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Prevalence of antenatal care use and the factors that influence it: a population-based study in Bangladesh

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ABSTRACT

Background: *Antenatal care (ANC) is very important for pregnant women because it provides information and advice for a healthy pregnancy, safe childbirth, and postnatal recovery, including newborn care, promotion of early, exclusive breastfeeding, and assistance in making a decision on future pregnancies in order to improve pregnancy outcomes. As a result, the purpose of this study was to determine the prevalence and characteristics that are substantially linked with ANC use during pregnancy among Bangladeshi mothers.*

Methods: *The information was taken from the Bangladesh Demographic and Health Survey, which was conducted in 2017-2018. The analysis included a total of 5012 mothers. ANC use was the outcome of interest. The variables linked with ANC usage were discovered using logistic regression models.*

Results*: About 51.8 percent of moms initiated fewer than or equal to three ANC visits, while another 48.2 percent commenced more than or equal to four ANC visits. Respondents' primary and secondary education, respondents' husbands' secondary and higher secondary and above education, higher birth order (three or more), an unwanted child at the time of pregnancy, being urban residents, wealth quintiles, told about signs of pregnancy complications, current ages of children (one year and more than two years), age at first birth, respondents from Khulna, Mymensingh, Rajshahi, Rangpur, and Sylhet divisions, blood sample taken during pregnancy,, blood pressure taken during pregnancy, given or bought iron tablet during pregnancy, family planning worker (FW) comes during pregnancy were significantly associated with the number of ANC visits during pregnancy.*

Conclusion*: Rural location, low household wealth, mothers' and partners' lack of education, and undesired pregnancy all have a substantial impact on the number of ANC visits in Bangladesh. We should start an ANC visit for a frequent ANC visit throughout pregnancy as soon as possible. Women with a high birth order, who live in rural areas, and who have a low educational status should be given extra attention in order to increase the frequency of ANC visits and improve the health of themselves and their children.*

Keywords: *Antenatal Care, Demographic and Health Survey, Binary logistic regression.*

INTRODUCTION

Antenatal care (ANC) is widely recognized as the routine health control of presumed healthy pregnant women without symptoms, in order to complicating obstetric conditions without symptoms or diagnose diseases, and to provide information about lifestyle, pregnancy and delivery. To improve maternal and perinatal health outcomes, ANC is an accessible and cost-effective method whose purpose is to optimize maternal and fetal health, to offer women maternal and fetal screening, to make medical or social interventions available to women where indicated, to improve women's experience of pregnancy and birth and to prepare women for motherhood whatever their risk status. Every pregnant women have to need at least four antenatal check-ups; this is the minimum requirement, the more antenatal visits may also be very necessary both for mother and children (Kurude, et al. 2020). In a study, it has been found that attending at least four ANC visits is an effective policy to increase skilled birth attendant use and institutional delivery (Ryan, et al. 2019). Regardless of significant improvement in primary health care over the latest years, in Bangladesh only 21% of pregnant women take at least four ANC visits, merely 31% of births are delivered at health facilities, and skilled birth attendants assist only 41% of women during childbirth in Bangladesh (Arifeen, et al. 2013). According to the recent recommendation by the World Health Organization (WHO), a lack of access to health providers and facilities has contributed to nearly three in four (73%) mothers in Bangladesh not receiving four or more ANC visits from skilled health professionals (WHO, 2016). Although, there is almost all modern facilities are available only 37% of Bangladeshi pregnant women are receiving at least four ANC services (BBS,UNICEF,2019).Since the Millennium Development Goals were signed by 189 world leaders in 2000 maternal health outcomes have been the center of public health-related international manifestos (Lozano et al., 2011). According to the World health report 2006, worldwide, among women of reproductive age complications during pregnancy, childbirth and the postnatal period are the leading causes of death and disability. Globally around 287000 maternal deaths occurred in 2010 (Goli, and Arokiasamy 2014). And between 1990 and 2015, the maternal mortality ratio has declined by 75% globally (Tsegaye and Ayalew, 2020). Almost all of maternal deaths are occurred in low and middle income countries (WHO, 2005). In 2017, maternal mortality for Bangladesh was 173 deaths per 100,000 live births. The national target for Bangladesh is to reduce maternal mortality ratio to 105 (per 100,000 live births) by 2021. It was observed that maternal mortality ratio in 2015 is 176 and is predicted as 87 per in 2021. (Rajia, et al. 2015).

In a study it has been found that high compliance (> 50%) of service sub-components were observed in blood pressure monitoring, weight measurement, iron and folate supplementation given, and tetanus vaccine, while lower compliance of service sub-components (< 50%) were observed in some physical examinations such as edema and ultra-sonogram and routine tests such as blood test and urine test; average unit costs of ANC service provision were about double at the facility level ($2.75) compared to community-based care ($1.62) and average unit costs of ANC service provision were about double at the facility level ($2.75) compared to community-based care ($1.62) (Jo,2019). In a study in Bangladesh it was found that about 22% of the pregnant women did not take any ANC visits and only 31% took ANC at least 4 times during their pregnancy period due to money constraint (Bhowmik, et al2020). A study conducted in Bangladesh using Bangladesh demographic and Health Survey (BDHS) 2014, had found, on average, mothers received less than three (2.7 visits) ANC visits and only 6% receive the recommended eight or more ANC visits, about 22% of the mothers received all the prescribed basic items of ANC services, about one-fifth (21%) of the mothers never received ANC visits and thus no items of ANC services (Islam and Masud 2018). In rural Bangladesh, around 25% of women attended at least four ANC contacts, with only 11% initiating ANC in the first trimester of pregnancy (Siddique et al. 2018). Another study conducted in Chittagong Hill Tracts, Bangladesh have found that 69% of respondents were aware of ANC services and the prevalence of attending ANC services was 53% where almost half (52%) attended private facilities; independent factors associated with knowledge about ANC were age ≥30 years, monthly household income greater than 20,000 Bangladeshi Taka; knowledge of pregnancy-related complications, knowledge about nearest health facilities and attending secondary school or above (Akter et al. 2020). In a study conducted in Dhaka City where two hundred married women in the age range 15-49 years were interviewed, it was found that ANC services were used in any of the previous pregnancy among women under study was 64.3%; education and income were significantly related with ANC suggesting that the higher the level of education and the higher the income of the respondents the higher is the likelihood of receiving ANC during pregnancy (Kabir and Khan 2013). A study in rural southern Ghana had found maternal age is significantly associated with timing of initiation of antenatal care visit among first-time mothers; older women were more likely to initiate ANC visit in the first trimester of gestation compared to the younger women (Manyeh, et al. 2020). Another study conducted in Nepal where half of the women had four or more ANC visits and 85% had at least one visit; women who did not smoke, had a power of decision-making, whose partners had higher levels of education and were who had occupations other than agriculture were more likely to attend four

or more visits (Joshi et al. 2014). Another study conducted in Uganda (Bbaale, 2011) had found that only 17% and 47% of mothers initiate the first antenatal visit in the first trimester and attain at least four antenatal visits, respectively. In south Ethiopia, a study (Gebremeskel et al. 2015) indicated that pregnant women having low monthly income, women who did not receive advice on when to start ANC, women with household food insecurity and women with unplanned pregnancy had higher odds of late ANC attendance compared with their counterparts. Another study of Ethiopia where women in low economic level, high birth order, rural residence, and low educational status was suggested to give special attention to increase the frequency of ANC visits (Muchie, 2017). In northern Ethiopia, women with unplanned pregnancy, whose previous first ANC was after 16 weeks, who did not accompany their partner for ANC visit, women recognized their current pregnancy at 3 months or late and participants provided adequate time for their previous ANC by health professionals were found the determinant factors of late ANC at first visit (Weldearegawi et a. 2019). In another study conducted in Ethiopia it was found that women who had completed primary school, who had secondary school, who listen radio less than once per week, who listen radio at least 1 per week, women in rich wealth quintile were positively associated with ANC utilization, and on the other hand, women having traditional belief, women having five children and above were associated negatively with ANC utilization (Tsegaye and Ayelew 2020). In another study of rural Bangladesh, around 25% of women attended at least four ANC contacts; in the first trimester of pregnancy, only 11% initiating ANC; blood pressure was measured in almost all of the ANC contacts (92%), abdominal examination performed in 80%; weight measured in 85% of ANC contacts; urine tests were conducted in less than half of the ANC contacts; blood screening tests and ultrasound were conducted in 45% contacts; health care providers counsel women on danger signs in only 66% of the ANC contacts (Jo et al. 2019). Timely, proper and sufficient antenatal checkup plays a very fruitful impact in reducing maternal mortality and morbidity. Without proper ANC checkup during pregnancy period, there may occur various serious pregnancy complications. Therefore, this study attempts to provide assessment about the prevalence of ANC visits and factors associated with ANC utilization in Bangladesh.

METHODS

Study design and sample

The study is a population-based study. The study populations were pregnant women in Bangladesh. Data of this study has been collected from Bangladesh Demographic and Health Survey (BDHS) 2017-2018. BDHS is nationally representative and covers the entire population residing in non-institutional dwelling units in the country. The survey used a list of enumeration areas (EAs) of the 2011 Population and Housing Census of the People's Republic of Bangladesh, provided by the Bangladesh Bureau of Statistics (BBS), as a sampling frame (BBS 2011). The primary sampling unit (PSU) of the survey is an EA with an average of about 120 households. The survey is based on a two-stage stratified sample of households. In the first stage, 675 EAs were selected with probability proportional to EA size, with 250 EAs in urban areas and 425 in rural areas. In the first stage, the sample was drawn by BBS, following the specifications provided by the DHS team. A complete household listing operation was then carried out in all selected EAs to provide a sampling frame for the second-stage selection of households. In the second stage of sampling, a systematic sample of 30 households on average per EA was selected to provide statistically reliable estimates of key demographic and health variables for the country as a whole, for urban and rural areas separately, and for each of the eight divisions. In accordance with this design, 20,250 residential households were selected. Completed interviews were expected from about 20,100 ever-married women aged 15–49 years. A total of 5012 mothers was included in the analysis.

Outcome measures

ANC utilization for ever-married women of reproductive ages was our outcomes of interest.

Explanatory variables

We identified potential explanatory variables from previously published literature on ANC in Bangladesh and other Southeast Asian countries. The individual-level variables were: Age, region, religion, education of the respondents' and their husbands', sex of child and household head, wealth quintile, visits during pregnancy, place of residence, wealth quintile, number ~~no~~ of living children, current age of children, birth order, wanted pregnancy, signs and complications of pregnancy, family planning worker attend during pregnancy, money problem during getting medical help, getting permission to go to health facility, blood pressure measured during pregnancy, urine and blood sample taken during pregnancy, iron tablet taken during pregnancy and number of ANC.

Statistical analysis

All interview questionnaires were checked for their internal consistency to exclude missing or inconsistent data. Data were entered into the data file using statistical software called SPSS (Statistical Package for Social Science). Data checked, cleaned and edited properly before analysis. Data was analyzed in the SPSS version 22, and frequency distribution, Chi-Square and binary logistic regression were done for important variables. Each of the respondents was ~~were~~ informed about the study and requested to provide verbal consent before starting the interview. It is expected that the findings would help policy makers, population scientists and planners to the understanding of health care utilization of urban slum poor women and can consider strategies for improving the health care utilization of the poor urban slum women. In retrospective study, it is difficult to get real picture of pregnant women and the associated factors because all related information were not available in the data set. Detailed information on maternal healthcare was available for the last births that have taken place during the last five years.

RESULTS

Table 1 shows background characteristics of the women analyzed. Most women included in this study are in age group of 15-24 years (88.6%). 16.7% respondent are in Chattogram division and lowest percentage of respondent had found in Rajshahi division that is 10.4%. Most of the respondent had their most recent birth at age less than or equal to age 24 years. 99.8% respondents are Muslims. Almost 47% women had secondary education and only 6.2% had no education. 33.1% of women's husband had primary education and 13.5% of respondent's husband had no education. The majority lived in rural areas (65.6%) and 45.9% reported having no regular access to mass media. Majority of household heads are reported as male (87.9%). In case of wealth quintile, 21.5% respondents are poorest and 20.4% are richest.

Table 2 shows reproductive health characteristics of women analyzed. 40.1% had one children and only 1.0% had no child; among them 35.6% of children are in age less than 1 year. 38.2% of women had birth order one and 29.1% had birth order greater than or equal to 3. 78.9% of women had wanted pregnancy and 97.9% had living children. 58.3% of pregnant women told about signs of pregnancy complications. In case of getting medical help for self, 59% of women getting money for treatment without any big problem and 88.8% had permission to go to health facility. 86.3% had measured blood pressure, 67.2% had taken urine sample, 61.1% taken blood

sample and 76.3% given or bought iron tablet during pregnancy. 51.8% of women had less than or equal to three antenatal care visits during the pregnancy, and 48.2 % had the WHO-recommended four or more visits.

From the χ^2test result in the table 3, we found that 52.5%, 44.4% respondents had received less than or equal to three ANC visits and 47.5%, 55.6% respondents had received greater than or equal to four ANC visits whose religion were Islam and others respectively. And we have the calculated chi-square value for the association between "ANC visits" and "religion" which is 10.109 with 1 degrees of freedom at 5% level of significant. Hence there is a significant relationship (ρ=.0001) between "ANC visits" and "religion" at 5% level of significance.

We have also found from the χ^2test result in the table 3 that 79.8%, 65.8%,48.5%, 29.5% respondents had received less than or equal to three ANC visits and 20.2%, 34.2%, 51.5%,70.5% respondents had received greater than or equal to four ANC visits whose educational qualification were no education, primary education, secondary education, higher secondary and above respectively. And we have the calculated chi-square value for the association between "ANC visits" and "education of the respondent" which is 398.529 with 3 degrees of freedom at 5% level of significant. Hence there is a significant relationship (ρ=.0000) between "ANC visits" and "education of the respondent" at 5% level of significance. In case respondent's husband's education, we get the chi-square value for the association between "ANC visits" and "education of the respondent's husband" which is 384.665 with 3 degrees of freedom at 5% level of significant. Hence there is a significant relationship (ρ=.0000) between "ANC visits" and "education of respondent's husband" at 5% level of significance. Birth order of respondent has also significant relationship (ρ=.0000) with "ANC visits" at 5% level of significance at 2 degrees of freedom where chi-square value is107.491.

From the χ^2test result in the table 3, we found that 53.3%, 27.7% respondents had received less than or equal to three ANC visits and 46.7%, 72.3% respondents had received greater than or equal to four ANC visits whose age at first birth less than or equal to twenty four and greater than or equal to 25 respectively. And we have the calculated chi-square value for the association between "ANC visits" and "age at first birth" which is 70.394 with 1 degrees of freedom at 5% level of significant. Hence there is a significant relationship (ρ=.0000) between "ANC visits" and "age at first birth" at 5% level of significance. Number of living children has a significant relationship (ρ=.0000) with "ANC visits" at 5% level of significance at 3 degrees of freedom. We have the calculated chi-square value for the association between "ANC visits" and "current age

of children" which is 11.033 with 2 degrees of freedom at 5% level of significant. Hence there is a significant relationship (ρ=.0004) between "ANC visits" and "current age of children" at 5% level of significance.

We have also found from the χ^2test result in the table 3 that 55.4%, 33.9% respondents had received less than or equal to three ANC visits and 44.6%,66.1% respondents had received greater than or equal to four ANC visits who told about signs of pregnancy complications who did not told about signs of pregnancy complications respectively. And we have the calculated chi-square value for the association between "ANC visits" and "told about signs of pregnancy complications" which is 197.238 with 1 degrees of freedom at 5% level of significant. Hence there is a significant relationship (ρ=.0000) between "ANC visits" and "told about signs of pregnancy complications" at 5% level of significance. We have the calculated chi-square value for the association between "ANC visits" and "Wanted pregnancy when became pregnant" which is 51.923 with 2 degrees of freedom at 5% level of significant. Hence there is a significant relationship (ρ=.0000) between "ANC visits" and "Wanted pregnancy when became pregnant" at 5% level of significance. There is significant relationship (ρ=.0000) between "ANC visits" and "getting medical help for self: getting permission to go" with 1 degrees of freedom at 5% level of significant. In case of getting money needed for treatment, we have found a significant relationship (ρ=.0000) p with "ANC visits" with 1 degrees of freedom at 5% level of significant.

We have also found from the χ^2test result in the table 3 that 41.0%, 57.5%,respondents had received less than or equal to three ANC visits and 59.0%,54.6% respondents had received greater than or equal to four ANC visits whose types of place of residence were rural and urban respectively. And we have the calculated chi-square value for the association between "ANC visits" and "types of places of residence" which is 124.026 with 1 degrees of freedom at 5% level of significant. Hence there is a significant relationship (ρ=.0000) between "ANC visits" and "types of place of residence" at 5% level of significance. There is significant relationship (ρ=.000-0) between "ANC visits" and "wealth quintile" with 4 degrees of freedom at 5% level of significant. In case of exposure to mass media, there is significant relationship (ρ=.0000) between "ANC visits" and "exposure to mass media" with 1 degrees of freedom at 5% level of significant. We have also found a significant relationship (ρ=.0000) between "ANC visits" and "region" with 7 degrees of freedom at 5% level of significance.

From the χ^2test result, we have found that 88.4%, 45.0% respondents had received less than or equal to three ANC visits and 11.6%,55.0% respondents had received greater than or equal to four ANC visits whose blood pressure were taken and were not taken during pregnancy respectively. And we have the calculated chi-square value for the association between "ANC visits" and "blood pressure taken during pregnancy" which is 197.490 with 1 degrees of freedom at 5% level of significant. Hence there is a significant relationship (ρ=.0000) between "ANC visits" and "blood sample taken during pregnancy" at 5% level of significance. There is also a significant relationship (ρ=.0000) between "blood pressure taken during pregnancy" with 1 degrees of freedom at 5% level of significant. We have also found significant relationship (ρ=.0000) between "ANC visits" and "urine sample taken during pregnancy"; "ANC visits" and "given or bought iron tablet during pregnancy" with 1 degrees of freedom at 5% level of significance. There is a significant relationship (ρ=.0000) between "ANC visits" and "FW come during pregnancy" with 1 degrees of freedom at 5% level of significance.

From the above chi-square table, we have found insignificant relationship between "ANC visits" & "current age of respondent"; "ANC visits" & "child is alive"; "ANC visits" & "sex of household head"; "ANC visits" & "sex of child" at 5% level of significance.

The table 4 gives the estimates of the logistic regression co-efficient corresponding to the independent variables and relative odds calculated for each category of the categorical variables. The category with relative odds of 1.000 represents the reference category for that variable. This table also gives the regression co-efficient of β and p-value.

In case of respondent's current age, from the table 4 it was found that the regression co-efficient and the odd ratio for literate are -0.123 and 0.884 respectively, which implies that it has non-significant negative impact on number of antenatal visits during pregnancy. So, the women aged 25-49 are 0.884 times likely to have antenatal visits than those who were aged 15-24.

In case of respondent's education, from the table 4 it was found that the regression co-efficient and the odd ratio for the respondents who had no education, primary education, secondary education and higher secondary and above education are -0.701&0.496, -0.384 & 0.681, and -0.120 & 0.887 respectively, which implies that respondent with primary & secondary education has significant and respondent with higher secondary and above education has non-significant impact on number of antenatal visit during pregnancy. So, respondent with primary & secondary education are -0.701 and -0.384 times likely to antenatal visits than those who had

no education. Respondent's husband with secondary and higher secondary education had significant impact on number of antenatal visit that are 1.453 & 1.999 times likely to antenatal visits than those who had no education.

Exposure to mass media has non-significant impact on number of antenatal visit during pregnancy. In case of birth order, respondent with 2nd birth order has non-significant impact greater than or equal to 3rd birth order has significant on number of ANC visits where pregnant women with 3rd birth order had 0.728 times likely to ANC visits than those who had 1st birth order. Pregnant women resided with urban place had significant impact on ANC and 1.381 times likely to ANC visits than those who lived in rural place.

Wealth quintile has significant impact on number of ANC visit during pregnancy and poorer, middle, richer, richest had 0.526, 0.531, 0.644 & 0.658 times respectively likely to ANC visits than those who are poorest. Women telling about sign of pregnancy complication has significant impact on ANC and 2.022 times likely to ANC visits than those who didn't tell about sign of pregnancy complications.

In case of current age of children, from the table 4 it was found that the regression co-efficient and the odd ratio for children aged 1 year & greater than or equal to 2 years are -0.297 and -0.154 respectively, which implies that it has significant negative impact on number of antenatal visit during pregnancy. So the women having children aged 1 year & greater than or equal to 2 years are respectively0.743 & 0.854 times likely to have ANC visits than those who had children aged less than 1 year. Respondents whose at first birth were greater than or equal to 25 has also significant negative impact on ANC and had 0.634 times likely to ANC visits than those whose age at first birth were less than or equal to 24.

From the table 4, it was found that the regression co-efficient and the odd ratio for whose blood sample were taken during pregnancy are -0.602 and 0.548 respectively, which implies that it has significant negative impact on number of antenatal visits during pregnancy. So the women for whose blood sample were taken during pregnancy are 0.548 times likely to have ANC visits than those whose blood sample were not taken during pregnancy. Pregnant women whose urine sample were taken during pregnancy had also significant impact on ANC visits and had 0.366 times likely to ANC visits than those where not taken urine sample during pregnancy. FW comes during pregnancy had also significant impact on ANC visits and had 0.275 times likely to ANC visits than those where FW didn't come during pregnancy.

DISCUSSION

This study used the 2017-2018 Bangladesh Demographic and Health Survey data to examine the prevalence and factors associated with antenatal care utilization among rural pregnant women in Bangladesh among mothers during their recent pregnancy in Bangladesh. The multilevel mixed-effects analyses were used to account for clustering. This study differed from previous studies conducted in Bangladesh (Jo et al. 2019) that describe the coverage and content of ANC contacts in the context of rural Bangladesh. The study found an overall 51.2% of the mothers had received less than or equal to three ANC visits, 48.2% received greater than or equal to four visits.

For frequency of ANC visits as a response, the binomial regression analysis revealed that the covariates: primary & secondary education of respondents, secondary & higher secondary and above education of respondent's husband, higher birth order -- three or more, an unwanted child at the time of pregnancy, being urban resident, wealth quintile (poorest, poorer, middle, richer, richest), told about signs of pregnancy complication, current age of children -- one year and more than 2 years, age at first birth, respondents of Khulna, Mymensingh, Rajshahi, Rangpur, Sylhet division, blood sample taken during pregnancy, blood pressure taken during pregnancy, given or bought iron tablet during pregnancy, FW comes during pregnancy were significantly associated with the number of ANC visits during pregnancy.

The result shows that the birth order of the child inversely associated with frequency of ANC visits. Mothers are less probable to start ANC visit early and frequently receive ANC services to their three or higher birth order child. This is in line with a previous study in Uganda (Bbaale, 2011) that has found mothers with third birth order, compared to those with the first, are about 6-7% less likely to attain the four antenatal visits, and mothers with at least the third birth order, are 4–5% times less likely to initiate the first visit in the first trimester. Another study conducted in Ethiopia (Muchie, 2017) also showed that 38 and 36% lower odds of completing four or more visits of ANC utilization for birth order of child four or five and six or more respectively.

Rural mothers are less probable to have a higher number of ANC than the urban mothers. This finding is congruent with a study of Chandi Joshi, (Joshi et al 2014) that reported urban women are 2.79 (2.13 to 3.65) times more likely to frequent ANC visits than those in rural area. Similar findings from Bangladesh (Siddique, 2018) reported urban mothers having 1.16 times more frequent ANC visits than their rural counterparts. The reason might be that in the rural areas of Bangladesh, there is a lack of information on antenatal care services. Further, majority of

mothers in rural area of Bangladesh were uneducated. But a contrary findings have been found from Gebremeskel et al (Gebremeskel, 2015), (Weldearegawi, 2019) reported place of residence was not associated with ANC visit. This inconsistency might be due to the statistical methodology used and the smaller sample size used (n=409), whereas the BDHS 2017 used (n= 5012).

In addition, the result shows that the frequency of ANC visits during pregnancy is higher among mothers from richest, richer, and middle household wealth status compared to the poorest household wealth. This finding is in line with that of (Siddique et al. 2018), (Yaya et al. 2017). But our findings is inconsistent in the sense that poorer and middle wealth status did not significantly associated with the number of ANC utilization in Bangladesh, whereas the richer and richest wealth status did significantly increase the incidence of ANC utilization by 28% and 46% respectively. The result shows that current age of respondent inversely associated with frequency of ANC visits. This study differed from the previous one conducted in Ethiopia (Tsegaye and Ayalew 2020) where from chi-square analysis result, it has been found that age of respondent significantly associated with ANC visits.

Furthermore, we found that the mothers' and husbands' education level is an important risk factor that significantly affects the frequency of ANC visits in Bangladesh. Mothers having at least primary education level are more likely to receive ANC visits. Similarly, mothers whose partners attained at least primary education are more likely to attain a higher number of ANC visits compared to those who had no education. Besides, a higher level of education of husbands associated with higher odds of ANC visit than a husband who attended no education. Further analysis of the 2014 Bangladesh DHS showed that education levels of mother and their husbands had a significant positive association with frequency of ANC visits. Mother with higher level of education were 1.59 times more likely to have ANC visits than the women with no education (OR = 1.59, 95% CI: 1.31–1.92) (Islam, 2018). In another study (Tsegaye and Ayalew 2020) respondent's education significantly associated with ANC visit where participants whose educational status of secondary education school were 4.4 times more likely to utilize antenatal care service than non-educated (AOR = 4.4, 95%CI, 1.1, 17.3, $p < 0.001$). Similar studies reported a findings of 1.22, 1.49, and 1.59 incidence rate ratio of the frequency of ANC visits among mothers with primary, secondary and higher education in Bangladesh (Islam and Masud 2018) .Consistent to our finding (Islam and Masud 2018) also found that mothers with primary 1.12 times, secondary 1.26 times, and higher education 1.39 times more

likely to receive higher numbers of items of ANC contents in Bangladesh. Contrary (Gebremeskel et al. 2015) it has been found that having a secondary or higher education did significantly increase the incidence frequency of ANC utilization by 35% and 63%, respectively, while a primary education did not significantly increase the incidence of utilizing the ANC service in Bangladesh.

Partner's primary level of education has not significantly increased the incidence of receiving the contents of ANC services in Bangladesh, whereas partners having a secondary or higher education did significantly increase the incidence of the contents of ANC services mothers received. But the number of ANC visits increases with primary, secondary, and higher education level of partners compared to the uneducated (Islam, 2018). In contrast, Ghana (Manyeh et al. 2020) found insignificant effect of husband's level of education on the timing of ANC visits. This may be due to the fact of educated mother has better access to information, make decisions on own health care and could empower them to exercise, and able to change traditional attitudes of utilizing the ANC service as compared to uneducated. So there is an urgent need to focus on education of mother.

The result suggests also that mother's frequently watching television insignificantly associated with ANC visits. Similar study has been found (Yaya et al, 2017) where mothers watching television were 2.29 times more likely to receive a minimum of four ANC visit compared to those didn't watch television at all. In contrast, a study in Bangladesh (Bhowmik et al. 2020) , showed association between watching television and the antenatal care visit. Mothers who had permission to go in seeking medical care for her own are more likely to frequently visited ANC (Woldeamanuel, 2020) .This is in line with a previous study in Ethiopia (Woldeamanuel, 2020) that has found mothers with no problem of getting permission to go in seeking their own medical care (IRR = 1.07; 95%CI: 1.01-1.14) has association with ANC visits.

Mothers whose pregnancies are unwanted or wanted later were less likely to have frequently visited and received the highest number of items of contents of ANC services. A similar result have also been found from some studies (Islam,2018),(Bhowmik,2020), (Weldearegawi,2019) where ANC visits is significantly associated with unwanted pregnancy. The results indicate that the number of ANC visits is positively associated with blood sample taken, blood pressure taken, urine sample taken during pregnancy. A comparable study conducted (Joshi, 2014) had found where 56% had a urine sample taken and 45% had a blood sample taken

Conclusion

This study point out that overall knowledge about antenatal care was found to be better among women who had utilized antenatal care as compared to women who did not receive antenatal care. Reproductive aged (15-49) women need to recognize the importance of antenatal care and to receive such care in the community.

Findings of this study suggest that educated respondents and respondents with educated husband are more aware to take more than four ANC visits rather than uneducated respondent and also whose husbands have no education. Yet again we have found that higher birth order (three or more), an unwanted pregnancy, respondent of urban resident, told about signs of pregnancy complication, current age of children (one year and more than 2 years), age at first birth, blood sample taken during pregnancy, blood pressure taken during pregnancy, given or bought iron tablet during pregnancy, FW comes during pregnancy were significantly associated with the number of ANC received in Bangladesh. Rural residence, poorest household wealth status, no education level of mothers or partners, unexposed to mass media, and unwanted pregnancy have significant impacts in reducing the number of ANC visits in Bangladesh.

Recommendations

From the study findings, we may have some policy implications, merit additional comment and recommendations that would help the Government to achieve improvement in maternal health: (1). increase in both male and female education and literacy, especially in rural areas, ~~that~~ can bring expected result in improved maternal health in Bangladesh. Education may provide awareness to achieve proper ANC service; and (2) an increase in frequency of blood sample taken, urine sample taken and blood pressure during pregnancy may improve maternal health by virtue of increase in the frequency of ANC visits in Bangladesh .

Limitations

This study had some core limitations: first, the study was limited to only the variables collected in the BDHS. Factors that may affect ANC care but are not available in DHS could not be examined. Secondly, in this study, we have used BDHS 2017-18 data that had been collected prior to the COVID-19 pandemic situation and that’s why this study is unable to represent the current situations. That is a major limitation of this study.

Data availability: The datasets used and analyzed during the current study are available from the Measure DHs website: https://dhsprogram.com/data/available-datasets.cfm.

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Authors' contribution: MNP was the ones who came up with the idea for the study, performed the key statistical analyses, and wrote the first draft of the manuscript. MR and NIM provided feedback on the statistical analyses as well as the draft manuscript. The final study was read and approved by all contributors.

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Table 1: Percentage distribution of socio-demographic characteristics of women who had a live birth in the five years proceeding in the survey where n=5012

Characteristics	**Categories**	**Number of women(n)**	**Percentage (%)**
Current age of respondent(in years)	15-24	4441	88.6
	25-42	285	5.7
Age at first birth(in years)	≤24	4727	94.3
	≥25	285	5.7
Region	Barishal	533	10.6
	Chattogram	835	16.7
	Dhaka	741	14.8
	Khulna	524	10.5
	Mymensingh	603	12.0
	Rajshahi	527	10.5
	Rangpur	559	11.2
	Sylhet	690	13.8
Religion	Muslim	5003	99.8
	Others	9	0.2
Education of the respondent	No education	312	6.2
	Primary	1392	27.8
	Secondary	2402	47.9
	Higher secondary and above	906	18.1
Husband's education	No education	679	13.5
	Primary	1657	33.1
	secondary	1635	32.6
	Higher secondary and above	962	19.2
Exposure to mass media (TV)	No	487	45.9
	Yes	2299	40.7
Sex of child	Male	2624	52.4
	Female	2388	47.6
Types of place of residence	Rural	3287	65.6
	Urban	1725	34.4
Sex of household head	Male	4404	87.9
	Female	608	12.1
Wealth quintile	Poorest	1079	21.5
	poorer	1017	20.3
	Middle	905	18.1
	richer	988	19.7
	richest	1023	20.4

Table 2. Percentage distribution of reproductive health characteristics of women who had a live birth in the five years proceeding in the survey where n=5012

Characteristics	**Categories**	**Number of women (*n*)**	**Percentage (%)**
Number of living children	No child	50	1.0
	1 child	2009	40.1
	2 child	1676	33.4
	≥3 child	1277	25.5
Current age of children	<1 year	1782	35.6
	1 year	1625	32.4
	≥2 years	1492	29.8
Birth order	1	1915	38.2
	2	1638	32.7
	≥3	1459	29.1
Wanted pregnancy when became pregnant	Then	3954	78.9
	Later	651	13.0
	No more	407	8.1
Child is alive	No	113	2.3
	Yes	4899	97.7
FW come during pregnancy	No	3129	62.4
	Yes	1883	37.6
Told about signs of pregnancy complications	No	2923	58.3
	Yes	1673	33.4
Getting medical help for self: getting money needed for treatment	Big problem	2053	41.0
	Not a big problem	2959	59.0
Getting permission to go to health facility	Big problem	560	11.2
	Not a big problem	4452	88.8
Blood pressure measured during pregnancy	No	277	5.5
	Yes	4327	86.3
Urine sample taken during pregnancy	No	1235	24.6
	Yes	3369	67.2
Blood sample taken during pregnancy	No	1544	30.8
	Yes	3060	61.1
Given or bought iron tablet during pregnancy	No	1180	23.5
	Yes	3822	76.3
Number of ANC visits	≤3	2598	51.8
	≥4	2414	48.2

Table 3: Association between the number of ANC visits and some selected socio-demographic and reproductive health related variables**:**

Characteristics	Level	No. of ANC visits			Cal χ^2, d .f ρ	Significance level at 5%
		≤3	≥4	Total		
Religion	Islam Other	2410(52.5%) 188(44.4%)	2179(47.5%) 235(55.6%)	4589(100%) 423(100%)	χ2cal=10.109 d.f=1 ρ=0.001	Significant
Education of the respondent	No education Primary Secondary Higher secondary and above	249(79.8%) 916(65.8%) 1166(48.5%) 267(29.5%)	63(20.2%) 476(34.2%) 1236(51.5%) 639(70.5%)	312(100%) 1392(100%) 2402(100%) 906(100%)	χ2cal=398.529 d.f=3 ρ=0.000	Significant
Husband education	No education Primary Secondary Higher secondary and above	476(70.1%) 1020(61.6%) 786(48.1%) 268(27.9%)	20329.9%) 637(38.4%) 849(51.9%) 694(72.1%)	679(100%) 1657(100%) 1635(100%) 962(100%)	χ2cal=384.665 d.f=3 ρ=0.000	Significant
Birth order	1 2 ≥3	854(44.6%) 832(50.8%) 912(62.5%)	1061(55.4%) 806(49.2%) 547(37.5%)	1061(100%) 806(100%) 547(100%)	χ2cal=107.491 d.f=2 ρ=0.000	Significant
Age at first birth(in years)	≤24 ≥25	2519(53.3%) 79(27.7%)	2208(46.7%) 206(72.3%)	4727(100%) 285(100%)	χ2cal=70.394 d.f=1 ρ=0.000	Significant
Number of living children	No child 1 child 2 child ≥3	33(66.0%) 888(44.2%) 852(50.8%) 825(64.6%)	17(34.0%) 1121(55.8%) 824(49.2%) 452(35.4%)	50(100%) 2009(100%) 1676(100%) 1277(100%)	χ2cal=134.988 d.f=3 ρ=0.000	Significant
	≤1 year	966(54.2%)	816(45.8%)	1782(100%)	χ2cal=11.033	Significant

Current age of children	1 year ≥2 years	842(51.8%) 722(48.4%)	783(48.2%) 770(51.6%)	1625(100%) 1492(100%)	d.f=2 ρ=0.004	
Current age of respondent(in years)	15-24 25-49	1368(51.8%) 1230(51.9%)	1274(48.2%) 1140(48.1%)	2642(100%) 2370(100%)	χ2cal=0.007 d.f=1 ρ=0.932	Insignificant
Told about signs of pregnancy complications	No Yes	1618(55.4%) 567(33.9%)	1305(44.6%) 1106(66.1%)	2923(100%) 1673(100%)	χ2cal=197.238 d.f=1 ρ=0.000	Significant
Wanted pregnancy when became pregnant	Then Later No more	1969(49.8%) 351(53.9%) 278(68.3%)	1985(50.2%) 300(46.1%) 129(31.7%)	3954(100%) 651(100%) 407(100%)	χ2cal=51.923 d.f=2 ρ=0.000	Significant
Child is alive	No Yes	68(60.2%) 2530(51.6%)	45(0.9%) 2369(48.4%)	113(100%) 4899(100%)	χ2cal=3.222 d.f=1 ρ=0.073	Insignificant
Sex of household head	Male Female	2270(51.5%) 328(53.9%)	2134(48.5%) 280(46.1%)	4404 (100%) 608(100%)	χ2cal=1.236 d.f=1 ρ=0.266	Insignificant
Sex of child	Male Female	1329(50.6) 1269(53.1%)	1295(49.4%) 548(46.9%)	2624(100%) 2388(100%)	χ2cal=3.112 d.f=1 ρ=0.078	Insignificant
Getting medical help for self: getting permission to go	Big problem Not a big problem	351(62.7%) 2247(50.5%)	209(37.3%) 2205(49.5%)	560(100%) 4452(100%)	χ2cal=29.688 d.f=1 ρ=0.000	Significant
Getting medical help for self: getting money needed for treatment	Big problem Not a big problem	1254(61.1%) 1344(45.4%)	799(38.9%) 1615(54.6%)	2053(100%) 2959(100%)	χ2cal=119.065 d.f=1 ρ=0.00	Significant
Types of place of residence	Rural Urban	707(41.0%) 1891(57.5)	1018(59.0%)	1725(100%)	χ2cal=124.026 d.f=1	Significant

			1396(42.5%)	3287(100%)	ρ=0.000	
Wealth quintile	Poorest Poorer Middle Richer Richest	746(69.1%) 630(61.9%) 472(52.2%) 456(46.2%) 294(28.7%)	333(30.9%) 387(38.1%) 433(47.8%) 532(53.8%) 729(71.3%)	1079(100%) 1017(100%) 905(100%) 988(100%) 1023(100%)	χ2cal=402.427 d.f=4 ρ=0.00	Significant
Exposure to mass media (TV)	No Yes	1473(64.1%) 800(39.2%)	826(35.9%) 1241(60.8%)	2299(100%) 2041(100%)	χ2cal=271.702 d.f=1 ρ=0.000	Significant
Region	Barisal Chittagong Dhaka Khulna Mymensingh Rajshahi Rangpur Sylhet	319(59.8%) 497(59.5%) 346(46.7%) 212(40.5%) 312(51.7%) 261(49.5%) 215(38.5%) 436(63.2%)	214(40.2%) 338(40.5%) 395(53.3%) 312(59.5%) 291(48.3%) 266(5.5%) 344(61.5%) 254(36.8%)	533(100%) 835(100%) 741(100%) 524(100%) 603(100%) 527(100%) 559(100%) 690(100%)	χ2cal=145.280 d.f=7 ρ=0.000	Significant
During pregnancy: blood pressure taken	No Yes	245(88.4%) 1945(45.0%)	32(11.6%) 2382(55.0%)	277(100%) 4327(100%)	χ2cal=197.490 d.f=1 ρ=0.000	Significant
During pregnancy: blood sample taken	No Yes	1024(66.3%) 1166(38.1%)	520(33.7%) 1894(61.9%)	1544(100%) 3060(100%)	χ2cal=327.593 d.f=1 ρ=0.000	Significant
During pregnancy: urine sample taken	No Yes	844(68.3%) 1346(40.0%)	391(31.7%) 2023(60.0%)	1235(100%) 3369(100%)	χ2cal=291.997 d.f=1 ρ=0.000	Significant
During pregnancy: given or bought iron tablets/syrup	No Yes	931(78.9%) 1661(43.5%)	249(21.1%) 2161(56.5%)	1180(100%) 3822(100%)	χ2cal=453.840 d.f=2	Significant

					ρ=0.000	
FW come during pregnancy	No Yes	1979(63.2%) 619(32.9%)	1150(36.8%) 1264(67.1%)	3129(100%) 1883(100%)	χ2cal=434.404 d.f=1 ρ=0.000	Significant

Table 4: Binary logistic regression models for the association between number of antenatal visits and other socio-demographic and reproductive health related variables, (n=5012)

Characteristics	Co-efficient (β)	Odds ratio (OR)	*p*-values	CI (95.0%) of OR	
				Lower	Upper
Age (in years)					
15-24	….	1			
25-49	-0.123	0.884	0.213	0.729	1.073
Education					
No education	….	1			
Primary	-0.701	0.496	0.001	0.329	0.749
Secondary	-0.384	0.681	0.003	0.527	0.880
Higher secondary and above	-0.120	0.887	0.260	0.720	1.093
Husband's education					
No education	…..	1			
Primary	0.188	1.207	0.111	0.958	1.520
Secondary	0.374	1.453	0.000	1.224	1.724
Higher secondary and above	0.692	1.999	0.000	1.703	2.346
Mass media exposure					
No	….	1			
Yes	-0.168	0.845	0.130	0.680	1.051
Birth order					
1	….	1			
2	-0.129	0.879	0.084	0.759	1.018
≥3	-0.318	0.728	0.000	0.621	0.854
Wanted pregnancy when became pregnant					
Then	…..	1			
Later	0.351	1.421	0.019	1.060	1.905
No more	0.188	1.207	0.279	0.585	1.698
Place of residence					
Rural	…..	1			
Urban	0.323	1.381	0.000	1.175	1.612
Wealth quintile					
Poorest	….	1			
Poorer	-0.642	0.526	0.000	0.387	0.716
Middle	-0.622	0.531	0.000	0.401	0.702
Richer	-0.439	0.644	0.001	0.501	0.829
Richest	-0.419	0.658	0.000	0.526	0.823
Told about sign of pregnancy complications					
No	….	1			
Yes	0.704	2.022	0.000	0.583	7.009
Getting medical help for self: getting permission to go					
Big problem	…….	1			
Not a big problem	0.123	1.131	0.296	0.898	1.425
Getting medical help for self: getting money needed for treatment					
Big problem	….	1			
Not a big problem	-0.147	0.863	0.064	0.739	1.008
No of living children					
No child	…..	1			
1 child	-0.406	0.667	0.273	0.323	1.337
2 children	0.200	1.221	0.129	0.943	1.581
≥3 children	0.120	1.128	0.272	0.910	1.397
Current age of children (in year)					
<1	….	1			
1	-0.297	0.743	0.001	0.743	0.637
≥2	-0.158	0.854	0.000	0.854	0.730
Age at first birth (in year)					

≤24	….	1			
≥25	-0.456	0.634	0.011	0.446	0.900
Division					
Barisal	….	1			
Chittagong	0.56	1.058	0.703	0.792	1.412
Dhaka	-0.052	0.950	0.690	0.738	1.223
Khulna	0.288	1.334	0.033	1.024	1.737
Mymensingh	0.571	1.771	0.000	1.327	2.364
Rajshahi	0.418	1.519	0.003	1.150	2.006
Rangpur	0.364	1.440	0.013	1.081	1.917
Sylhet	0.846	2.331	0.000	1.742	3.118
During pregnancy: blood sample taken					
No	….	1			
Yes	-0.602	0.548	0.000	0.444	0.667
During pregnancy: blood pressuretaken					
No	……	1			
Yes	-1.410	0.244	0.000	0.161	0.371
During pregnancy: given or bought iron tablet					
No	….	1			
Yes	-0.145	0.865	0.820	0.249	3.005
During pregnancy: urine sample taken					
No	…..	1			
Yes	-1.006	0.366	0.000	0.316	0.423
FW comes during pregnancy					
No	….	1			
Yes	-1.293	0.275	0.000	0.236	0.319

Note: 'CI, confidence interval', significance level is <0.05, OR is odds ratio;'FW, family planning worker'