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Patterns and Determinants of Antenatal Care Visits during Pregnancy in Bangladesh: An Application of the Negative Binomial Regression Model

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ABSTRACT

Antenatal care (ANC) interactions are acknowledged as essential for safeguarding the health and welfare of pregnant women and their infants. In the analysis of count data pertaining to ANC use, overdispersion frequently arises; neglecting it may result in misinterpretations and erroneous results. This study analyses trends in antenatal care visit utilization in Bangladesh over recent years. Data were extracted from the Bangladesh Demographic and Health Survey (BDHS) for the years 2007, 2011, 2014, and 2017-18, each encompassing a nationally representative sample of 11,485, 17,842, 17,863, and 20,127 ever-married women, respectively. The analysis concentrated on 4,770, 6,965, 4,371, and 4,884 mums who had delivered within the three years preceding each survey. The data analysis utilized descriptive, inferential, and multivariate statistical methods. The utilization of antenatal care (ANC) has significantly improved, with the percentage of women attending four or more ANC appointments rising from 23.2% in 2007 to 48.4% in 2017-18. Crucial determinants that markedly influence the frequency of ANC visits encompass residential location, media exposure, and delivery care setting, at the 0.05 significance level. Urban women received ANC visits at rates 1.272, 1.263, 1.136, and 1.112 times higher than rural women in the same survey years. Other notable predictors included administrative division, maternal education, wealth index, birth order, and delivery site. The research demonstrates a steady increase in ANC visit participation among Bangladeshi women. To optimize outcomes, elevating ANC service standards and instituting educational initiatives with periodic workshops may assist women in comprehending the significance of ANC visits.

1. Introduction

The main intervention in the continuum of care for mothers and babies known as antenatal care (ANC) visits is the systematic monitoring of a woman during pregnancy. Better antenatal care (ANC) services are essential for ensuring both the mother's and the unborn child's health during pregnancy (Akter et al., 2022). Antenatal care (ANC) is widely acknowledged as a practical and affordable way to enhance maternal and neonatal health outcomes which provides women with the chance to access the healthcare system and enhance mother and child health outcomes (Jo et al., 2019). ANC visits provide a vital chance to identify and resolve pregnancy-related problems in order to enhance mother and child health (Thapa et al., 2023). Life-threatening problems during pregnancy affect millions of women in developing countries (Hossain et al., 2020). Approximately 830 maternal deaths occur every day due to issues related to pregnancy and delivery worldwide; regrettably, 99% of these deaths occur in underdeveloped

nations. Between 1990 and 2015, the global maternal mortality ratio (MMR) per 100,000 live births decreased by around 44% (WHO, 2019). The state of affairs in emerging nations hasn't altered over time, nevertheless. One of the Sustainable Development Goals (SDGs) is to lower the maternal mortality rate (MMR) to less than 70 maternal deaths per 100,000 live births by 2030 (WHO, 2018).

Over the past three decades, Nepal has achieved progress in reducing maternal and infant mortality. Between 2006 and 2016, the maternal death rate dropped from 281 per 100,000 live births to 239 per 100,000 live births (Acharya et al., 2022). In India, nearly one-fourth of all diseases affecting women that are caused by obstetrical factors are caused by teenage pregnancies, and nearly all of these births (about 95%) occur in low- and middle-income nations. In Ethiopia, 62 percent of expecting mothers received ANC services from trained medical professionals, and three out of ten women had four ANC

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visits, according to the 2016 Demographic and Health Survey (Hailu et al., 2022). Additionally, from 10% in 2000 to 43% in 2019, more women now attend four or more ANC visits (Tesfay et al., 2023).

Despite Bangladesh's remarkable progress towards achieving MDGs 4 and 5, the country's maternal mortality ratio (MMR) and newborn mortality rate (NMR) remain low (Rahman et al., 2017). Low use of maternal health services, such as prenatal care, skilled birth attendance (SBA) at delivery, and postnatal care (PNC), is one of the main causes of these high mortality rates (NIPORT, 2015). Skilled birth attendance (doctor, nurse, or midwife) is more frequently used during delivery and postnatal care (Mrisho et al., 2009).

Twenty-one percent (21%) of mothers in Bangladesh never received an ANC visit (Chanda et al., 2020; Islam and Masud, 2018). In the world, particularly Southeast Asia, improving reproductive, maternal, neonatal, and child health outcomes is still difficult (Sebayang et al., 2017). Regular sessions for pregnant women to improve their education programmes play a vital role in increasing the awareness of the importance of attending antenatal care visits and finding out the contribution of socio-demographic factors to antenatal care (Hossain et al., 2015; Akter et al., 2022).

Sustainable Development Goal (SDG) 3 has established a universal target, meaning that Bangladesh must lower maternal mortality to less than 70 per 10,000 live births, neonatal deaths to 12 per 1000 live births, and child (under-5) deaths to 38 per 1000 by 2030 in order to meet the goals of the Health, Population, and Nutrition Sector Development (HPNSDP) (UNB, 2023). The Ministry of Health and Family Welfare (MOHFW) aims to reduce under-five mortality to 20 per 1,000 live births by the year 2035. Aziz et al. (2022) reported a steady improvement in the utilisation of antenatal care (ANC) services from 2004 to 2017–18.

Specifically, the percentage of women receiving four or more ANC visits increased from 18.9% in 2004 to 48.3% in 2017–18. The Fourth Health, Population and Nutrition Sector Program (4th HPNSP) has accordingly set a goal to achieve 50% coverage for at least four ANC visits by 2023. The quality of antenatal care is influenced by various maternal health and socio-demographic factors, and providing quality ANC services is crucial to lowering both maternal and newborn mortality rates. (Patel et al., 2016; Radovich et al., 2022; Dandona et al., 2022.)

Literature shows a number of studies conducted about ANC using BDHS but most of the studies use regression models and concentrate mostly on the number of ANC visits. Regional differences and the quality of ANC services have received little consideration. Therefore, in order to better explain disparities in ANC utilization in Bangladesh, more study is required to examine these dimensions.

1.1. Objectives of the study

The objectives of the study are to

- i. Determines the present antenatal care visit pattern of Bangladeshi women.
- ii. Determine whether the number of ANC visits in Bangladesh is correlated with socioeconomic and demographic characteristics.
- iii. Evaluate the performance of Negative Binomial Regression using assumptions that have been broken.
- iv. Use Negative Binomial Regression to identify variables influencing ANC visits.

2. Materials and Methods

2.1. Data and Survey Design

The research is conducted using Bangladesh Demographic and Health Survey (BDHS) data from 2007, 2011, 2014 and 2017-2018. The BDHS is a retrospective study using a two-stage stratified-cluster sampling design in which divisions were considered strata. A nationally representative sample of 11485, 17842, 17863 and 20127 ever-married women was used as a sample in the survey. All the ever-married women aged 15-49 years who are regular residents of the selected houses or whoever slept in the selected households the night before the survey were interviewed in individual ways. The data were gathered with regard to the individual and institution that ANC was provided to (where applicable), the number of ANC visits and the content of ANC visits. In order to analyse coverage and content of ANC visits, we have taken 4770, 6965, 4371 and 4884 women who have given birth within the three years before the survey.

2.2. Variables of interests

On the basis of the literature review, a number of socio-economic and demographic variables are chosen. In order to make the research more appropriate, certain variables are recoded, while others are formed by merging data from many other variables in place of the original codes for those variables.

Dependent variable

The number of antenatal care (ANC) visits during pregnancy is the response or outcome variable. In the BDHS, 2007, 2011, 2014 and 2017-18 questionnaires, mothers were asked whether they had received antenatal care during pregnancy and how many times they received antenatal care during pregnancy. The number of antenatal care visits is recorded as a count variable.

Explanatory variables

On the basis of literature, this study considers several predictor variables for analysis on the number of ANC visits during pregnancy of ever-married women in Bangladesh, such as the respondent's current age, division, place of residence, religion, sex of household head, media exposure, respondent's and partner's education, wealth index, respondent's current employment status, family planning through mass media, age of respondent at first birth, age at first marriage, number of living children, ideal number of children,

terminated pregnancy, childbirth order, place of delivery care, and women's empowerment.

2.3. Statistical analysis

The background characteristics of the respondents were described using frequency distribution. Bivariate analysis tests the statistically significant but uncontrolled correlation between the dependent variables and the choice of explanatory variables. Analysis of variance (ANOVA) of the count-dependent variable was carried out to test the statistical significance. A p-value below 0.05 was regarded as significant. The statistical tests conducted on multivariate analysis according to the generalized linear model (GLM) were conducted to determine the determinants of frequency of ANC visits. As our response variable is a count variable, the natural selection is a Poisson regression model, i.e., a Poisson distribution with a log link.

2.4. Negative Binomial Regression Model

But the most severe weakness of Poisson regression is that it is assumed that the variance of the distribution of the count response variable is equal to its mean; that is often referred to as the Equi dispersion property. In real-life experiences, this assumption is frequently broken because the variance may be either bigger (excessive dispersion) or smaller (under dispersion) than the mean. When Equi dispersion is not fulfilled, then the Poisson regression model estimates remain consistent, but invalid inferences can be drawn on the parameters. To analyze the data of over dispersed count variables, the alternative models to use are negative binomial (NB) regression or generalized Poisson regression (Islam and Masud, 2018). Because in our instance, the frequency of ANC visits, the response variable, is over dispersed, we used the negative binomial regression model in estimating regression coefficients. Lastly, the incidence rate ratio (IRR) and the respective 95% confidence interval of each category of the predictors were computed. All statistical analysis is done with SPSS 21 statistical software packages.

3. Results

3.1. Background profile of the respondents

Table 1 shows the distribution of respondents according to their background characteristics. Respondent's age group shows that more than half of the respondents belong to the age group 20-29. About forty percent of the respondents were from two large administrative divisions, namely Chattogram and Dhaka. The media is accessible to about one in two respondents. Most of the respondents had primary or above-level education (75%), lived in rural areas (64%), were unemployed, and about four in ten of the respondents came from rich families. More than two-thirds of the respondents got early marriage (<18 years) and gave their first birth at age <20 years.

3.2. Level of Utilization of ANC services

Figure 1 shows the frequency of ANC visits for different

years among pregnant women in Bangladesh. There are three categories of ANC visits. In 2007 and 2011, near about one quarter (23.2% and 26.7%) of the respondents received four or more ANC visits, and about one third of the respondents did not receive any ANC visits. In 2014 about one third of the respondents received four or more ANC services, whereas nearly half (48.4%) of the respondents in 2017-18 received four or more ANC visits. The trend shows that the proportion of women receiving ANC visits has increased noticeably from 2007 to 2017-18.

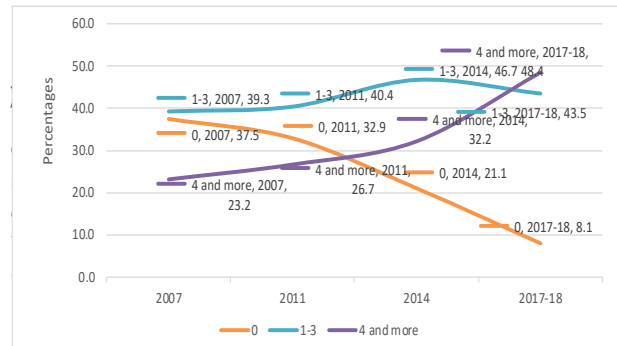


Figure 1: Percentages of ANC visits for different years

3.3. Association of ANC visit with some variables

Table 1 presents the mean number of ANC visits and the 95% confidence interval (CI) for the mean value. The analysis indicates that respondents' division, place of residence, media exposure, respondent's education, partner's education, wealth index, media exposure on family planning, age of respondent at first birth, age at first marriage, number of living children, ideal number of children, childbirth order and place of delivery care have significant associations with the mean number of ANC visits. The respondents aged 20-29 years at the time of birth of the child were more likely to have visited ANC compared to their younger (aged ≤ 19) and their older counterparts (aged 30-39 and ≥ 40).

Between the divisions, respondents of Khulna registered the greatest number of ANC visits for different years and Sylhet the least. The education of the respondent, wealth index of the respondent, respondent partner education, media exposure, age at first birth, number of live children, and order and place of delivery care at first birth (ANC) were significantly associated with mean ANC visits.

3.4. Multivariable analysis

This section shows the use of the Negative Binomial (NB) regression model for ANC visits. Since four years of the data of the individuals depict that the variances are never lower than the mean values. The negative binomial regression model has included the common variables that are found to be significant in the bivariate analysis.

Table 2 indicates the findings of the negative binomial regression analysis foreseeing the use of the number of ANC visits that a mother utilizes during her pregnancy. The findings have shown that division, place of residence, mother's education, wealth index, media exposure, age at

Table 1: Distribution with percentage of respondents, mean number of ANC visits with 95% CI for mean and p-value according to background characteristics.

Covariates	Mean Number of ANC Visits (95% CI for mean) and Frequency (%)			
	2007	2011	2014	2017-18
Respondent's Age Group				
≤19	2.01 (1.85, 2.18) 735 (15.4)	2.48 (2.32, 2.64) 996 (14.3)	2.67 (2.52, 2.83) 915 (20.9)	3.83 (3.64, 4.01) 837 (17.1)
20-29	2.34 (2.24, 2.44) 2802 (58.7)	2.47 (2.39, 2.55) 4310 (61.9)	2.89 (2.79, 2.99) 2612 (59.8)	4.00 (3.90, 4.11) 3009 (61.6)
30-39	2.04 (1.88, 2.20) 1090 (22.9)	2.38 (2.23, 2.53) 1458 (20.9)	2.65 (2.47, 2.83) 790 (18.1)	3.84 (3.66, 4.03) 982 (20.2)
≥40	1.30 (0.93, 1.67) 143 (3.0)	1.26 (0.95, 1.56) 201 (2.9)	1.63 (1.15, 2.11) 54 (1.2)	3.86 (2.99, 4.72) 56 (1.1)
P-value	<0.001	<0.001	<0.001	0.279
Division				
Barishal	1.94 (1.74, 2.13) 641 (13.4)	2.39 (2.22, 2.57) 817 (11.7)	2.44 (2.24, 2.65) 523 (12.0)	3.54 (3.29, 3.79) 517 (10.6)
Chattogram	2.12 (1.96, 2.29) 954 (20.0)	2.14 (2.00, 2.28) 1328 (19.1)	2.61 (2.44, 2.78) 835 (19.1)	3.43 (3.26, 3.60) 814 (16.7)
Dhaka	2.20 (2.03, 2.38) 1024 (21.5)	2.44(2.27, 2.60) 1180 (16.9)	3.05 (2.87, 3.23) 775 (17.7)	4.39 (4.16, 4.62) 721 (14.8)
Khulna	2.75 (2.51, 2.98) 615 (12.9)	2.83 (2.64, 3.02) 844 (12.1)	3.46 (3.22, 3.69) 512 (11.7)	4.68 (4.41, 4.95) 505 (10.3)
Mymensingh				3.85 (3.62, 4.08) 590 (12.1)
Rajshahi	2.49 (2.31, 2.67) 814 (17.1)	2.38 (2.22, 2.54) 910 (13.1)	2.83 (2.59, 3.06) 536 (12.3)	4.15 (3.90, 4.40) 518 (10.6)
Rangpur		2.96 (2.79, 3.13) 920 (13.2)	3.20 (3.00, 3.41) 542 (12.4)	4.58 (4.35, 4.81) 551 (11.3)
Sylhet	1.67 (1.50, 1.83) 722 (15.1)	1.95 (1.78, 2.13) 966 (13.9)	2.06 (1.88, 2.24) 648 (14.8)	3.21 (3.02, 3.40) 668 (13.7)
P-value	<0.001	<0.001	<0.001	<0.001
Place of Residence				
Urban	3.25 (3.10, 3.40) 1698 (35.6)	3.54 (3.42, 3.67) 2220 (31.9)	3.69 (3.54, 3.83) 1402 (32.1)	4.72 (4.57, 4.87) 1680 (34.4)
Rural	1.60 (1.53, 1.68) 3072 (64.4)	1.89 (1.82, 1.96) 4745 (68.1)	2.36 (2.28, 2.44) 2969 (67.9)	3.53 (3.44, 3.62) 3204 (65.6)
P-value	<0.001	<0.001	<0.001	<0.001
Sex of Household Head				
Male	2.15 (2.07, 2.23) 4312 (90.4)	2.39 (2.32, 2.45) 6440 (92.5)	2.74 (2.67, 2.82) 3989 (91.3)	3.96 (3.87, 4.04) 4306 (88.2)
Female	2.54 (2.28, 2.81) 458 (9.6)	2.80 (2.54, 3.07) 525 (7.5)	3.22 (2.95, 3.48) 382 (8.7)	3.79 (3.56, 4.01) 578 (11.8)
P-value	<0.001	<0.001	<0.001	0.184
Media Exposure				
No	1.25(1.17, 1.33) 2084 (43.7)	1.56 (1.49, 1.63) 3354 (48.2)	1.96(1.87, 2.06) 2099 (48.0)	3.08(2.98, 3.18) 2239 (45.8)
Yes	2.92(2.81, 3.03) 2686 (56.3)	3.21 (3.12, 3.31) 3611 (51.8)	3.55(3.44, 3.66) 2272 (52.0)	4.67(4.55, 4.78) 2645 (54.2)
P-value	<0.001	<0.001	<0.001	<0.001
Respondent's Education Level				
No Education	0.94 (0.85, 1.04) 1206 (25.3)	1.11 (1.00, 1.22) 1234 (17.7)	1.48 (1.33, 1.63) 569 (13.0)	2.24 (1.98, 2.50) 300 (6.1)
Primary	1.57 (1.46, 1.68) 1463 (30.7)	1.71 (1.61, 1.80) 2077 (29.8)	2.09 (1.96, 2.21) 1191 (27.3)	3.08 (2.94, 3.22) 1352 (27.7)
Secondary	2.88 (2.75, 3.02) 1705 (35.7)	2.86 (2.77, 2.95) 3053 (43.8)	3.07 (2.96, 3.17) 2099 (48.0)	4.09 (3.98, 4.20) 2347 (48.1)
Higher Education	5.30 (4.98, 5.61) 396 (8.3)	5.30 (5.05, 5.55) 601 (8.6)	4.72 (4.47, 4.97) 512 (11.7)	5.42 (5.23, 5.61) 885 (18.1)
P-value	<0.001	<0.001	<0.001	<0.001

Partner's Education				
No Education	1.13 (1.04, 1.22) 1517 (31.8)	1.32(1.23, 1.41) 1847 (26.5)	1.83 (1.70, 1.96) 980 (22.4)	2.80 (2.61, 3.00) 675 (13.8)
Primary	1.65 (1.54, 1.77) 1349 (28.3)	1.98 (1.87, 2.08) 2014 (28.9)	2.29 (2.16, 2.41) 1324 (30.3)	3.29 (3.17, 3.42) 1643 (33.6)
Secondary	2.82(2.66, 2.97) 1287 (27.0)	2.77 (2.66, 2.88) 2108 (30.3)	3.15(3.01, 3.28) 1388 (31.8)	4.17(4.04, 4.31) 1620 (33.2)
Higher Education	4.67 (4.40, 4.93) 617 (12.9)	4.60 (4.41, 4.80) 996 (14.3)	4.39 (4.18, 4.61) 679 (15.5)	5.47 (5.28, 5.65) 946 (19.4)
P-value	<0.001	<0.001	<0.001	<0.001
Religion				
Muslim	2.16 (2.08, 2.24) 4326 (90.7)	2.36(2.29, 2.42) 6269 (90.0)	2.76 (2.68, 2.84) 4017 (91.9)	3.92 (3.83, 4.00) 4470 (91.5)
Non-Muslim	2.51 (2.25, 2.76) 444 (9.3)	2.97 (2.74, 3.20) 696 (10.0)	3.08 (2.80, 3.36) 354 (8.1)	4.17 (3.92, 4.42) 414 (8.5)
P-value	0.009	<0.001	0.023	0.088
Wealth Index				
Poor	1.13 (1.05, 1.21) 1862 (39.1)	1.41(1.33, 1.48) 2762 (39.6)	1.85 (1.75, 1.95) 1734 (39.7)	3.05 (2.94, 3.17) 2042 (41.8)
Middle	1.56 (1.43, 1.69) 884 (18.5)	2.04 (1.91, 2.16) 1343 (19.3)	2.51 (2.36, 2.66) 837 (19.1)	3.92 (3.74, 4.11) 874 (17.9)
Rich	3.44 (3.30, 3.58) 2024 (42.4)	3.57(3.46, 3.68) 2861 (41.1)	3.82 (3.69, 3.94) 1800 (41.2)	4.86 (4.73, 4.99) 1968 (40.3)
P-value	<0.001	<0.001	<0.001	<0.001
Age of Respondent at First Birth				
<20 years	1.81 (1.74, 1.89) 3534 (74.0)	2.14(2.07, 2.20) 5174 (74.3)	2.52 (2.44, 2.61) 3172 (72.6)	3.63 (3.53, 3.72) 3369 (69.0)
20-29 years	3.22 (3.04, 3.41) 1200 (25.2)	3.17 (3.03, 3.32) 1736 (24.9)	3.43 (3.28, 3.59) 1169 (26.7)	4.59 (4.44, 4.75) 1475 (30.2)
>29 years	4.64 (3.58, 5.70) 36 (0.8)	4.91 (4.02, 5.80) 56 (0.8)	5.57 (4.27, 6.86) 30 (0.7)	6.10 (5.13, 7.07) 40 (0.8)
P-value	<0.001	<0.001	<0.001	<0.001
Number of Living Children				
≤ 2	2.62 (2.51, 2.72) 3040 (63.7)	2.79(2.71, 2.87) 4760 (68.3)	3.06 (2.97, 3.15) 3246 (74.3)	4.22 (4.12, 4.31) 3633 (74.4)
≥ 3	1.44 (1.34, 1.54) 1730 (36.3)	1.61 (1.52, 1.71) 2205 (31.7)	1.99 (1.86, 2.12) 1125 (25.7)	3.12 (2.98, 3.27) 1251 (25.6)
P-value	<0.001	<0.001	<0.001	<0.001
Family Planning through Mass Media				
No	1.61 (1.53, 1.69) 2975 (62.4)	2.07 (2.00, 2.13) 4980 (71.5)	2.49 (2.40, 2.57) 3457 (79.1)	3.70 (3.61, 3.78) 4066 (83.3)
Yes	3.15 (3.01, 3.29) 1795 (37.6)	3.30 (3.17, 3.43) 1985 (28.5)	3.92 (3.75, 4.10) 914 (20.9)	5.14 (4.93, 5.35) 818 (16.7)
P-value	<0.001	<0.001	<0.001	<0.001
Respondent's Age at First Marriage				
<18 years	1.81 (1.74, 1.89) 3723 (78.0)	2.15 (2.09, 2.22) 5281 (75.8)	2.58 (2.50, 2.67) 3127 (71.5)	3.75 (3.65, 3.84) 3374 (69.1)
18-25 years	3.46 (3.26, 3.66) 1001 (21.0)	3.13 (2.99, 3.28) 1608 (23.1)	3.20 (3.05, 3.35) 1187 (27.2)	4.30 (4.15, 4.45) 1441 (29.5)
>25 years	5.09 (4.20, 5.98) 46 (1.0)	5.54 (4.78, 6.30) 76 (1.1)	5.37 (4.40, 6.34) 57 (1.3)	5.84 (5.14, 6.54) 69 (1.4)
P-value	<0.001	<0.001	<0.001	<0.001
Ideal Number of Children				
Two or Less	2.43 (2.34, 2.53) 3561 (74.7)	2.58 (2.51, 2.65) 5796 (83.2)	2.96 (2.87, 3.04) 3616 (82.7)	4.10 (4.01, 4.19) 3946 (80.8)
Three or More	1.47 (1.34, 1.59) 1209 (25.3)	1.59 (1.45, 1.74) 1169 (16.8)	1.97 (1.80, 2.13) 755 (17.3)	3.26 (3.08, 3.43) 938 (19.2)
P-value	<0.001	<0.001	<0.001	<0.001

Respondent's Employment Status				
No	2.27 (2.18, 2.36) 3572 (74.9)	2.39(2.33, 2.46) 6267 (90.0)	2.82 (2.74, 2.91) 3435 (78.6)	4.00 (3.90, 4.10) 3051 (62.5)
Yes	1.93 (1.80, 2.07) 1198 (25.1)	2.63 (2.41, 2.84) 698 (10.0)	2.65 (2.49, 2.82) 936 (21.4)	3.84 (3.71, 3.97) 1833 (37.5)
P-value	<0.001	0.031	0.068	0.062
Child Birth Order				
1st Birth	2.95 (2.80, 3.10) 1518 (31.8)	3.09 (2.97, 3.20) 2356 (33.8)	3.16 (3.04, 3.28) 1777 (40.7)	4.38 (4.25, 4.51) 1852 (37.9)
2nd- 3rd Ordered Birth	2.21 (2.10, 2.32) 2097 (44.0)	2.38 (2.29, 2.47) 3327 (47.8)	2.78 (2.66, 2.89) 1994 (45.6)	3.91 (3.79, 4.02) 2444 (50.0)
≥4 th Ordered Birth	1.14 (1.04, 1.25) 1155 (24.2)	1.27 (1.16, 1.39) 1282 (18.4)	1.71 (1.54, 1.87) 600 (13.7)	2.67 (2.47, 2.87) 588 (12.1)
P-value	<0.001	<0.001	<0.001	<0.001
Place of Delivery				
Home and Other	1.54 (1.47, 1.60) 3862 (81.0)	1.70 (1.64, 1.76) 4944 (71.0)	2.02 (1.94, 2.10) 2611 (59.7)	2.94 (2.84, 3.04) 2425 (49.7)
Health Facility	4.97 (4.76, 5.19) 908 (19.0)	4.17(4.04, 4.30) 2021 (29.0)	3.92 (3.80, 4.04) 1760 (40.3)	4.92 (4.81, 5.04) 2459 (50.3)
P-value	<0.001	<0.001	<0.001	<0.001
Terminated Pregnancy				
No	2.12 (2.04, 2.21) 3777 (79.2)	2.40(2.33, 2.47) 5695 (81.8)	2.72 (2.64, 2.80) 3721 (85.1)	3.88 (3.79, 3.97) 4055 (83.0)
Yes	2.43 (2.26, 2.61) 993 (20.8)	2.50(2.34, 2.65) 1270 (18.2)	3.17 (2.97, 3.37) 650 (14.9)	4.23 (4.02, 4.43) 829 (17.0)
P-value	0.001	0.248	<0.001	0.002
Women Empowerment				
No	2.06 (1.95, 2.17) 1913 (40.1)	2.23 (2.14, 2.32) 3098 (44.5)	2.61 (2.50, 2.73) 1936 (44.3)	3.88 (3.75, 4.01) 1734 (35.5)
Yes	2.28 (2.18, 2.38) 2857 (59.9)	2.56 (2.48, 2.65) 3867 (55.5)	2.92 (2.82, 3.03) 2435 (55.7)	3.97 (3.87, 4.07) 3150 (64.5)
P-value	0.006	< 0.001	<0.001	0.270

first marriage, ideal number of children, childbirth order and place of delivery highly predict the receipt of ANC services. The regression models are used to forecast the estimated regression coefficients and their standard errors, p-values, rate of incidence ratio (IRR) and 95 per cent confidence interval of the IRR given degree of dispersion estimates as parameters.

The table indicates that the visits made by women during pregnancy in Barishal division, Khulna division, Rajshahi division, and Rangpur division are statistically significant in all years. The antenatal care visits of urban women during pregnancy are higher compared to that of the rural women. The ANC visits of 11, 13, 12 and 14 are less likely to visit ANC than the women who have been exposed to the media. The number of ANC visits of women during pregnancy significantly depend on respondents' family wealth status. Respondents belongs to poor families are 9 percent less visit compared to rich families for BDHS 2017-18 dataset. Based on the values of IRR of various education levels of women reported, it is evident that ANC visits increase with the rise in the level of education of the women. Uneducated women and those that have

completed primary education are less likely to receive ANC visits compared to higher educated women.

The place of delivery care is very important and statistically significant effect in modifying the number of ANC visits of women during pregnancy in Bangladesh. It is observed that the mean of ANC visits of respondents who receive delivery care at home and others is less than that of the respondent who also receives delivery care at a health facility.

3.5. Discussion

The study results showed that a smaller proportion of the respondents got the recommended four or above ANC visits when given by the WHO. There are also the growing patterns of four and more ANC visits in the past ten years with the analysis. The research established that wealth index has a considerable predictive value on the number of ANC visits, which is also comparable with other studies carried out in Bangladesh and other countries (Fagbamigbe and Idemudia, 2015; Agha and Tappis, 2016).

The present research established that there were a lot of differences in ANC visits division. Divisions of Khulna

Table 2: The results of the negative binomial regression model with incidence rate ratio (IRR) and p-value for different years.

Covariates with category	IRR and P-value for different years							
	IRR	P-value	IRR	P-value	IRR	P-value	IRR	P-value
	2007		2011		2014		2017-18	
Intercept	1.259	0.00	1.298	0.000	1.407	0.000	1.625	0.000
Division								
Barishal	1.027	0.714	1.231	0.001	1.119	0.130	1.039	0.586
Chattogram	0.992	0.896	0.954	0.388	1.039	0.564	0.955	0.451
Dhaka	0.949	0.425	1.033	0.565	1.184	0.011	1.088	0.185
Khulna	1.154	0.050	1.141	0.031	1.336	0.000	1.196	0.011
Mymensingh	-	-	-	-	-	-	1.197	0.007
Rajshahi	1.271	0.001	1.144	0.026	1.091	0.242	1.119	0.106
Rangpur	-	-	1.726	0.000	1.444	0.000	1.368	0.000
Sylhet (Ref)	1	-	1	-	1	-	1	-
Place of Residence								
Urban	1.272	0.000	1.263	0.000	1.136	0.003	1.112	0.005
Rural (Ref)	1	-	1	-	1	-	1	-
Respondents Education Level								
No Education	0.612	0.000	0.608	0.000	0.625	0.000	0.698	0.000
Primary	0.793	0.011	0.745	0.000	0.779	0.002	0.878	0.045
Secondary	0.945	0.475	0.880	0.038	0.915	0.192	0.965	0.502
Higher (Ref)	1	-	1	-	1	-	1	-
Media Exposure								
No	0.887	0.019	0.867	0.000	0.877	0.005	0.858	0.000
Yes (Ref)	1	-	1	-	1	-	1	-
Wealth Index								
Poor	0.716	0.000	0.712	0.000	0.788	0.000	0.907	0.052
Middle	0.795	0.000	0.810	0.000	0.852	0.003	0.985	0.756
Rich (Ref)	1	-	1	-	1	-	1	-
Age at First Birth Interval								
<20 years	0.950	0.820	0.957	0.811	0.824	0.432	0.875	0.494
20-29 years	1.001	0.998	0.990	0.953	0.896	0.650	0.927	0.692
>29 years (Ref)	1	-	1	-	1	-	1	-
Number of Living Children								
≤ 2	1.050	0.475	1.034	0.298	1.089	0.157	1.047	0.356
≥ 3	1	-	1	-	1	-	1	-
Family Planning through Mass Media								
No	0.908	0.035	0.947	0.134	0.891	0.014	0.913	0.048
Yes (Ref)	1	-	1	-	1	-	1	-
Age at First Marriage								
<18 years	1.052	0.801	0.960	0.798	1.027	0.886	1.072	0.654
18-25 years	1.146	0.483	0.965	0.815	0.968	0.859	1.027	0.857
>25 years (Ref)	1	-	1	-	1	-	1	-
Ideal Number of Children								
≤ 2	1.114	0.023	1.124	0.009	1.154	0.007	1.000	0.993
≥ 3	1	-	1	-	1	-	1	-
Partner Education								
No Education	0.769	0.001	0.736	0.000	0.895	0.159	0.822	0.007
Primary	0.856	0.038	0.852	0.005	0.893	0.100	0.852	0.006
Secondary	0.989	0.873	0.889	0.022	0.943	0.338	0.935	0.195
Higher (Ref)	1	-	1	-	1	-	1	-
Child Birth Order								
1 st Birth	1.192	0.027	1.269	0.000	1.025	0.770	1.109	0.163
2 nd -3 rd Ordered	1.136	0.050	1.156	0.009	1.055	0.473	1.115	0.090
≥4 th Ordered (Ref)	1	-	1	-	1	-	1	-
Place of Delivery								
Home and Other	0.554	0.000	0.630	0.000	0.712	0.000	0.735	0.000
Health Facility (Ref)	1	-	1	-	1	-	1	-

and Chattagram were the least performing in terms of frequency of ANC received and ANC visits, respectively, with close proximity of Dhaka and Sylhet divisions. The regional differences in ANC visit utilization could be explained by dissimilarity in the health-seeking behavior, service availability, accessibility and quality. It was revealed that women in rural settings were less likely to receive fewer visits by ANC than their urban counterparts. It was also found in several studies that the use of ANC services was lower in rural women (Fagbamigbe and Idemudia, 2015; Agha and Tappis, 2016; Bloom et al., 1999; Joshi et al., 2014).

The education level of the respondent also had a positive significant impact on the maximum utilization of ANC services, which is also confirmed in other regions of the world (Edward Bbaale, 2011; Joshi et al., 2014; Fagbamigbe and Idemudia, 2015; Agha and Tappis, 2016; Magadi et al., 2000). Education of the partner was also positively associated with the increased use of the number of ANC visits. The government must take appropriate actions to educate women better, as in Bangladesh 27% of women never attended school, and 12% of women only completed secondary level and above (NIPORT et al., 2014).

Exposure of the mother in the media manifested as a major factor of maternal health seeking behavior. Since the government of Bangladesh is spreading essential health information using television, radio and newspapers, it is conceivable that the mass-media campaigns might have been effective in increasing the number of ANC visits used. The media exposure on family planning and the place of delivery care was also another important factor in the mean number of ANC visits by pregnant women in Bangladesh.

There are a number of issues which are establishing the strengths and weaknesses of the current study. The research relied on cross-sectional data, giving the research a hard time in assessing how the temporal relations between the factors of the study and the ANC visits are. The ANC data gathered in the four BDHS was also based on self-report data, making it prone to recall bias. We relied on the Measure DHS data and the WHO guideline of four or more ANC visits; nevertheless, eight or more ANC visits made by pregnant women is what the WHO recently advocated would have been useful, especially in the reduction of perinatal mortality. There are also the strengths of our study.

The huge representative sample, having a high response rate, suggests that most chances of the selection bias impacting the results observed are unlikely to occur. Trained personnel that will be used to administer the validated questionnaires in the BDHS will also tend to minimise measurement bias in the research. Lastly, the research offers some very important insights on the essential factors that are related to ANC visitations in Bangladesh and possibly a chance for policymakers and practitioners in the sphere of public health to develop and

execute specific maternal health interventions in order to enhance ANC service utilization in Bangladesh.

4. Conclusion

The research results indicate that division, place of residence, birth order, media exposure, educational level of the respondent, wealth index and place of delivery are significant as far as the number of ANC visits is concerned. The place of residence, birth order and ideal number of children are significant factors that positively affect the antenatal care visits of Bangladeshi women, whereas the media exposure, wealth index and place of delivery have a negative impact. To be more exact, women living in urban areas, in rich families, having a higher level of education and also being exposed to media get more visits during the antenatal care.

On the findings of the given study, it can be stated that awareness needs to be generated among women who deliver their first birth at the age of below 20 years so that they could be provided with more ANC visits during the period of pregnancy. Women's education should be prioritized, and access to media for women should also be enabled to achieve better antenatal care in Bangladesh with the current practice of the ANC program as dictated by the previous WHO of at least 4 ANC visits, which was a challenge to the mothers in Bangladesh. Secondly, the predisposition to reach out to nonqualified healthcare providers for ANC can become a health risk to both the mother and the child. Thus, improved WHO guidelines, which aim at at least eight ANC contacts and sufficient ANC contacts with a qualified doctor, must be adhered to in order to guarantee the positive pregnancy of women.

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