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Factors Affecting the Early Initiation of First Antenatal Care Visit among Pregnant Women in Bangladesh: A Multiple Logistic Regression Analysis

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Abstract

Antenatal care (ANC) is essential for improving maternal and child health outcomes by reducing mortality and malnutrition. In countries with higher maternal mortality and morbidity rates, the timely initiation of antenatal care (ANC) is essential. However, a substantial proportion of women delay the commencement of ANC visits beyond the recommended period. This study investigates the prevalence of early initiation of the first ANC visit among pregnant women in Bangladesh and explores the associated risk factors influencing the timing of ANC utilization. The analysis is based on cross-sectional data from the 2017–2018 Bangladesh Demographic and Health Survey (BDHS). In this present study, total 4,451 pregnant women were involved. The study employed chi-square tests and a multiple binary logistic regression model to identify factors associated with the early initiation of the first ANC visit. The objective was to determine the key predictors contributing to the first ANC visit among pregnant women in Bangladesh. Results exposed that 41.6% of pregnant women introduced their first ANC visit within the suggested timeframe. The regression analysis identified several statistically significant predictors of early ANC initiation, including place of residence ($p < 0.05$), women's education level ($p < 0.01$), household wealth index ($p < 0.05$), age at first birth ($p < 0.05$), birth order number ($p < 0.05$), husband's education level ($p < 0.01$), media access ($p < 0.01$), and division ($p < 0.05$). These results highlight the need for targeted public health policies and interventions to promote timely ANC initiation and improve maternal healthcare utilization in Bangladesh.

Keywords: Antenatal care visit, Pregnant women, Binary logistic regression, Timely initiation, Media access.

AMS Classification: 62P10, 62P25, 62J12.

1. Introduction

To lower malnutrition and maternal and infant mortality, ANC is essential. Pregnancy-related morbidity and mortality remain unacceptably high on a global scale. According to Adulo et al. (2022), approximately 303,000 women and adolescent girls, along with 2.7 million babies within the first 28 days of life, died due to complications related to pregnancy and childbirth. Additionally, in 2015, an estimated 2.6 million stillbirths were recorded (Alkema et al., 2016). UN projections for 2020 indicated a global sex ratio of 101 men for every 100 women. By 2022, the world population had reached approximately 7.95 billion, comprising 4.95 billion men and 3.95 billion women. Due to higher rates of female prenatal mortality, the global sex ratio at birth is generally estimated to be around 107 boys for every 100 girls (Sarker et al., 2020). Late initiation of prenatal care is associated with adverse perinatal outcomes, including preterm birth, low birth weight, and neonatal conditions such as jaundice (Islam and Masud, 2018; Adulo et al., 2022). Pregnant women, who represent more than one-fifth of the global population, are recommended to attend a minimum of four antenatal care (ANC) visits during each pregnancy an essential strategy for reducing maternal mortality. However, millions of women around the world continue to face inadequate access to these essential services (Idris & Sari, 2023).

Timely initiation of ANC visits is vital for assessing pregnant women's health, determining gestational age, screening pre-existing conditions, and detecting pregnancy complications, promoting preventative healthcare and birth preparedness. It also provides opportunities for immunizations, iron and folic acid supplements, nutrition counselling, and malaria treatments (Akter et al., 2023). According to UN projections, maternal mortality defined as deaths resulting from pregnancy or childbirth complications declined by 34% between 2000 and 2020, dropping from 339 to 223 deaths per 100,000 live births. The average yearly rate of decrease is 2.1% (Sarker et al., 2020; WHO, 2020). The World Health Organization reported over 800 daily preventable pregnancy and delivery deaths (Gebresilassie et al., 2019), with 95% occurring in low and lower-middle-income countries despite a 34% global maternal mortality reduction in 2020 (Gebresilassie et al., 2019).

The South Asian region accounts for one-third of all maternal and child fatalities worldwide. By 2030, the Global Strategy for Women's, Children's, and Adolescent's Health aims to reduce the neonatal mortality rate to 12 or fewer deaths per 1,000 live births and to lower the maternal mortality ratio to less than 70 deaths per 100,000 live births (Kayemba et al., 2023).
Bangladesh's utilization of health facilities for antenatal care and deliveries has increased, with 47% of women receiving four or more services, but only 37% receive their first ANC before 16 weeks (Pervin et al., 2021). BDHS 2017-18 reveals that eighth antenatal care (ANC) is only 18% of pregnant women, with only 7% from the lowest wealth quintile receiving it, compared to 37% from the highest wealth quintile (Sarker et al., 2020). Prenatal check-ups provide medical information on physiological changes, biological changes, and prenatal nutrition. Regular care reduces maternal death rates, miscarriages, birth abnormalities, low birth weight, and newborn infections (Sarker et al., 2020; Pervin et al., 2021).

ANC rates vary based on different determinants like mother's educational background, with educated mothers seeking medical treatment more frequently and earlier. Low female literacy rates increase maternal death rates (Mgata et al., 2019). A few other studies were carried out in various regions of Bangladesh (Ali et al., 2018; Jo et al., 2019), in addition to the national survey, also provide data on the total number of ANC visits that a woman receives throughout her pregnancy. There is a lack of knowledge in Bangladesh about the necessity of ANC visits to national

guidelines (Ali et al., 2018; Jo et al., 2019; Rahman et al., 2016) and WHO guidelines for pregnant women (Jo et al., 2019). Investigating the true state of timely ANC intake, which has a higher impact on the survival chances of both mother and child is crucial. As a result, we sought to investigate MTP's prompt adoption of ANC by WHO recommendations and national guidelines using a cross-sectional survey in Bangladesh (Pervin et al., 2012).

2. Materials and Methods

2.1 Data Source

This research utilized a cross-sectional design, drawing on secondary data from the Bangladesh Demographic and Health Survey (BDHS) conducted from October 2017 to March 2018. The survey focused on Bangladeshi women of reproductive age, specifically those between 15 and 49 years old, and included a total of 20,127 participants. The data gathered encompassed various socio-demographic, health, and lifestyle attributes of the respondents. Comprehensive details regarding the survey methodology and participant characteristics can be found in other sources (Mulinge et al., 2017).

2.2 Study Design

This study employed data from the 2017–2018 Bangladesh Demographic and Health Survey (BDHS), which is a cross-sectional survey that provides a nationally representative snapshot at a specific point in time. The BDHS is part of the global Demographic and Health Survey (DHS) initiative and was conducted in Bangladesh by the National Institute of Population Research and Training (NIPORT). The survey received both technical and financial assistance from the United States Agency for International Development (USAID). Ethical approval and scientific clearance for the survey were obtained from the Government of Bangladesh as well as the Institutional Review Board of the DHS Program.

2.3 Study Population and Sampling Technique

The Bangladesh Demographic and Health Survey (BDHS) conducted in 2017–2018 utilized a two-stage stratified cluster sampling method to obtain a representative sample of pregnant women. The administrative framework of Bangladesh is organized into seven divisions, which are further divided into zilas, upazilas, urban wards, and rural union parishads (Islam et al., 2023). This structure facilitated the categorization of the population into urban and rural groups. The sampling frame was derived from the enumeration areas (EAs) established in the 2014 BDHS, with each EA containing around 120 households. In the initial stage, 675 EAs were chosen through probability proportional to size sampling, resulting in a total of 20,250 residential households and an expected 20,108 completed interviews with eligible women. After implementing data cleaning procedures, which included the removal of outliers and incomplete responses, the final analytical sample consisted of 4,451 pregnant women.

2.4 Study of the Variables

2.4.1 Dependent Variable

The early initiation of the first antenatal care (ANC) visit was the dependent variable in this study. It had two possible values because it was a binary outcome variable. "yes = 1" denoted that a woman was considered "early" if she attended the ANC visit during the first 12 weeks of pregnancy. Conversely, if she showed up for the ANC visit after 12 weeks of pregnancy, she was

recorded as "delayed" and assigned a "no = 0" classification (Habte et al., 2024; Appiah, 2022; Abebe et al., 2023; Woldeamanuel and Belachew, 2021; Belay et al., 2023).

2.4.2 Independent Variables

We included determinants of the first antenatal care visit based on available literature and all independent variables were selected based on previous studies (Appiah, 2022; Abebe et al., 2023; Belay et al., 2023). More detail on the definition of these variables is available in the BDHS 2017-18 survey report (NIPORT, 2020). Eighteen independent variables were used and included as shown in Table 1;

Table 1: Descriptions of the independent variables along with their categorizations

Serial	Variables	Categorization
1.	Women's current age	1 = 15-19 years, 2 = 20-24 years, 3 = 25-29 years, 4 = 30-34 years, 5 = 35-49 years
2.	Place of residence	1 = Urban, 2 = Rural
3.	Women's education level	1 = Up to primary, 2 = Secondary and above
4.	Women's occupation	0 = Not working, 1 = working
5.	Wealth index	1 = Poor, 2 = Middle, 3 = Rich
6.	Women's age at first birth	1 = Less than equal 18 years, 2 = 19-24 years, 3 = 25 and above years
7.	Number of living children	0 = 0 members, 1 = 1-2 members, 2 = 3 and above members
8.	Total children ever born	1 = 1-2 children, 2 = 3 and above children
9.	Birth order number	1 = 1, 2 = 2-3, 3 = 4-5, 4 = 6 and above
10.	Contraceptive use and intention	1 = Using, 2 = Not using
11.	Wanted pregnancy when became pregnant	1 = Yes, 2 = No
12.	Distance to health facility	1 = Big problem, 2 = Not a big problem
13.	Husband's education level	1 = Up to primary, 2 = Secondary and above
14.	Husband's occupation	0 = Not working, 1 = working
15.	Person who usually decides on women's health care	1 = Women alone, 2 = Women and husband, 3 = Husband alone, 4 = Others
16.	Media Access	0 = Unexposed, 1 = Exposed
17.	Body mass index	1 = Underweight, 2 = Normal weight, 3 = Overweight, 4 = Obese.
18.	Division	1 = Barishal, 2 = Chattogram, 3 = Dhaka, 4 = Khulna, 5 = Mymensingh, 6 = Rajshahi, 7 = Rangpur, 8 = Sylhet

2.5 Statistical analysis

Frequency distributions were utilized to evaluate the prevalence of early initiation of the first antenatal care visit across different categories of independent variables. To investigate the

relationship between early initiation of the first antenatal care visit and socio-economic as well as demographic factors, the chi-square (χ^2) test was employed. Factors that were found to be significantly associated through the χ^2 test were subsequently incorporated as independent variables in the multiple binary logistic regression (MLR) model. This MLR model was applied to assess the impact of socio-economic and demographic variables on the probability of early initiation of the first antenatal care visit among pregnant women in Bangladesh. Statistical significance was established at $p < 0.01$ and $p < 0.05$. All analyses were performed using STATA version 14.2 and IBM SPSS version 26.

3. Results

3.1 Prevalence of Early Initiation of First Antenatal Care Visit among Pregnant Women in Bangladesh

The study sample consisted of 4,451 pregnant women from Bangladesh, aged 15 to 49 years. The prevalence of early initiation of the first antenatal care visit among these women was found to be 41.6%, as presented in Table 2.

3.2 Association between First Antenatal Care Visit among Pregnant Women on Different Socio-economic and Demographic Factors in Bangladesh

Table 2 presents the associations between early initiation of the first antenatal care visit and various socio-economic and demographic factors among pregnant women in Bangladesh. A significant association ($p<0.05$) was observed between early initiation of the first antenatal care visit and the women's current age. Women's current age with the highest percentages of early initiation of first antenatal care visits were observed in 25-29 years (44.3%), 20-24 years (42.5%), and 30-34 years (41.4%), 35-49 years (39.4%), while the lowest percentage is in 15-19 years (36.7%). Early initiation of first antenatal care visits was also significantly ($p<0.01$) varied due to place of residence. Early initiation of first antenatal care visits was more prevalent in urban areas (49.6%) compared to rural areas (37.2%). Women's education level with Secondary and above have a significant ($p<0.01$) higher prevalence of early initiation of first antenatal care visits (46.7%) compared to pregnant women with up to primary (30.4%) education. Women's occupation was also significantly ($p<0.01$) associated with early initiation of first antenatal care visits. In Bangladeshi pregnant women who not working (44.8%) were more prevalent in early initiation of first antenatal care visits than those who working (36.7%). Early initiation of first antenatal care visits was significantly ($p<0.01$) associated with the wealth index. Pregnant women who live in rich families have a high prevalence of early initiation of first antenatal care visits (52.8%). For women who live in middle-income families, the prevalence of early initiation of first antenatal care visits (39.1%) decreases and low-income families demonstrate a significantly lower prevalence of early initiation of first antenatal care visits (30.7%). Women's age at first birth was significantly ($p<0.01$) associated with early initiation of first antenatal care visits. Women who had a child aged 25 and above went to early initiation of ANC visit (66.1%) and who had a child aged 19-24 years went to the early initiation of ANC visit (46.3%) and women who had a child less than equal 18 years (35.6%). The number of living children with 0 members has a significant ($p<0.01$) higher prevalence of early initiation of first antenatal care visits (44.4%) compared to 3 and above members (33%). Total children ever born with 1-2 children have a significant ($p<0.01$) higher prevalence of early initiation of first antenatal care visits (44.4%) than lower rate of 3 and above members (34.2%). Birth order numbers with first birth have a significant ($p<0.01$) higher prevalence of early initiation of first antenatal care visits (46%) than lower rate of 6 and above

birth (23.9%). The women expressed a desire to become pregnant (42.5%) when they conceived. A majority of (44.7%) women did not perceive the distance to health facilities as a significant ($p<0.01$) associated factor. Husbands education level of Secondary and above have a significant ($p<0.01$) higher prevalence of early initiation of first antenatal care visits (50.5%) compared to pregnant women with up to primary (30.8%) education. The person who usually decides on women's health care with women and husband has a significantly ($p<0.01$) higher prevalence of early initiation of first antenatal care visits (43.3%) than a lower prevalence of husband alone (37.2%). Media access with exposed women has a significantly ($p<0.01$) higher prevalence of early initiation of first antenatal care visits (47.2%) than a lower prevalence of unexposed women (30.3%). Body mass index with obese women (52.5%) has a significantly ($p<0.01$) higher prevalence of early initiation of first antenatal care visits than lower prevalence of underweight women (33.3%). There was a significant ($p<0.01$) association between early initiation of first antenatal care visits and division. The highest percentages of early initiation of first antenatal care visits were observed in Dhaka (50.8%), Sylhet (47.7%), Khulna (43.3%), Mymensingh (40.9%), Rangpur (39.6%), Barisal (37.6%), Rajshahi (36.6%) and while the lowest percentage is in Chattogram (35.1%).

Table 2: Association between first antenatal care visit among pregnant women on different socio-economic and demographic factors in Bangladesh

Variables	**Total** N (%)	**First Antenatal care visit**		χ^2- **value**	**P-value**
		Delayed, N (%)	**Early,** N (%)		
Overall, n (%)	4451 (100%)	2599 (58.4%)	1852 (42.6%)		
Women's current age					
15-19 years	788 (17.7%)	499 (63.3%)	289 (36.7%)	12.544	0.014
20-24 years	1568 (35.3%)	901 (57.5%)	667 (42.5%)		
25-29 years	1171 (26.3%)	652 (55.7%)	519 (44.3%)		
30-34 years	665 (14.9%)	390 (58.6%)	275 (41.4%)		
35-49 years	259 (5.8%)	157 (60.6%)	102 (39.4%)		
Place of residence					
Urban	1570 (35.3%)	791 (50.4%)	779 (49.6%)	64.041	0.001
Rural	2881 (64.7%)	1808 (62.8%)	1073 (37.2%)		
Women's education level					
Up to primary	1394 (31.3%)	970 (69.6%)	424 (30.4%)	104.653	0.001
Secondary and above	3057 (68.7%)	1629 (53.3%)	1428 (46.7%)		
Women's occupation					
Not working	2716 (61%)	1500 (55.2%)	1216 (44.8%)	28.693	0.001
Working	1735 (39%)	1099 (63.3%)	636 (36.7%)		
Wealth index					
Poor	1745 (39.2%)	1209 (69.3%)	536 (30.7%)	184.256	0.001
Middle	821 (18.4%)	500 (60.9%)	321 (39.1%)		
Rich	1885 (42.4%)	890 (47.2%)	995 (52.8%)		

Women's age at first birth					
Less than equal 18 years	2432 (54.6%)	1565 (64.4%)	867 (35.6%)	114.894	0.001
19-24 years	1762 (39.6%)	947 (53.7%)	815 (46.3%)		
25 and above years	257 (5.8%)	87 (33.9%)	170 (66.1%)		
Number of living children					
0 members	45 (1%)	25 (55.6%)	20 (44.4%)	42.826	0.001
1-2 members	3347 (75.2%)	1864 (55.7%)	1483 (44.3%)		
3 and above members	1059 (23.8%)	710 (67%)	349 (33%)		
Total children ever born					
1-2 children	3230 (72.6%)	1796 (55.6%)	1434 (44.4%)	37.661	0.001
3 and above children	1221 (27.4%)	803 (65.8%)	418 (34.2%)		
Birth order number					
1	1752 (39.4%)	946 (54%)	806 (46%)	43.460	0.001
2-3	2219 (49.8%)	1316 (59.3%)	903 (40.7%)		
4-5	409 (9.2%)	283 (69.2%)	126 (30.8%)		
6 and above	71 (1.6%)	54 (76.1%)	17 (23.9%)		
Contraceptive use and intention					
Using	3056 (68.7%)	1771 (58%)	1285 (42%)	0.776	0.378
Not using	1395 (31.3%)	828 (59.4%)	567 (40.6%)		
Wanted pregnancy when became pregnant					
Yes	4110 (92.3%)	2364 (57.5%)	1746 (42.5%)	16.833	0.001
No	341 (7.7%)	235 (68.9%)	106 (31.1%)		
Distance to health facility					
Big problem	1766 (39.7%)	1115 (63.1%)	651 (36.9%)	27.137	0.001
Not a big problem	2685 (60.3%)	1484 (55.3%)	1201 (44.7%)		
Husband's education level					
Up to primary	2002 (45%)	1386 (69.2%)	616 (30.8%)	175.959	0.001
Secondary and above	2449 (55%)	1213 (49.5%)	1236 (50.5%)		
Husband's occupation					
Not working	36 (0.8%)	21 (58.3%)	15 (41.7%)	0.001	0.994
Working	4415 (99.2%)	2578 (58.4%)	1837 (41.6%)		
Person who usually decides on women's health care					
Women alone	336 (7.5%)	196 (58.3%)	140 (41.7%)	11.640	0.009
Women and husband	2907 (65.4%)	1649 (56.7%)	1258 (43.3%)		
Husband alone	912 (20.5%)	573 (62.8%)	339 (37.2%)		

Others	296 (6.7%)	181 (61.1%)	115 (38.9%)		
Media access					
Unexposed	1466 (32.9%)	1022 (69.7%)	444 (30.3%)	115.338	0.001
Exposed	2985 (67.1%)	1577 (52.8%)	1408 (47.2%)		
Body mass index					
Under weight	69 (1.6%)	46 (66.7%)	23 (33.3%)	74.307	0.001
Normal weight	2001 (45%)	1285 (64.2%)	716 (35.8%)		
Overweight	1508 (33.9%)	853 (56.6%)	655 (43.4%)		
Obese	873 (19.5%)	415 (47.5%)	458 (52.5%)		
Division					
Barishal	447 (10%)	279 (62.4%)	168 (37.6%)	54.356	0.001
Chattogram	727 (16.3%)	472 (64.9%)	255 (35.1%)		
Dhaka	655 (14.7%)	322 (49.2%)	333 (50.8%)		
Khulna	485 (10.9%)	275 (56.7%)	210 (43.3%)		
Mymensingh	535 (12%)	316 (59.1%)	219 (40.9%)		
Rajshahi	492 (11.1%)	312 (63.4%)	180 (36.6%)		
Rangpur	523 (11.8%)	316 (60.4%)	207 (39.6%)		
Sylhet	587 (13.2%)	307 (52.3%)	280 (47.7%)		

3.3 Effect of Risk Factors of First Antenatal Care Visit among Pregnant Women in Bangladesh using MLR

Table 3 demonstrates that all factors significantly associated with the early initiation of the first antenatal care visit were included as independent variables in the multiple binary logistic regression model. The standard errors of each independent variable ranged from 0.001 to 0.5, indicating no evidence of multicollinearity. After adjusting for cluster effects and controlling for other variables, the analysis identified significant factors influencing the likelihood of early initiation of the first antenatal care visit. Logistic regression showed that urban pregnant women exhibited approximately 0.84 times higher odds of experiencing early initiation of the first antenatal care visit compared to their rural counterparts (AOR: 0.84, 95% CI: 0.73-0.98, $p<0.05$). Secondary and above educated pregnant women have a significantly 1.33 times higher experience of early initiation of first antenatal care visit compared to those with up to primary educated pregnant women (AOR: 1.33, 95% CI: 1.33-1.56, $p<0.01$). In the case of the wealth index, pregnant women who belonged to rich families experienced a 1.27 times higher rate of early initiation of first antenatal care visit than poor-income families (AOR: 1.27; 95% CI: 1.06-1.53; $p<0.05$). Women who gave birth for the first time at or after the age of 25 and above years (AOR: 1.579, 95% CI: 1.11-2.247, $p<0.05$) had a considerably increased likelihood of the early initiation of the first antenatal care visit, with chances 1.58 times greater compared to those who gave birth at the age of less than equal 18 years. Pregnant women who were born second or third (AOR: 0.82, 95% CI: 0.68-0.99, $p<0.05$) had a significantly 0.82 times lower experience of the early initiation of first antenatal care visit compared to those who were born first. Furthermore, pregnant women whose husbands with a secondary and above education (AOR: 1.57, 95% CI: 1.36-1.82, $p <0.01$)

demonstrated approximately 1.57 times higher odds of early initiation of first antenatal care visit compared to husbands with up to primary education. The pregnant women who were exposed (AOR: 1.39, 95% CI: 1.19-1.62, p<0.01) to media access had a considerably 1.39 times greater likelihood of experiencing early initiation of first antenatal care visit compared to those who were not exposed. Pregnant women from the Chattogram division (AOR: 0.75, 95% CI: 0.58-0.97, p<0.05) had 0.75 times lower odds of experiencing early initiation of the first antenatal care visit compared to those in the Barishal division. Alternatively, pregnant women from the Dhaka division (AOR: 1.31, 95% CI: 1.01-1.71, p<0.05) and Sylhet division (AOR: 1.70, 95% CI: 1.30-2.24, p<0.01) had 1.31 times and 1.70 times higher odds of experiencing early initiation of first antenatal care visit compared to those in Barishal division.

Table 3: Effect of risk factors of first antenatal care visit among pregnant women in Bangladesh using MLR.

Variables	B	S.E.	P-value	AOR	95% CI for AOR	
					Lower	Upper
Women's current age						
15-19 years (Ref.)				1		
20-24 years	0.13	0.11	0.259	1.14	0.91	1.41
25-29 years	0.28	0.15	0.053	1.33	0.20	1.77
30-34 years	0.28	0.18	0.114	1.33	0.93	1.89
35-49 years	0.31	0.23	0.173	1.37	0.87	2.14
Place of residence						
Urban (Ref.)				1		
Rural	-0.17	0.07	0.022	0.84	0.73	0.98
Women's education level						
Up to primary (Ref.)				1		
Secondary and above	0.29	0.08	0.001	1.33	1.13	1.56
Women's occupation						
Not working (Ref.)				1		
Working	-0.13	0.07	0.067	0.88	0.76	1.01
Wealth index						
Poor (Ref.)				1		
Middle	0.05	0.10	0.593	1.05	0.87	1.27
Rich	0.24	0.09	0.011	1.27	1.06	1.53
Women's age at first birth						
Less than equal 18 years (Ref.)				1		
19-24 years	0.08	0.08	0.368	1.08	0.92	1.26
25 and above years	0.46	0.18	0.011	1.58	1.11	2.25
Number of living children						
0 members (Ref.)				1		
1-2 members	-0.05	0.32	0.888	0.96	0.51	1.79

3 and above members	-0.39	0.37	0.282	0.67	0.33	1.38
Total children ever born						
1-2 children (Ref.)				1		
3 and above children	0.15	0.18	0.404	1.16	0.82	1.65
Birth order number						
1 (Ref.)				1		
2-3	-0.20	0.10	0.041	0.82	0.68	0.99
4-5	-0.23	0.18	0.202	0.79	0.56	1.13
6 and above	-0.44	0.34	0.197	0.65	0.34	1.25
Wanted pregnancy when became pregnant						
Yes (Ref.)				1		
No	-0.18	0.15	0.207	0.83	0.63	1.11
Distance to health facility						
Big problem (Ref.)				1		
Not a big problem	0.09	0.07	0.185	1.09	0.96	1.25
Husband's education Level						
Up to primary (Ref.)				1		
Secondary and above	0.45	0.08	0.001	1.57	1.36	1.82
Person who usually decides on women's health care						
Women alone (Ref.)				1		
Women and husband	0.11	0.12	0.358	1.12	0.88	1.43
Husband alone	-0.15	0.14	0.292	0.87	0.66	1.13
Others	-0.06	0.17	0.717	0.94	0.67	1.32
Media Access						
Unexposed (Ref.)				1		
Exposed	0.33	0.08	0.001	1.39	1.19	1.62
Body mass index						
Under weight (Ref.)				1		
Normal weight	0.12	0.27	0.645	1.13	0.67	1.92
Overweight	0.29	0.27	0.288	1.33	0.78	2.27
Obese	0.49	0.28	0.078	1.63	0.95	2.80
Division						
Barishal (Ref.)				1		
Chattogram	-0.29	0.13	0.030	0.75	0.58	0.97
Dhaka	0.27	0.14	0.046	1.31	1.01	1.71
Khulna	0.05	0.14	0.705	1.06	0.80	1.39
Mymensingh	0.20	0.14	0.150	1.22	0.93	1.61
Rajshahi	-0.15	0.14	0.310	0.86	0.65	1.15
Rangpur	0.10	0.14	0.477	1.11	0.84	1.46
Sylhet	0.53	0.14	0.001	1.70	1.30	2.24

N. B.: AOR: Adjusted Odds Ratio, CI: Confidence Interval, Ref.: Reference case, S.E.: Standard Error.

4. Discussion

The investigation disclosed that 58.4% of pregnant women prolong their first antenatal care visit and 40.6% of pregnant women utilize early initiations. A great deal of teenage women in Nigeria initiate ANC at four months of pregnancy or later (Stephen and Joshua, 2016). The result supports earlier findings that minority pregnant women who saw an ANC during the primary trimester of their gestation received all prescribed therapy components (Kayemba et al., 2023). Knowing the motives for the postponement of teen women's debut ANC visit (Kayemba et al., 2023). Significant associations between criteria including the place of residence, women's education level, wealth index, women's age at first birth, birth order number, husband's education level, media access, and division are prevalent in the study. Those studies executed in Bangladesh divulge a significant lag in the commencement of the first ANC (Jo et al., 2019; Islam et al., 2022). Variations in the amount of ANC receivable were additionally identified according to place of residence. Based on our research, women from rural regions had higher postponed ANC, whereas females from urban centres had lower postponed ANC. According to another Nepalese inquiry, compared to urban women, rural women are less likely to seek ANC medications (Hayen et al., 2014). The reason can be transportation issues or supply-side constraints, such as the absence of medical facilities, competent workers, or accurate outcomes from diagnostic laboratory testing, which might be the root of the discrepancy (Ali et al., 2018).

Our study showed that women's education level has a substantial influence on the early initiation of ANC visits; moms who complete their higher study have a higher chance of taking ANC than moms who complete primary education. From different studies, worldwide data shows that women who complete primary school are more likely to postpone their ANC visits than those who complete secondary or higher education (Tran et al., 2012; Edward, 2011; Fagbamigbe and Idemudia, 2017). According to another study, women with a greater degree of education are more likely to be fluent in childbirth and to meet their prerequisites (Islam and Masud, 2018; Nwaru et al., 2012; Matsumura and Gubhaju, 2001). Education enhances women's decision-making power within the household, fostering confidence and capability to make health-related decisions (Matsumura and Gubhaju, 2001). Also, women's education level encourages new attitudes and values that encourage utilizing modern medical amenities regularly (Furuta and Salway, 2006).

In this research, pregnant women who lived in poor-income families had less opportunity to take the early initiation of antenatal care visits rather than rich-income family women. The study found that the household wealth index significantly predicts early ANC initiations, consistent with previous research in Bangladesh and other countries (Adulo et al.,2022; Gebresilassie et al., 2019; Hayen et al., 2014; Fagbamigbe and Idemudia, 2017). Another research reflects the main rationality, Bangladesh's economy, where one-third of the people live in poverty, may have an immense effect on how frequently women seek medical help (Agargaon, 2024). The only way to optimize the efficacy of maternity care usage is to elevate the quality of life generally (Islam and Masud, 2018). As to our examination, since females are prone to experience delivery problems, women aged 25 and above years of age or beyond are more likely to undergo early prenatal care visits, which is similar to a Nigerian study (Fagbamigbe and Idemudia, 2017). Tessema and Minyihun, 2021; also identified that senior women were conscious of the perks of using health services. The reason behind this is that they might even be more educated and cautious of ANC (Tessema and Minyihun, 2021).

The early start of initial antenatal care (ANC) visits is influenced by birth order number; women with 2-3 children are less likely to begin visits, whereas females with first newborns are more circumspect in this examination. According to a 2018 study by Ali et al., new mothers in Bangladesh necessitate more prenatal care (ANC) services due to the nation's elevated rate of early pregnancies (Ali et al., 2018).

Husband education significantly impacts pregnant women's early initiation of the first ANC visit, with higher-educated husbands having a higher likelihood of successful outcomes in our research. The outcomes of a systematic review conducted in low-income nations are comparable with our study (Simkhada, 2008). According to an urban Nepalese study, women retain maternal health education information better when husbands are included in the program (Mullany et al., 2007).
The portrayal of factors that determine the early beginning of the first ANC visit is facilitated by media access. Our inquiry demonstrated a strong beneficial association between exposure to media access and early attendance rates. Our study is similar to the study of Uganda that is conducted by Australian medical journal. They explained that media access enhances mother's knowledge about the importance of antenatal care and the use of recommended content (Edward, 2011).

Variations were also observed in the application of consequences of the early launch of the first ANC consultation throughout Bangladeshi administrative divisions. Our study revealed that respondents from the Chattogram division had significantly lower odds of the early initiation of antenatal care visits compared to the Barishal division. Alternatively, the Dhaka and Sylhet divisions had higher odds than the Barishal division. Another study shows the dissimilarity that respondents from the Rangpur division had higher odds. Mothers from the Rangpur region received noticeably more ANC services than those from Sylhet (Ali et al., 2018; Rahman et al., 2016). It often remains uncertain the reason why divisions differ from one another and requires more research.

5. Strengths and Limitations of the Study

A key strength of this study is its analysis, which utilizes a large sample size from the most recent nationally representative secondary dataset, the BDHS 2017-18. However, we were unable to consider other potentially relevant factors due to data limitations and missing observations. Future research should aim to include these missing observations to broaden the scope and better assess the factors influencing the early initiation of the first ANC visit.

6. Conclusions

In this study observed the socio-economic and demographic factors influencing the prevalence of antenatal care (ANC) visits and the reception of essential ANC services among pregnant women in Bangladesh. Risk factors such as place of residence, women's education level, wealth index, women's age at first birth, birth order number, husband's education level, media access, and division were more recurrent antenatal care visits. The lower prevalence of ANC visits and rarer services conventional in the Chattogram and Barishal divisions underscore the need for region-specific policies. For sustained improvement, it's important to focus on women's education level and access to quality ANC services. Strengthening media access campaigns to highlight the benefits of regular ANC visits and adherence to recommended ANC guidelines would further improve maternal care. Additionally, the government should expand health facilities across various divisions and increase training for skilled maternal healthcare providers to ensure equitable

distribution of health workers. Further qualitative and quantitative research is necessary to identify barriers to ANC service utilization in Bangladesh and to develop an effective ANC program.

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References

[1] Abebe, G. F., Alie, M. S., Girma, D., Mankelkl, G., Berchedi, A. A., and Negesse, Y. (2023). Determinants of early initiation of first antenatal care visit in Ethiopia based on the 2019 Ethiopia mini-demographic and health survey: A multilevel analysis. PLoS One, 18(3), e0281038. doi: 10.1371/journal.pone.0281038

[2] Adulo, L. A., Hassen, S. S., and Chernet, A. (2022). Timing of the first antenatal care visit and associated risk factors in rural parts of Ethiopia. International Journal of Applied Research on Public Health Management (IJARPHM), 7(1), 1-12. doi: 10.4018/ijarphm.20220101.oa1

[3] Agargaon P-E-32. The World Bank World Bank Office Dhaka Design: Cover designed by Zuber Mahbub Tusher and Report published by Creative Idea Illustration Credits: Front cover: Bangladesh Bridge Authority Back cover: Andrew Biraj. Available: www.worldbank.org

[4] Akter, E., Hossain, A. T., Rahman, A. E., Ahmed, A., Tahsina, T., Tanwi, T. S., ... and Chowdhury, M. E. (2023). Levels and determinants of quality antenatal care in Bangladesh: Evidence from the Bangladesh Demographic and Health Survey. Plos one, 18(5), e0269767. doi: 10.1371/journal.pone. 0269767

[5] Ali, N., Sultana, M., Sheikh, N., Akram, R., Mahumud, R. A., Asaduzzaman, M., and Sarker, A. R. (2018). Predictors of optimal antenatal care service utilization among adolescents and adult women in Bangladesh. Health services research and managerial epidemiology, 5, 2333392818781729. doi:10.1177/2333392818781729

[6] Alkema, L., Chou, D., Hogan, D., Zhang, S., Moller, A. B., Gemmill, A., ... and Say, L. (2016). Global, regional, and national levels and trends in maternal mortality between 1990 and 2015, with scenario-based projections to 2030: a systematic analysis by the UN Maternal Mortality Estimation Inter-Agency Group. The lancet, 387(10017), 462-474.

[7] Appiah, F. (2022). Individual and community-level factors associated with early initiation of antenatal care: Multilevel modelling of 2018 Cameroon Demographic and Health Survey. PLoS One, 17(4), e0266594. doi: 10.1371/journal.pone.0266594

[8] Ariestanti, Y., Widayati, T., and Sulistyowati, Y. (2020). Determinan perilaku ibu hamil melakukan pemeriksaan kehamilan (antenatal care) pada masa pandemi covid-19. Jurnal Bidang ilmu kesehatan, 10(2), 203-216.

[9] Belay, D. G., Alemu, M. B., Aragaw, F. M., and Asratie, M. H. (2023). Time to initiation of antenatal care visit and its predictors among reproductive age women in Ethiopia: Gompertz inverse Gaussian shared frailty model. Frontiers in Global Women's Health, 4, 917895. doi:10.3389/fgwh.2023.917895

[10] Dengo, M. R., and Mohamad, I. (2019). Faktor Berhubungan dengan Rendahnya Kunjungan Antenatal pada Kontak Pertama Pemeriksaan Ibu Hamil (K-1). Gorontalo Journal of Public Health, 2(2), 162-169.

[11] Edward, B. (2011). Factors influencing the utilisation of antenatal care content in Uganda. The Australasian medical journal, 4(9), 516. doi:10.4066/AMJ.2011.849

[12] Fagbamigbe, A. F., and Idemudia, E. S. (2015). Assessment of quality of antenatal care services in Nigeria: evidence from a population-based survey. Reproductive health, 12, 1-9. doi:10.1186/s12978-015-0081-0

[13] Fagbamigbe, A. F., and Idemudia, E. S. (2017). Wealth and antenatal care utilization in Nigeria: policy implications. Health care for women international, 38(1), 17-37. doi:10.1080/07399332.2016.1225743

[14] Furuta, M., and Salway, S. (2006). Women's position within the household as a determinant of maternal health care use in Nepal. International family planning perspectives, 17-27.

[15] Gebresilassie, B., Belete, T., Tilahun, W., Berhane, B., & Gebresilassie, S. (2019). Timing of first antenatal care attendance and associated factors among pregnant women in public health institutions of Axum town, Tigray, Ethiopia, 2017: a mixed design study. BMC pregnancy and childbirth, 19, 1-11. doi:10.1186/s12884-019-2490-5

[16] Gross, K., Alba, S., Glass, T. R., Schellenberg, J. A., and Obrist, B. (2012). Timing of antenatal care for adolescent and adult pregnant women in south-eastern Tanzania. BMC pregnancy and childbirth, 12, 1-12. doi:10.1186/1471-2393-12-16

[17] Habte, A., Tamene, A., and Melis, T. (2024). Compliance towards WHO recommendations on antenatal care for a positive pregnancy experience: Timeliness and adequacy of antenatal care visit in Sub-Saharan African countries: Evidence from the most recent standard Demographic Health Survey data. Plos one, 19(1), e0294981. doi: 10.1371/journal.pone.0294981

[18] Hayen, A., Hodgson, R., Torvaldsen, S., and Joshi, C. (2014). Factors associated with the use and quality of antenatal care in Nepal: a population-based study using the demographic and health survey data.doi:10.1186/1471-2393-14-94

[19] Idris, H., and Sari, I. (2023). Factors associated with the completion of antenatal care in Indonesia: A cross-sectional data analysis based on the 2018 Indonesian Basic Health Survey. Belitung Nursing Journal, 9(1), 79. doi:10.33546/bnj.2380

[20] Islam, M. M., and Masud, M. S. (2018). Determinants of frequency and contents of antenatal care visits in Bangladesh: Assessing the extent of compliance with the WHO recommendations. PloS one, 13(9), e0204752. doi: 10.1371/journal.pone.0204752

[21] Islam, M. T., Islam, J. M., Akanda, M. A. S., Pikul, M. A. J., and Yesmin, F. (2022). Shape anisotropy effect on magnetic domain wall dynamics in nanowires under thermal gradient. Abdus Sami and Pikul, Md. Abu Jafar and Yesmin, Ferdouse, Shape Anisotropy Effect on Magnetic Domain Wall Dynamics in Nanowires Under Thermal Gradient.

[22] Islam, M. A., Islam, M. K., Al Mamun, A. S. M., Rana, M. S., and Hossain, M. G. (2023). Multilevel Approach of Factors Influencing Child Marriage among Bangladeshi Women: Data from the 2017-18 Bangladesh Demographic and Health Survey. *International Journal of Statistical Sciences*, *23*(2), 63-73.

[23] Jinga, N., Mongwenyana, C., Moolla, A., Malete, G., and Onoya, D. (2019). Reasons for late presentation for antenatal care, healthcare providers' perspective. BMC health services research, 19, 1-9. doi:10.1186/s12913-019-4855-x

[24] Jo, Y., Alland, K., Ali, H., Mehra, S., LeFevre, A. E., Pak, S., ... and Labrique, A. B. (2019). Antenatal care in rural Bangladesh: current state of costs, content and recommendations for effective service delivery. BMC health services research, 19, 1-13. doi:10.1186/s12913-019-4696 7

[25] Kayemba, V., Kabagenyi, A., Ndugga, P., Wasswa, R., and Waiswa, P. (2023). Timing and quality of antenatal care among adolescent mothers in a rural community, Uganda. Adolescent health, medicine and therapeutics, 45-61. doi: 10.2147/ahmt. s374296

[26] Matsumura, M., and Gubhaju, B. (2001). Women's Status, Household Structure and the Utilization of Maternal Health Services in Nepal: Even primary-leve1 education can significantly increase the chances of a woman using maternal health care from a modem health facility. Asia-pacific population journal, 16(1), 23-44.

[27] Mgata, S., and Maluka, S. O. (2019). Factors for late initiation of antenatal care in Dar es Salaam, Tanzania: A qualitative study. BMC Pregnancy and Childbirth, 19, 1-9. doi:10.1186/s12884-019-2576-0

[28] Mgata, S., and Maluka, S. O. (2019). Factors for late initiation of antenatal care in Dar es Salaam, Tanzania: A qualitative study. BMC Pregnancy and Childbirth, 19, 1-9. doi:10.1186/s12884-019-2576-0

[29] Mulinge, N., Yusuf, O., and Aimakhu, C. (2017). Factors influencing utilization of antenatal care services among teenage mothers in Malindi Sub-County Kenya-a cross sectional study. Sci J Publ Health, 5(2), 61-7. doi: 10.11648/j.sjph.20170502.12

[30] Mullany, B. C., Becker, S., & Hindin, M. J. (2007). The impact of including husbands in antenatal health education services on maternal health practices in urban Nepal: results from a randomized controlled trial. Health education research, 22(2), 166-176. doi:10.1093/her/cyl060

[31]. NIPORT (2020). Bangladesh demographic and health survey 2017-18. Dhaka: National Institute of Population Research and Training, Dhaka; Bangladesh and Rockville, Maryland, USA: NIPORT and ICF.

[32] Nwaru, B. I., Wu, Z., and Hemminki, E. (2012). Determinants of the use of prenatal care in rural China: the role of care content. Maternal and child health journal, 16, 235-241. doi:10.1007/s10995-010-0734-0

[33] Pervin, J., Moran, A., Rahman, M., Razzaque, A., Sibley, L., Streatfield, P. K., ... and Rahman, A. (2012). Association of antenatal care with facility delivery and perinatal survival–a population-based study in Bangladesh. BMC pregnancy and childbirth, 12, 1-12. doi:10.1186/1471-2393-12-111

[34] Pervin, J., Venkateswaran, M., Nu, U. T., Rahman, M., O'Donnell, B. F., Friberg, I. K., ... and Frøen, J. F. (2021). Determinants of utilization of antenatal and delivery care at the community level in rural Bangladesh. PloS one, 16(9), e0257782. doi: 10.1371/journal.pone.0257782

[35] Putri, N. K. S. E. (2021). Analisis Pekerjaan dengan Perilaku Ibu Hamil untuk Melakukan Kunjungan Antenatal Care. Jurnal Stethoscope, 1(2).

[36] Rahman, M. M., Rahman, M. M., Tareque, M. I., Ferdos, J., and Jesmin, S. S. (2016). Maternal pregnancy intention and professional antenatal care utilization in Bangladesh: a nationwide population-based survey. PloS one, 11(6), e0157760. doi: 10.1371/journal.pone.0157760

[37] Sarker, B. K., Rahman, M., Rahman, T., Rahman, T., Khalil, J. J., Hasan, M., ... and Rahman, A. (2020). Status of the WHO recommended timing and frequency of antenatal care visits in Northern Bangladesh. Plos one, 15(11), e0241185. doi: 10.1371/journal.pone.0241185

[38] Simkhada, B., Teijlingen, E. R. V., Porter, M., and Simkhada, P. (2008). Factors affecting the utilization of antenatal care in developing countries: systematic review of the literature. Journal of advanced nursing, 61(3), 244-260. doi:10.1111/j.1365-2648.2007.04532. x

[39] Stephen, A. A., and Joshua, A. O. (2016). Determinants of maternal utilization of health services and nutritional status in a rural community in South-West Nigeria. African journal of reproductive health, 20(2), 72-85.

[40] Tessema, Z. T., and Minyihun, A. (2021). Utilization and determinants of antenatal care visits in East African countries: a multicountry analysis of demographic and health surveys. Advances in Public Health, 2021(1), 6623009. doi:10.1155/2021/6623009

[41] Tran, T. K., Gottvall, K., Nguyen, H. D., Ascher, H., and Petzold, M. (2012). Factors associated with antenatal care adequacy in rural and urban contexts-results from two health and demographic surveillance sites in Vietnam. BMC health services research, 12, 1-10. doi:10.1186/1472-6963-12-40

[42] Woldeamanuel, B. T., and Belachew, T. A. (2021). Zeitpunkt der ersten Besuche bei der Schwangerenvorsorge und Anzahl der erhaltenen Inhalte der Schwangerenvorsorge und damit verbundene Faktoren in Äthiopien: Mehrebenenanalyse mit gemischten Effekten. Reproductive Health, 18, 1-16. doi:10.1186/s12978-021-01275-9

[43] World Health Organization. (2023). Trends in maternal mortality 2000 to 2020: estimates by WHO, UNICEF, UNFPA, World Bank Group and UNDESA/Population Division. World Health Organization. https://data.unicef.org/topic/maternal-health/maternal-mortality/