Above 35	3.4	141
Mother's education		
No education	4.6	190
Primary	24.1	1006
Secondary	50.3	2096
Higher	21	876
Wanted child		
No	19.7	797
Yes	80.3	3243
Birth order		
1 & 2	74.2	2999
3 & more	25.8	1041
Wealth index		
Poor	35.4	1476
Middle	18.7	780
Rich	45.9	1912
Mother's decision on health care visit		
No	26.9	1108
Yes	73.1	3011

To identify whether there is a significant relationship between skilled antenatal care visits and community facilities, as well as demographic and socio-economic factors, a chi-square analysis was utilized, and the results of the associations with p-values are displayed in Table 2. From Table 2, the association between community facilities and skilled ANC visits reveals that among the mothers using all weather road, took highest percentage (55.5%) of skilled ANC visits, and among the mothers traveling by other roads, took lowest percentage (36.4%) of skilled ANC visits. On the other hand, the mothers who needed 1 hour or less to reach healthcare took highest percentage (55.5%) of visits.

Notably, these associations are highly significant at a 1% of level of significance.

In respect of the association between demographic factors and skilled ANC visits, no significant association has observed between a mother's age at last birth and skilled ANC visits at a 5% or 10% level of significance. Moreover, the most (71.5%) of the higher educated mothers took skilled ANC visits, whereas the lowest percentage (27.9%) of mothers among no education received skilled ANC. A significant association between mother's education and skilled ANC visits has been observed at a 1% level of significance. Further, majority (55.7%) of mothers who

wanted their last child received ANC visits, while 49.1% of mothers who did not want their last child took skilled ANC visits. Furthermore, 57% of the mothers went for skilled ANC if her child was the first or second born, while 46.8% of the mothers went for skilled ANC if her child was the third or more born. It is observed from Table 1 that wanted child as well as birth order is significantly associated with skilled ANC visits at a 1 % level of significance.

In terms of the association between socio-economic covariates and skilled ANC visits, it is observed from Table

1 that the mothers who belong to rich family among them, received the highest percentage (64.8%) of skilled ANC visits, while the lowest percentage (49.1) has observed among the poor mothers. A significant relationship between wealth index and skilled ANC visits has been observed. Finally, the percentage of mothers among whom decided about their health care visits received 55.4% skilled ANC visits, whereas 51.7% for the mothers who couldn't. It is noted that a significant association has observed between a mother's decision on health care visit and skilled ANC visits at a 5% level of significance.

Table 2. Percentage distribution of skilled ANC visits by selected community facilities, demographic, and socio-economic covariates.

Covariates	Skilled ANC visits		p-value
	Yes	No	
Main access road			<0.001
All weather	55.5	44.5	
Seasonal	49.8	50.2	
Other	36.4	63.6	
Time taken to reach			<0.001
1 hour or less	58	42	
More than 1 hour	49.1	50.9	
Mother's age at last birth			0.123
Below 18	53.4	46.7	
18-35	45.2	54.8	
Above 35	46.2	53.8	
Mother's education			<0.001
No education	27.9	72.1	
Primary	41.0	59.0	
Secondary	56.0	44.0	
Higher	71.5	28.5	
Wanted child			<0.001
Yes	55.7	44.3	
No	49.1	50.9	
Birth order			<0.001
1 & 2	57.0	43.0	
3 & more	46.8	53.2	
Wealth index			<0.001
Poor	49.1	58.1	
Middle	52.5	47.5	
Rich	64.8	35.2	
Mother's decision on health care visit			0.036
Yes	55.4	44.6	
No	51.7	48.3	

In short, all covariates (community facilities, demographic and socio-economic) excluding mother's age at last birth are highly correlated with skilled ANC visits.

The impact of community facilities, demographic factors, and socio-economic covariates on skilled antenatal care (ANC) is assessed by implementing a binary logistic regression model, as the outcome variable is categorized as a binary response. To achieve this goal, three separate models have been run to address the control effects of each

category of covariates. In Model 1, only the influence of community facilities covariates on skilled ANC visits is examined. Following this, the study introduces the control effects of demographic covariates on community facilities covariates and also examines the combined effects of demographic and community facilities covariates on skilled ANC visits in Model 2. Furthermore, all categories of covariates: community facilities, demographic factors, and socio-economic covariates are considered in Model 3. The

results of the three models are presented in Table 3, which contains the odds ratios (OR) and p-values for each model.

In Model 1, the influence of community facilities on skilled ANC visits is examined. The findings highlight the importance of the main access road in relation to skilled

ANC utilization. Notably, mothers who use other roads to access health facilities are significantly less likely to receive skilled ANC compared to those who use all-weather roads. This is reflected in the odds ratio of 0.517 (p-value = 0.002), indicating a 48.3% lower odds of receiving skilled ANC for mothers traveling on other roads

Table 3. Odds ratio (OR) and p-value of skilled ANC visits associated with selected community facilities, demographic and socio-economic covariates from the binary logistics regression model.

Covariates	Model 1		Model 2		Model 3	
	OR	p-value	OR	p-value	OR	p-value
Intercept	1.407	<0.001	0.296	<0.001		
Main access road						
All Weather ®						
Seasonal	0.863	0.136	0.935	0.560	1.054	0.612
Other	0.517	0.002	0.581	0.013	0.632	0.038
Time taken to reach						
1 hour or less ®						
More than 1 hour	0.724	<0.001	0.767	<0.001	0.855	0.025
Mother's Age at Last Birth						
Below18 ®						
18-35			1.307	0.100	1.209	0.249
Above 35			1.797	0.014	1.564	0.063
Mother's Education						
No education ®						
Primary			1.853	<0.001	1.801	0.001
Secondary			3.279	<0.001	2.879	<0.001
Higher			6.106	<0.001	4.630	<0.001
Wanted child						
No ®						
Yes			1.224	0.016	1.190	0.041
Birth order						
1 & 2 ®						
3 & more			0.896	0.182	0.881	0.128
Wealth index						
Poor ®						
Middle					1.315	0.004
Rich					1.825	<0.001
Mother's decision on health care visit						
No ®						
Yes					1.143	0.072

® means reference category

compared to those travelling on all-weather roads. Conversely, while mothers using seasonal roads to reach health facilities also show lower odds of receiving skilled ANC compared to those on all-weather roads, this difference is not statistically significant (p-value = 0.136, OR = 0.863). Moreover, mothers requiring more than 1 hour to reach health facilities are significantly less likely to access skilled ANC visits compared to those with travel times of 1 hour or less. The odds ratio for travel time exceeding 1 hour is 0.724 (p-value < 0.001), suggesting a 27.6% lower odds of receiving skilled ANC for mothers with longer travel times

compared to those with travel times of 1 hour or less. These insights from Model 1 emphasize the critical role that different types of access roads and travel times play in determining the likelihood of skilled ANC visits among expectant mothers.

In Model 2, after incorporating the control effect of demographic covariates, the influence of community facilities covariates remains same as it is in Model 1, though some slight changes in the magnitude of effects are observed. Specifically, the odds ratios for seasonal and other roads are 0.935 (p-value = 0.560) and 0.581 (p-value = 0.013),

respectively. Additionally, the odds ratio for the time taken to reach the health facility is 0.767 (p -value < 0.001). This implies that mothers using other roads to reach health facilities have a significantly 41.9% lower odds of receiving skilled ANC visits compared to those using all-weather roads, while the impact of seasonal roads on skilled ANC visits remains insignificant. Similarly, mothers needing more than 1 hour to reach health facilities have a significantly 23.3% lower odds of receiving skilled ANC compared to those needing 1 hour or less, aligning with Model 1's findings. Regarding demographic covariates, it is observed that mothers who gave birth to their last child above the age of 35 are significantly more likely to receive skilled ANC, with an odds ratio of 1.797 (p -value = 0.014), compared to those who gave birth below the age of 18. However, there is no significant effect for mothers aged 18-35 who gave birth at that age (OR = 1.307, p -value = 0.100) on skilled ANC visits. Furthermore, maternal education significantly influences skilled ANC visits, with a p -value of < 0.001 for each education category. Specifically, mothers with primary education, secondary education, and higher education are significantly 1.853, 3.279, and 6.106 times more likely to receive skilled ANC compared to those who are illiterate. This suggests that higher levels of maternal education correspond to increased skilled ANC visits. Additionally, mothers who desired their last child are significantly more likely, with an odds ratio of 1.224 (p -value = 0.016), to receive skilled ANC compared to those who did not want their last child. However, birth order shows no significant effect on skilled ANC visits, as the p -value is greater than 0.05 or 0.1.

In Model 3, where the control effect incorporates all covariates, a consistent influence on skilled ANC visits is observed for community facilities, similar to findings from Model 1 and Model 2. Additionally, the impact of demographic covariates on skilled ANC visits remains similar to that of Model 2, with slight adjustments in effect magnitudes due to the inclusion of socio-economic covariates. Moreover, it is worth noting that mothers from middle and rich socioeconomic classes exhibit a significantly more likely to receive skilled ANC compared to those from poor family. Specifically, mothers from these classes have a 31.5% (p -value=0.004) and 82.5% (p -value <0.001) higher odds, respectively, of accessing skilled ANC visits compared to those from poor families. Notably, mothers who are able to make their own decisions regarding healthcare visits are significantly more likely, with an odds ratio of 1.143 and a p -value of 0.072, to receive skilled ANC compared to those who are not able to make their own decisions. These results underscore the importance of socio-economic status and decision-making autonomy in accessing skilled ANC visits, alongside the consistent influence of community facilities and demographic factors on skilled ANC visits.

V. Discussion

For an expectant mother, it is crucially important to visit skilled providers to monitor her health conditions and her

baby's health condition, especially in Bangladesh. Therefore, it is important to identify the factors that encourage a pregnant mother to receive skilled ANC, as well as the factors that hinder them from receiving skilled ANC. To achieve these goals, community facility, demographic, and socio-economic covariates are extensively utilized to assess the impact of these factors on skilled ANC visits.

The results in Table 3 indicate that community facilities play an important role in increasing skilled ANC visits among mothers. Specifically, concerning the main access road, mothers who use other roads have a significantly lower odds of receiving skilled ANC compared to those using all-weather roads. Essendi et al. have also found that poor road quality hindered health service access²⁴. On the other hand, mothers who require more than 1 hour of travel time to reach a health facility have a lower chance of receiving skilled ANC compared to those requiring 1 hour or less. This suggests that mothers residing in remote areas from health facilities are less likely to receive skilled ANC compared to those living nearby, with similar results observed in other studies^{9,21,25}. Therefore, the government should take necessary steps to upgrade other road types to all-weather roads as soon as possible. Additionally, efforts are needed to reduce the time taken to reach health facilities. Hopefully, if these necessary steps are implemented effectively, they will play a significant role in enhancing skilled ANC visits.

On the other hand, among demographic covariates, maternal education and the desire for their last child have a significant positive impact on the frequency of skilled ANC visits, aligning with findings from other studies^{7,9}. However, mothers aged above 35 are significantly more likely to receive skilled ANC visits frequently compared to those aged below 18⁸. One major reason for this could be that expectant mothers aged above 35 have a higher likelihood of experiencing complications such as hypertension, gestational diabetes, etc. To address these challenges, they tend to seek an adequate number of skilled ANC visits. Nevertheless, women of all age categories should receive the appropriate frequency of skilled ANC visits.

This study has revealed that socio-economic factors also exert a significantly positive influence on receiving the appropriate number of skilled ANC visits. Particularly, wealthier women are significantly more likely to receive skilled ANC compared to the poorest women. This trend is observed in other countries as well, where financially stable individuals can afford the necessary number of skilled ANC visits⁸. Consequently, the government should prioritize ensuring the proper number of skilled ANC visits at lower costs for the poorest families in Bangladesh.

Moreover, mothers who make their own decisions regarding healthcare visits are significantly more likely to receive skilled ANC compared to those who cannot. This observation is consistent with findings from other parts of the world⁸. Therefore, every family should empower expectant mothers to make their own decisions about healthcare visits,

as this approach benefits the well-being of both the mother and the child.

VI. Conclusion

This study explores the significant factors that influence skilled ANC utilization in Bangladesh. Community facilities comprised of travel time and physical accessibility, particularly road condition significantly affects the likelihood of receiving skilled ANC. Additionally, maternal education, age, wealth status, and autonomy in healthcare decision-making were all found to be important determinants. Policy interventions should give priority to infrastructure development, such as constructing all-weather roads and enhancing transportation options in rural areas, in order to increase skilled ANC coverage. Furthermore, funding for women's economic development and education is essential. Ensuring equitable access to maternal healthcare services also requires promoting women's autonomy in health-related decisions.

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