ISSN No:-2456-2165

Exploring Sociodemographic Factors Influencing Maternal Healthcare Access: A Cross-Sectional Analysis of Reproductive Women in Bangladesh

Farhana Hasan[1]
Department of Statistics, University of Rajshahi, Rajshahi-6205, Bangladesh

Abstract:- Maternal health care utilization is a critical determinant of maternal and neonatal health outcomes in low- and middle-income countries like Bangladesh. This study investigates the demographic and socioeconomic correlates associated with the utilization of antenatal care (ANC), facility-based childbirth (FBCB), skilled birth attendance (SBA), and postnatal care (PNC) services among reproductive women in Bangladesh. Using a cross-sectional study design, data were collected through structured interviews and questionnaires from a representative sample of BDHS- 2017-18. Logistic regression analysis was employed to calculate adjusted odds ratios (AORs) with 95% confidence intervals (CIs) to assess the relationship between utilization of maternal health care services and explanatory variables including division of residence, mother's education, husband's education, age at first birth, total children ever born, intake of vitamin A during pregnancy, and wealth index. The study identified significant correlates associated with maternal health care utilization. Women residing in the Khulna, Rajshahi, and Rangpur divisions had significantly higher odds of utilizing ANC, FBCB, and SBA services compared to those in other divisions. Maternal education was positively associated with ANC, FBCB, and SBA utilization, with higher education levels leading to higher odds. Husband's education also played a role, with higher education levels correlating with increased odds of utilizing maternal health care services. Women who gave birth at an age younger than 20 years had lower odds of utilizing ANC, FBCB, and SBA services. Intake of vitamin A during pregnancy was associated with increased odds of utilizing maternal health care services. Women in wealthier households were more likely to utilize ANC, FBCB, and SBA services. This study provides valuable insights into the demographic and socioeconomic factors influencing maternal healthcare utilization in Bangladesh. Findings highlight the importance of tailored interventions to address disparities in maternal healthcare access and utilization, particularly among women with lower education levels, younger mothers, and those from economically disadvantaged backgrounds. These insights can inform policy and program development aimed at improving maternal and child health outcomes in Bangladesh.

Keywords:- *Maternal Health Care, ANC, FBCB, SBA, PNC, Bangladesh.*

I. INTRODUCTION

Maternal healthcare utilization holds immense significance in safeguarding the health and well-being of mothers and infants, particularly in nations grappling with elevated maternal and infant mortality rates. In the context of Bangladesh, where these challenges persist, unraveling the factors influencing maternal health care utilization is not only imperative but also offers a pathway to address these critical concerns. Globally, maternal mortality is still one of the main barricades to human advances. Because it is a major public health problem in most emerging countries [1, 2]. Worldwide the yearly maternal death rate is approximately 300,000 which is related to pregnancy or childbirth obstacles and one-third of these cases occur annually in South Asian countries [3-5] Approximately 295,000 mothers died worldwide in 2017 from pregnancy-related causes [3]. Proper routine maternal care can play an important role in preventing and reducing maternal and child mortality, which will be vital to achieving the global SDG goals [6-8]. The state of maternal health in Bangladesh is a matter of considerable apprehension [9]. In 2020 The estimated maternal mortality ratio (MMR) was 163 per 100,000 live births, which was greater than other south-Asian countries like India 145, Pakistan 140, and Sri Lanka 36 [10,11]. This cross-sectional study derives its foundation from the comprehensive dataset provided by the 2017-18 Bangladeshi Demographic and Health Survey (BDHS). Acknowledged as a cornerstone in public health research in Bangladesh, the BDHS serves as a robust repository of data, encompassing a myriad of demographic, socioeconomic, and health-related facets, thereby rendering it invaluable for understanding maternal health care utilization dynamics [12]. The undeniable burden of maternal and infant mortality within Bangladesh lends a sense of urgency to this inquiry. Although noteworthy strides have been made, maternal mortality rates persist as a pressing issue [13]. Against this backdrop, a thorough comprehension of the determinants shaping maternal healthcare utilization becomes imperative. This study endeavors to unravel the intricate tapestry of demographic and socioeconomic factors that influence the utilization of maternal healthcare services among women of reproductive age in Bangladesh. The utilization of the rich BDHS dataset is pivotal in unraveling the intricate associations between various variables and maternal health care service utilization. These insights hold promise in steering evidence-based interventions and policy formulations tailored to ameliorate maternal and child health outcomes not only within Bangladesh but also in contexts

that mirror similar challenges. The utilization of maternal healthcare services is an essential component of comprehensive healthcare systems, particularly in low and middle-income countries grappling with maternal and infant mortality challenges. Extensive literature underscores the multifaceted interplay of demographic and socioeconomic factors in shaping maternal healthcare utilization patterns. Previous studies in the context of Bangladesh have shed light on the profound impact of demographic factors such as maternal age, parity, and place of residence on maternal healthcare utilization. Early maternal age has been associated with reduced utilization of antenatal care (ANC) and skilled birth attendance (SBA) services [14]. Similarly, rural residency has been identified as a barrier to accessing maternal health care services, leading to lower utilization rates compared to urban areas [15]. Socioeconomic determinants have also been widely explored, revealing significant correlations with maternal healthcare utilization. Education, a pivotal factor, has consistently shown positive associations with utilization rates. Studies have highlighted that women with higher education levels are more likely to seek ANC services and skilled birth attendants with institutional birth facilities [16]. Moreover, the education level of spouses has been observed to influence utilization rates, indicating the role of family support in decision-making [17]. The role of socioeconomic status, often represented by wealth index or household income, is also prominent in maternal health care utilization research. Women from economically disadvantaged backgrounds are less likely to access essential maternal healthcare services, indicating the presence of disparities in service utilization [18]. In a subsequent study, Methun et al. (2022) undertook an examination with the aim of elucidating the multifaceted interplay of socioeconomic determinants in relation to maternal healthcare utilization within the context of Bangladesh. The study discerns that maternal care utilization is significantly influenced by variables such as maternal education, household wealth, urban/rural dichotomy, and access to media [19]. The investigation of Nizum et al. (2023) found that antenatal care utilization is intricately interwoven with a matrix of factors, including maternal education, husband's occupational status, proximity to healthcare facilities, and the level of awareness regarding the salience of antenatal care. Socioeconomic variables and consciousness regarding antenatal care's significance jointly emerged as influential determinants of utilization patterns [20]. The work of Kabir (2021) illuminated the pervasive influence of maternal education, family income, geographic proximity to healthcare facilities, and maternal parity in determining the extent to which maternal healthcare services are harnessed [21]. Additionally, investigations into specific services like antenatal care and skilled birth attendance have provided valuable insights into utilization patterns [12-22]. However, as the landscape of maternal health care evolves, there are noteworthy gaps that warrant further exploration. While individual factors have been extensively studied, a holistic understanding is lacking regarding the intricate interplay of demographic and socioeconomic factors on maternal healthcare utilization. A comprehensive examination of the combined impact of these factors remains scarce, signifying a research gap that requires attention [23-24]. In the realm of maternal healthcare services utilization in India, Paul and Chouhan (2020) endeavored to probe the socio-demographic underpinnings that shape the uptake of these essential services. Their research unveiled a rich tapestry of factors encompassing maternal education, household affluence, caste dynamics, religious considerations, and urban-rural gradients that intricately mold the contours of maternal healthcare utilization. Education manifested as a key variable that significantly impacts the degree to which these services are accessed and effectively utilized [25-26]. The study by Kangbai et al. (2022) demonstrated that maternal education, wealth status, marital affiliations, and frequency of antenatal care visits collectively shape the contours of maternal healthcare engagement [27]. The research by Bain et al. (2022) into the sub-Saharan African context, found the vital role played by factors including maternal education, marital status, media exposure, wealth, and urban-rural distinctions in shaping maternal healthcare utilization patterns [28]. The study by Jahan & Islam (2022) reveals that women's dealings and approaches during the postnatal period are shaped by individual beliefs and views as well as by socio-cultural practices. It shows how home-grown knowledge and practices affected women's postnatal care practices for generations [29]. Andersen's Behavioral Model of Health Services Use is used as a theoretical framework in some of the studies to analyze the factors that influence access to medical care, providing a conceptual basis for understanding healthcare utilization [30]. Zegeye et al. (2022) examines disparities in the use of skilled birth attendants and neonatal mortality rates in Guinea over two decades [31]. This study underscores the importance of addressing disparities to improve maternal and neonatal health outcomes. The Bangladesh Demographic and Health Survey 2014 serves as an important source of information on maternal health care in Bangladesh, offering insights into the state of maternal health during that period [32]. Another study discusses antenatal care in rural Bangladesh, focusing on the costs, content, and recommendations for effective service delivery [33]. It provides an overview of the challenges and opportunities in rural healthcare settings. Banik's research highlights the barriers to accessing maternal healthcare services in Northern Bangladesh, emphasizing the need to address these barriers to improve access and utilization [34]. Amartya's article provides a broader perspective on the state of healthcare in Bangladesh, including maternal health. It discusses the challenges and progress made in the healthcare sector [35]. The determinants of antenatal and delivery care utilization at the community level in rural Bangladesh explored by Pervin et al. provide insights into the factors influencing access to care [36]. Maraga et al.'s research investigates socio-demographic factors associated with maternal health care utilization in Wosera, East Sepik Province, Papua New Guinea. This study offers insights into maternal healthcare in a different cultural and geographic context [37]. Some studies examine factors associated with the use of antenatal care services contributing to understanding of maternal healthcare utilization in specific local settings [38, 39,40]. The factors associated with the utilization of skilled service delivery among women was documented in some previous studies [41, 42]. It focuses on healthcare utilization in a sub-Saharan African context and

ISSN No:-2456-2165

Bangladesh contributing to our understanding of skilled birth attendance.

In conclusion, the literature underscores the intricate interplay between demographic and socioeconomic factors in shaping maternal healthcare utilization in Bangladesh. While education, wealth, and urban residency emerge as pivotal determinants, the influence of cultural norms and contextual factors cannot be underestimated. A comprehensive understanding of these factors is crucial for designing effective interventions aimed at improving maternal health care service utilization and consequently reducing maternal and infant mortality rates. This study aims to provide a comprehensive understanding of the demographic and socioeconomic correlates of maternal health care service utilization among women of reproductive age in Bangladesh. This paper examines the latest BDHS 2017–18 data for nationally representative estimates of the prevalence of maternal healthcare utilization like antenatal care (ANC) visits, facility-based childbirth (FBCB), skilled birth attendance (SBA), and postnatal care (PNC) visits and to identify their association with potential correlates such as age, place of residence, educational achievement, socioeconomic status, and nutritional status. In conclusion, the identified research gaps emphasize the need for studies that holistically explore the combined influence of demographic and socioeconomic factors, consider cultural and community dynamics, incorporate qualitative methodologies, and investigate the evolving healthcare delivery landscape. Addressing these gaps will contribute to a richer understanding of maternal healthcare utilization, paving the way for informed interventions to enhance maternal and infant health outcomes in Bangladesh to achieve its intended goals. The findings will contribute valuable insights to inform targeted interventions and policies aimed at improving maternal and infant health outcomes in the country.

II. METHODS

This study utilized data from the Bangladesh Demographic and Health Survey (BDHS) conducted in 2017-18. The BDHS is a nationally representative cross-sectional survey designed to collect comprehensive information on demographic, health, and socioeconomic indicators among women of reproductive age, men, and children in Bangladesh [12]. To inspect the up-to-date nationally representative estimates of maternal health care utilization prevalence and management among the reproductive women in Bangladesh and to detect its association with potential predictors, we followed and modified an adaptation of the conceptual framework proposed by Andersen RM. In 1995 (Fig. 1) [30]. The primary dependent variables of the study were maternal health care services like antenatal care (ANC) visits, facility-based childbirth (FBCB), skilled birth attendance (SBA), and postnatal care (PNC) visits among reproductive women, and the independent variables that comprised the predisposing, enabling and need factors were based on the national survey by BDHS 2017–18. Following this conceptual framework, the study hypothesized that the selected predisposing, enabling, and need factors significantly predict the outcome variable based on the conceptual model. Therefore, the study also hypothesized that enabling factors might have a greater predictive influence on healthcare utilization.

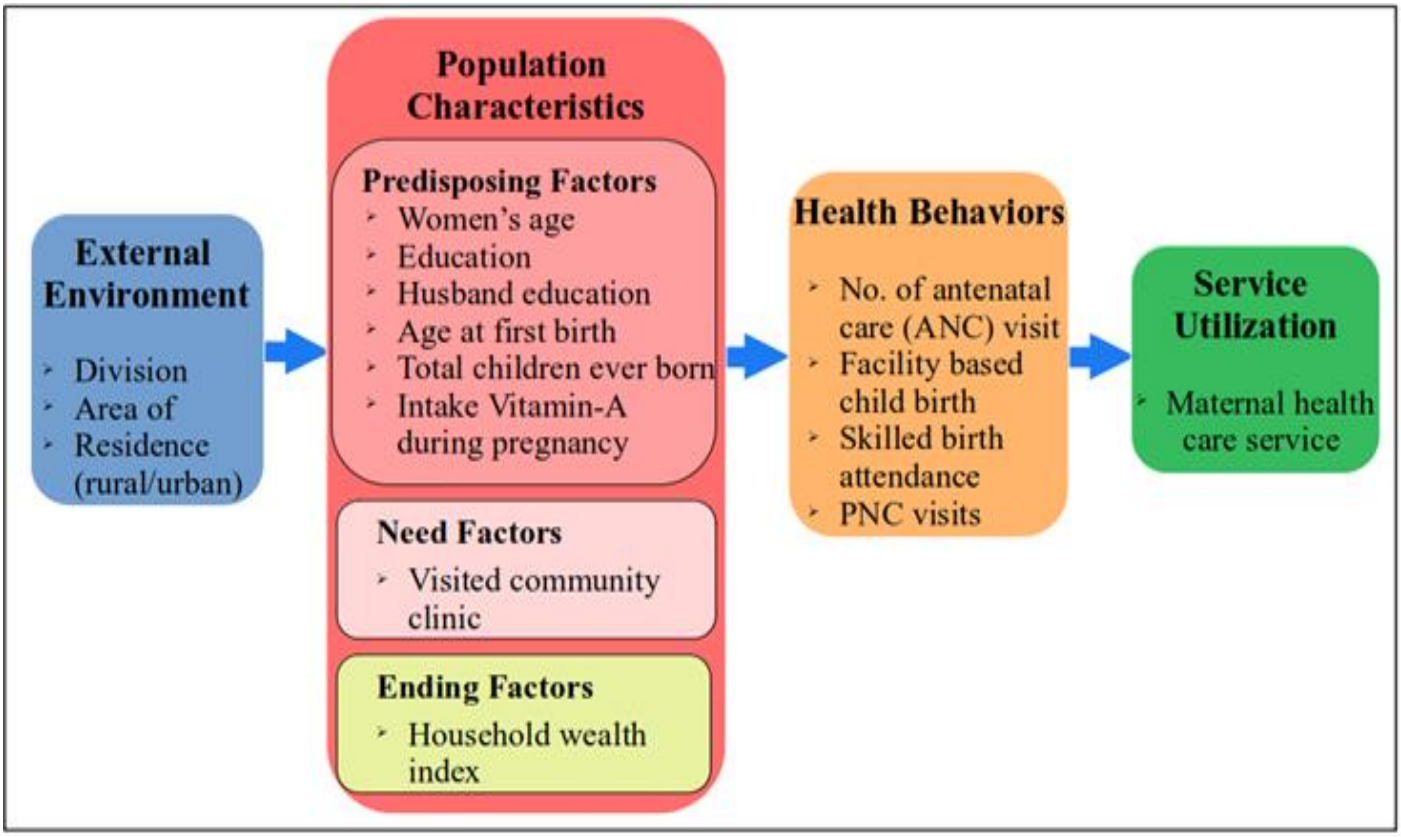

Fig 1 Conceptual Framework

III. DATA SOURCE, SAMPLING AND STUDY POPULATION AND SAMPLE SIZE

A population-based cross-sectional study design was employed to investigate the demographic and socioeconomic factors associated with the utilization of maternal health care services among women of reproductive age in Bangladesh. This study utilized nationally representative survey data conducted in 2017–18. This is the eighth national survey that informed the demographic and health status of women and children from a nationally representative sample, with selected information on men from the same households. The survey employs a multi-stage cluster sampling design to ensure the representation of both urban and rural areas, as well as different administrative divisions of the country. In total, 20,250 households were surveyed following a two-stage stratified sampling procedure from 675 clusters in the first stage. In the second stage, a systematic sample of 30 households was selected per enumeration unit [24]. Among the women, only 5,012 women reported the pregnancy in three years preceding the survey. Thus, the study population was turned into 5,012 women.

- *Outcome Variables*

The primary outcome variables included maternal health care service utilization indicators such as antenatal care (ANC) visits, facility-based childbirth (FBCB), skilled birth attendance (SBA), and postnatal care (PNC) visits. Antenatal care visit was extracted from the number of times the respondents used the service during pregnancy up to delivery. Although WHO recommended at least eight antenatal care visits, due to the low rate of these visits we defined a case with at least one antenatal care visit as "Yes" and a case without a visit as "No." Facility-based childbirth was extracted from the data of women's places of delivery, where delivery at any public sector (government/private hospital, health center, or clinic) and private sector (home delivery). Women who delivered at a facility were indicated by a "Yes," and those who delivered at home were indicated by a "No." Women were considered to use skilled birth attendance (SBA) if their delivery was attended to or assisted by skilled health personnel [13]. The response for the outcome variable was dichotomous (coded as 1 for SBA use and 0 for unskilled attendant) [31]. PNC visits were derived from the question, "Did follow PNC checks within 2 months?". The response options were coded 1 for "Yes" and coded 0 for "No".

- *Exposure Variables*

Based on previous literature the independent variables encompassed various demographic and socioeconomic factors, including division(Barisal, Chittagong, Dhaka, Khulna, Mymensingh, Rajshahi, Rangpur and Sylhet), maternal age(15–19 years, 35+years), education levels of mothers and husbands(no education, primary, secondary, higher), age at first birth(<18,18-24, 25 years) total children ever born(≤ 2, 2+), intake of vitamin A during pregnancy(yes, no) and the respondent's wealth index(poor, middle, rich)[28].

- *Ethical Considerations*

The BDHS survey protocol was reviewed and approved by the National Research Ethics Committee of the Bangladesh Medical Research Council. Informed consent was obtained from all study participants, and the collected information was kept confidential.

- *Statistical Tools*

An association analysis was conducted to investigate the relationships between maternal healthcare service utilization indicators and demographic and socioeconomic factors. The chi-square test was employed as the statistical method to assess the associations with the outcome variables of the utilization of ANC, FBCB, SBA, and PNC visits. For all variables, descriptive statistics were computed. Univariate analysis was used to assess the relationships between the factors and outcome variables. After all possible interactions among independent variables were evaluated, adjusted odds ratio (AOR) and 95% confidence interval (CI) were calculated using a bivariate logistic regression model. The modeling was adjusted for other covariates, such as region of residence, education, husband's education, age at first birth, total children ever born, intake of vitamin A, and the quintile wealth index. Variables with a p-value of less than 0.05 were considered significant. We created an adequate logistic regression model, which confirmed that the model's multicollinearity did not occur. Following the above model specification, factors affecting maternal healthcare utilization prevalence and management were examined by using separate multiple logistic regression models.

IV. RESULTS

The analysis of maternal health care service utilization and its associations with demographic and socioeconomic factors yielded noteworthy findings, shedding light on the intricate dynamics of maternal health care utilization among women of reproductive age in Bangladesh. The provided data presents valuable insights into the demographic characteristics of the study participants, particularly focusing on urban and rural distinctions. The highest percentage of respondents originates from the Chittagong division (16.7%), followed by Dhaka (14.8%) and Khulna (10.5%) divisions. Notably, urban areas display a greater proportion of respondents from the Dhaka division (24.3%), whereas rural areas exhibit higher shares from Chittagong (17.2%) and Mymensingh (13.6%) divisions. The largest group of respondents falls within the bracket of 20-24 (35.4%), closely followed by 25-29 (26.1%). Remarkably, respondents below 18 years of age are significantly more represented in rural areas (70.1%). Mothers' education level is prominently spread across secondary education (31.8%) and primary education (30.1%). Respondents with higher levels of education are more prevalent in urban settings, whereas those with no education are more common in

ISSN No:-2456-2165

Table 1 Background Characteristics of the Study Participants

Variables	All %(number)	Urban %(number)	Rural %(number)
Division			
Barishal	10.6(533)	9.3(160)	11.3(373)
Chittagong	16.7(835)	15.6 (269)	17.2(566)
Dhaka	14.8(741)	24.3(4190	9.8(322)
Khulna	10.5(524)	11.2(194)	10.0(330)
Mymensingh	12.0(603)	9.0(156)	13.6(447)
Rajshahi	10.5(527)	9.3(160)	11.2(367)
Rangpur	11.2(559)	9.6(165)	12.0(394)
Sylhet	13.8(690)	11.7(202)	14.8(488)
Maternal age			
15-19	17.3(869)	16.8(279)	17.9(590)
20-24	35.4(1773)	33.4(577)	36.4(1196)
25-29	26.1(1310)	27.4(473)	25.5(837)
30-34	14.9(749)	15.8(273)	14.5(476)
35+	6.2(311)	7.1(123)	5.7188)
Mother's education level			
No education	6.2(312)	5.8(100)	6.4(212)
Primary	27.8(1392)	24.3(419)	29.6(973)
Secondary	47.9(2402)	44.3(765)	49.8(1637)
Higher	18.1(906)	25.6(441)	14.1(465)
Husband's education level			
No education	13.9(698)	9.8(169)	16.1(529)
Primary	33.3(1667)	28.8(497)	35.6(1170)
Secondary	33.0(1653)	33.0(570)	32.9(1083)
Higher	19.8(994)	28.3(489)	15.4(505)
Age at first birth			
<18	55.6(2788)	48.4(835)	59.4(1953)
18-24	38.7(1939)	42.6(735)	36.6(1204)
25+	5.7(285)	9.0(155)	4.0(130)
Total children ever born			
<= 2	70.9(3553)	75.0(1294)	68.7(2269)
2+	29.1(1459)	25.0(431)	31.3(1028)
Intake vitamin A during pregnancy			
No	58.1(2912)	53.6(924)	60.5(1988)
Yes	41.9(2100)	46.4(801)	39.5(1299)
Respondent's wealth index			
Poor	41.8(2096)	19.2(331)	53.7(1765)
Middle	37.8(1893)	39.6(683)	36.8(1210)
Rich	20.4(1023)	41.2(711)	9.5(312)

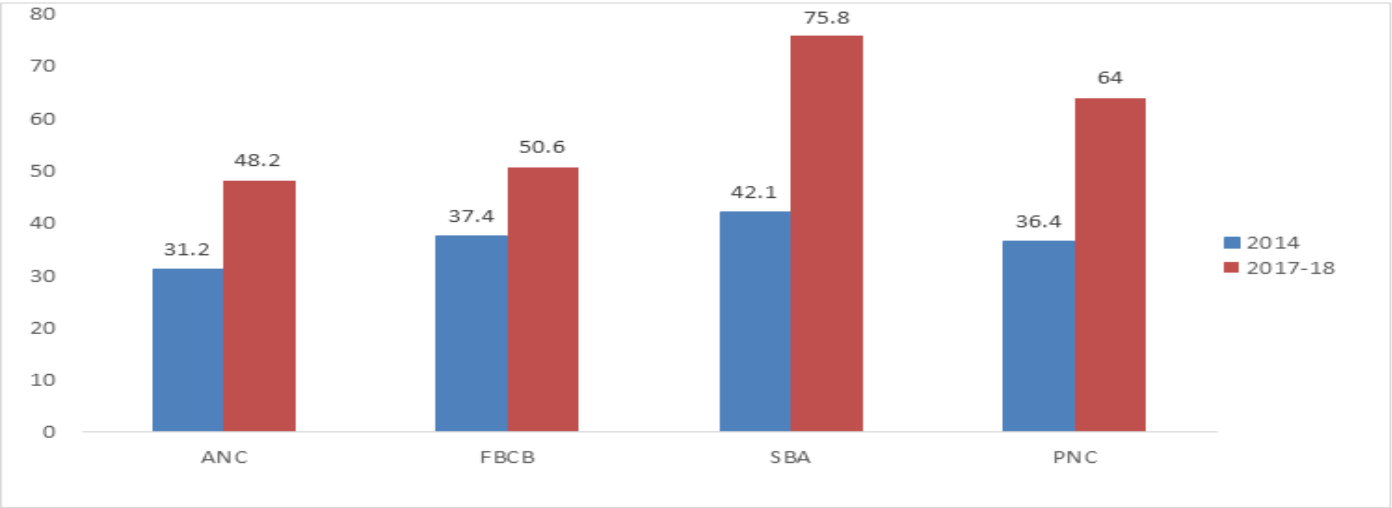

Fig 2 Trend in Utilization of Maternal Health Care Service from 2014 to 2017-18

Rural areas. Husband's education level also shows a higher percentage of respondents with secondary education (34.5%) and primary education (29.8%). Respondents with higher education levels are more frequent in urban areas. A significant proportion of respondents had their first birth before the age of 18 (29.9%), especially in rural areas (70.1%). Conversely, respondents with a first birth age of 25 and above are more prevalent in urban settings. Respondents have fewer than two children (70.9%) living in urban areas (75.0%). Taking vitamin, A during pregnancy, it is evident that 31.7% of respondents did not consume vitamin A, while 38.1% did. A greater percentage of respondents who consume vitamin A during pregnancy are found in urban areas. The wealth index distribution reveals that the majority of respondents belong to the middle wealth index category (36.1%), followed by the poor (15.8%) and rich (29.5%) categories. Urban areas notably feature a significantly higher representation of respondents from the rich wealth index category (**Table 1)**. Bivariate analysis shows the prevalence of maternal health care services (**Table 2**). The prevalence revealed from present BDHS- 2017-18 are increasing like ANC visit 48.2%, FBCB 50.6%, SBA 75.8%, and PNC visit 64.0%. Compared these values to BDHS- 2014 were ANC visit 31.2%, FBCB. 37.4%, SBA 42.1%, and PNC visit 36.4% (**Fig. 2**). The utilization of ANC visits in the 2017–18 BDHS are remarkably high, with a prevalence of 48.2% significantly varied across divisions (p<0.001). Rangpur had the highest percentage receiving ANC at 61.5%, while Sylhet had the lowest at 36.8%. (Table 2). The prevalence of FBCB, SBA, and PNC was also highest in Khulna and Mymensingh and lowest in Barishal respectively. The prevalence of ANC was found significantly higher among urban residents at 59% compared to rural at 42.5% (p<0.001). The prevalence Of FBCB and SBA is also significantly higher at more than 60% in urban areas. There is no significant association between age and maternal healthcare utilization. Both parental education levels showed a strong association with maternal healthcare service utilization (p<0.001). Early childbearing was associated with lower ANC visits, FBCB, SBA, and PNC respectively with approximately 60% range. ANC uptake was significantly higher among women with ≤2 children compared to those with more (52.5% vs 37.5%, p<0.001). FBCB was 56.5% for women with ≤2 children but only 36.2% for women with more children (p<0.001). Women with ≤2 children had 80.5% SBA compared to 64.2% for women with more children (p<0.001). PNC uptake was 61.7% for ≤2 children but higher at 69.5% for women with more children (p<0.001). Intake of Vitamin A during the last pregnancy was strongly associated with higher ANC visits (55.9% vs 42.6%, p<0.001). Pregnant women who consumed vitamin A had 59.8% FBCB compared to 43.9% without vitamin A (p<0.001). SBA percentage was 81.3% for women consuming vitamin A during pregnancy versus 71.8% without (p<0.001). Intake of vitamin A during pregnancy increased PNC slightly (63.2% vs 65.2%; p=0.008). Women from richer households had significantly greater ANC coverage (71.3%) compared to poor (34.4%) and middle (51%) households (p<0.001). Higher SES showed substantially greater FBCB - 80.2% for the richest women versus 31.8% for the poorest (p<0.001). The poorest women had the lowest SBA at 58.9% while the richest women enjoyed 95.1% skilled attendance (p<0.001). The poorest women had the greatest PNC coverage at 71.5% versus 60% for the richest (p<0.001) (**Table 2**).

This table (**Table 3**) presents results from logistic regression models examining sociodemographic correlates of four important maternal health service utilization outcomes in Bangladesh. The outcomes assessed were antenatal care (ANC) visit, facility-based childbirth (FBCB), skilled birth attendance (SBA), and postnatal care (PNC) visit.

- *ANC Visit*

Dhaka division had significantly increased odds of ANC visit utilization (AOR: 1.47, 95% CI: 1.17-1.86). The Khulna division also exhibited higher odds of ANC visits (AOR: 2.18, 95% CI: (1.67-2.81); p<0.001). Other divisions, such as Mymensingh, Rajshahi, and Rangpur show significant associations with ANC visit utilization accept Barishal and Chittagong. The educational level of mothers significantly influences ANC visit utilization. Women with primary education had substantially higher odds of ANC visit utilization (AOR: 2.55, (95% CI: 1.87-3.49); p<0.001). Women with secondary education also showed increased odds of ANC visits (AOR: 1.82, (95% CI: 1.33-2.49); p<0.001). Women with higher education levels exhibited even higher odds of ANC visits (AOR: 2.97, (95% CI: 2.06-4.23); p<0.001). Women whose husbands had primary education had lower odds of ANC visits ((AOR: 1.40, (95% CI: 1.13-1.74); p value=0.002). Women whose husbands had higher education had significantly higher odds (AOR: 1.90, (95% CI: 1.46-2.48); p<0.001) of ANC visit utilization. Women with ages at first birth below 20 had lower odds of ANC visits (AOR: 0.58, (95% CI: 0.43-0.79); p value=0.001). Women with ages at first birth between 20 and 34 showed higher odds of ANC visits compared to the reference group above 35 years and the outcome is statistically significant. Women with fewer than or equal to 2 children had higher odds of ANC visit utilization (AOR: 1.19, (95% CI: 1.04-1.38); p value= 0.012). Women who did not consume vitamin A during pregnancy had lower odds of ANC visit utilization (AOR: 0.66, (95% CI: 0.58-0.77): p<0.001). Women in the middle and rich wealth index category had significantly higher odds of ANC visit utilization (AOR: 1.62, 95% CI: 1.41-1.88); p<0.001) and (AOR: 3.09, 95% CI: 2.53-3.78); p<0.001) respectively than the reference group (**Table 3**). These odds ratios provide insights into the associations between various factors and the likelihood of Antenatal Care (ANC) visit utilization. They highlight the roles of division, education levels, husband's education, age at first birth, total children ever born, vitamin A intake during pregnancy, and respondent's wealth index in influencing ANC visit utilization.

- *FBCB*

The odds ratios suggest that certain divisions have a significant influence on FBCB utilization. Khulna

ISSN No:-2456-2165

Table 2 Distribution of Prevalence of Maternal Healthcare Service Utilization by Explanatory Variables

	ANC visit		FBCB		SBA		PNC visit	
Variables	**%**	**p-value**	**%**	**p-value**	**%**	**p-value**	**%**	**p-value**
Division								
Barishal	40.2	<0.001	41.8	<0.001	72.4	<0.001	63.0	<0.001
Chittagong	40.5		47.8		78.0		69.6	
Dhaka	53.3		59.6		83.8		56.7	
Khulna	59.5		63.2		84.7		58.8	
Mymensingh	48.3		42.5		70.3		68.7	
Rajshahi	50.5		55.4		82.9		58.6	
Rangpur	61.5		52.2		66.2		66.0	
Sylhet	36.8		43.3		67.4		68.1	
Place of residence								
Urban	59.0	< 0.001	63.1	<0.001	84.8	<0.001	62.9	0.129
Rural	42.5		50.6		71.1		64.6	
Maternal age								
15-19	47.9	0.144	50.5	0.303	76.5	0.251	61.7	0.076
20-24	48.4		52.2		76.4		63.0	
25-29	49.9		50.1		76.6		64.2	
30-34	47.5		49.3		73.4		68.1	
35+	41.8		46.3		72.3		65.3	
Respondent's education level								
No education	20.2	<0.001	25.3	<0.001	48.7	<0.001	73.7	<0.001
Primary	34.2		32.3		63.1		70.8	
Secondary	51.5		53.4		79.9		61.4	
Higher	70.5		79.7		93.7		57.0	
Husband's education level								
No education	29.9	<0.001	29.4	<0.001	56.6	<0.001	73.6	<0.001
Primary	38.3		38.8		66.3		67.1	
Secondary	51.8		55.1		83.0		61.5	
Higher	71.3		77.7		93.1		56.0	
Age at first birth								
< 18	42.8	<0.001	42.3	<0.001	70.5	<0.001	65.2	0.027
18-24	52.4		57.9		81.1		63.1	
25+	73.3		81.8		91.6		57.9	
Total children ever born								
<=2	52.5	<0.001	56.5	<0.001	80.5	<0.001	61.7	<0.001
2+	37.5		36.2		64.2		69.5	
Vitamin A during pregnancy								
No	42.6	<0.001	43.9	<0.001	71.8	<0.001	65.2	0.008
Yes	55.9		59.8		81.3		63.2	
Wealth Index								
Poor	34.4	<0.001	31.8	<0.001	58.9	<0.001	71.5	<0.001
Middle	51.0		55.3		84.0		57.8	
Rich	71.3		80.2		95.1		60.0	
Total (95% CI)	48.2(46.8-49.6)		50.6(49.2-52.0)		75.8(74.6-77.0)		64 (62.6-65.3)	

- Note: When chi-square tests were performed to see the proportional differences between the outcomes variables and explanatory variables, they were significant except-for maternal age and residence.

Division exhibited higher odds of FBCB utilization (AOR: 1.91, (95% CI: 1.47-2.48); p<0.001), followed by Dhaka (AOR: 1.34, (95% CI: 1.06-1.71); p value=0.016), Rangpur (AOR: 1.63, (95% CI:1.26-2.11). p<0.001) and Rajshahi (A OR: 1.61, (95% CI:1.24-2.09); p<0.001) respectively. Mymensingh, Barishal, and Chittagong divisions showed a non-significant association with FBCB utilization. The educational level of mothers and their partners has a significant impact on FBCB utilization. Women with higher and primary education had significantly higher odds of FBCB utilization (AOR: 2.81, 95% CI: 1.96-4.01); p<0.001). Women with secondary education showed increased odds (AOR: 1.16, (95% CI: 0.86-1.56), but it was not statistically significant. Women with primary education also exhibited higher odds of FBCB utilization (AOR: 1.79, 95% CI: 1.33-2.42); p<0.001). Women whose husbands had primary and higher education showed significantly higher odds of FBCB utilization (AOR: 1.36, (95% CI: 1.09-1.70); p value=0.006) and (AOR: 1.88, (95% CI: 1.43-2.47);

p<0.001) respectively. Women with ages at first birth below 20 years (AOR: 0.38, (95% CI: 0.26-0.53); p< 0.001) and between 20 and 34 years had significantly lower odds of FBCB utilization (AOR: 0.47, (95% CI: 0.33-0.68); p<0.001) than the reference category of age more than 35 years were statistically significant. Women with fewer than or equal to 2 children had significantly higher odds of FBCB utilization (AOR: 1.44, (95% CI: 1.24-1.66); p<0.001). Women who did not consume vitamin A during pregnancy had significantly lower odds of FBCB utilization (AOR: 0.60, (95% CI: 0.53-0.69); p< 0.001). Women in the rich wealth index category had significantly higher odds of FBCB utilization (AOR: 4.40, (95% CI: 3.55-5.44); p<0.001). Women in the middle wealth index category also had significantly higher odds (AOR: 1.89, (95% CI: 1.64-2.19); p<0.001) **(Table 3)**. These odds ratios highlight the roles of division, education levels, husband's education, age at first birth, total children ever born, vitamin A intake during pregnancy, and respondent's wealth index in influencing FBCB utilization.

- *SBA*

The division variable represents different regions of Bangladesh. Dhaka division exhibited significantly higher odds of SBA utilization (AOR: 1.63, (95% CI: 1.23-2.16); p value= 0.001). Khulna division also showed elevated odds of SBA utilization (AOR: 2.08, (95% CI: 1.52-2. 28); p<0.001). Rajshahi and Mymenshingh division had moderate odds of SBA utilization (AOR: 2.21, (95% CI: 1.63-2.99); p<0.001) and (AOR: 1.33, (95% CI: 1.02-1.73); p value= 0.033) respectively. Other divisions, such as Barishal, Chittagong, and Rangpur did not exhibit significant associations with SBA utilization. Women with primary education had significantly higher odds of SBA utilization (AOR: 2.04, (95% CI: 1.55-2.70); p<0.001). Women with secondary education also showed increased odds of SBA utilization (AOR: 1.46, (95% CI: 1.12-1.92); p value=0.006). Women with higher education levels exhibited higher odds of SBA utilization (AOR: 3.14, (95% CI: 2.07-4.74); p<0.001). Women whose husbands had primary and higher education exposed higher odds of SBA utilization (AOR: 1.66, (95% CI: 1.32-2.09); p<0.001) and (AOR: 2.17, (95% CI: 1.54-3.06); p< o.oo1) respectively. Age at first birth did not show a strong association with SBA utilization. The odds ratios were not statistically significant across different age groups. Women with not more than 2 children had significantly higher odds of SBA utilization (AOR: 1.42, (95% CI: 1.22-1.66); p<0.001). Vitamin A intake during pregnancy shows a significant association with SBA utilization. Women in the middle wealth index category had significantly higher odds of SBA utilization (AOR: 2.44, (95% CI: 2.07-2.88). Women in the rich wealth index category also exhibited higher odds (AOR: 6.13, (95% CI: 4.43-8.49); p<0.001) of SBA utilization. These odds ratios provide insights into the relationships between various factors and the likelihood of Skilled Birth Attendance (SBA) utilization.

- *PNC*

Division-wise variations show how different regions of Bangladesh influence the utilization of Postnatal Care (PNC) visits. Only Dhaka and Rajshahi divisions displayed higher odds of PNC utilization (AOR: 0.72, (95% CI: 0.57-0.89); p value=0.003) and (AOR: 0.75, (95% CI: 0.59-0.969); p value=0.020), indicating a lower likelihood of PNC visits. Other divisions, including Barishal, Chittagong, Khulna, Mymensingh, and Rangpur did not show significant associations with PNC utilization. Mothers' education levels had varying effects on PNC utilization although not statistically significant. Women with secondary education did not show significant associations with PNC utilization. The husband's education levels influenced PNC utilization to some extent. Women whose husbands had primary education had slightly higher odds of PNC utilization (AOR: 0.77, (95% CI: 0.62-0.96); p value=0.019). Women whose husbands had higher education levels showed slightly higher odds (AOR: 0.68, (95% CI: 0.52-0.88) of PNC utilization. Age at first birth did not show significant associations with PNC utilization. Women with fewer than or equal to 2 children had slightly higher odds of PNC utilization (AOR: 1.02, 95% CI: 0.77-1.33) but statistically insignificant. Intake of Vitamin A during pregnancy did not show significant associations with PNC utilization. Women with middle and rich wealth index categories displayed slightly lower odds of PNC utilization which were statistically significant. These odds ratios provide perceptions of the factors that influence the likelihood of postnatal care (PNC) utilization. Division, husband's education, total children ever born, and respondent's wealth index seem to play roles in shaping PNC utilization patterns. Notably, husband's education and wealth index categories show stronger associations with PNC visits in comparison to other factors.

V. DISCUSSION

Our study stands out in comparison to existing research in the realm of maternal healthcare utilization, particularly regarding ANC visits, FBCB, SBA, and PNC visits. While prior studies have made significant contributions by examining various aspects of maternal care utilization, our research offers a distinctive perspective and advances the understanding of the factors that influence maternal care utilization in Bangladesh. This study detected an increasing level of having four or more ANC visits, FBCB, SBA, and PNC, all together with optimal coverage of these maternal healthcare services in Bangladesh. By using BDHS 2027-18 data we found that overall, 48% of women attended four or more ANC visits, 50.6% have FBCB, 75.8% received care by an SBA, and 64.0% of women took PNC visits after delivery. This prevalence is high compared with the results of BDHS-2014, which were 31.2%, 37.4%, 42.1%, and 36.4% respectively [32]. With this high proportion of women making use of maternal healthcare, Bangladesh will reach the goal of the 4th HPNSP by increasing the percentage of all maternal healthcare services. Previous studies have often examined a broader range of maternal health care services, sometimes grouping PNC visits with Antenatal Care (ANC) and Skilled Birth Attendance (SBA). While these studies have provided essential insights into maternal care-seeking behavior grouped as Antenatal Care (ANC), Facility Based Childbirth FBCB), Skilled Birth Attendance (SBA) and Post Natal Care (PNC), have addressed the unique dynamic association with maternal healthcare utilization comprehensively. This study has documented a bunch of

socio-demographic factors for the utilization of maternal care services and revealed some significant associated factors such as division, respondent's and husband's education, age at first birth, parity, consumption of vitamin A, and wealth status. Maternal care was correlated with particular-level factors such as residence, division, age, and religion [14, 16, 17]. Young mothers (below 20 years) exhibit lower odds of utilizing ANC, FBCB, and SBA services compared to older mothers. This finding echoes the importance of addressing the specific healthcare needs and barriers faced by adolescent mothers [14]. Several other individual and household factors including the educational level of women and household.

Table 3 Adjusted Odds Ratios (AORs) for Utilization of ANC, FBCB, SBA, and PNC Service by Explanatory Variables.

	ANC visit	**FBCB**	**SBA**	**PNC visit**
Variables	**AOR (95%CI)**	**AOR (95%CI)**	**AOR (95%CI)**	**AOR (95%CI)**
Division				
Barishal	1.17(0.91-1.51)	0.94(0.72-1.22)	1.29(0.98-1.70)	0.86(0.67-1.09)
Chittagong	0.91(0.73-1.15)	0.89(0.71-1.13)	1.28(0.99-1.66)	1.24(0.99-1.56)
Dhaka	1.47(1.17-1.86) **	1.34(1.06-1.71) *	1.63(1.23-2.16) *	0.72(0.57-0.89) *
Khulna	2.18(1.67-2.81) **	1.91(1.47-2.48) **	2.08(1.52-2.84) **	0.80(0.63-1.02)
Mymensingh	1.89(1.48-2.42) **	1.08(0.84-1.40)	1.33(1.02-1.73) *	1.04(0.82-1.33)
Rajshahi	1.71(1.33-2.20) **	1.61(1.24-2.09) **	2.21(1.63-2.99) **	0.75(0.59-0.96) *
Rangpur	3.26(2.53-4.21) **	1.63(1.26-2.11) **	0.99(0.76-1.29)	0.95(0.74-1.22)
Sylhet	**Ref.**	**Ref.**	**Ref.**	**Ref.**
Mother's education				
No education	**Ref.**	**Ref.**	**Ref.**	**Ref.**
Primary	2.55(1.87-3.49) **	01.79(1.33-2.42) **	3.14(2.07-4.74) **	0.77(0.58-1.03) *
Secondary	1.82(1.33-2.49) **	1.16(0.86-1.56)	1.46(1.12-1.92) **	0.99(0.74-1.32)
Higher	2.97(2.06-4.23) **	2.81(1.96-4.12) **	2.04(1.55-2.70) **	0.76(0.55-1.07) *
Husband's education				
No education	**Ref.**	**Ref.**	**Ref.**	**Ref.**
Primary	1.40(1.13-1.74) *	1.36(1.10-1.70) *	2.04(1.55-2.70) **	0.77(0.62-0.96) *
Secondary	1.12(0.91-1.37)	1.14(0.93-1.40)	1.46(1.12-1.92) *	0.84(0.69-1.04) *
Higher	1.90(1.46-2.48) **	1.88(1.43-2.47) **	3.14(2.07-4.74) **	0.68(0.52-0.88)
Age at first birth				
< 20	0.58(0.43-0.79) *	0.38(0.26-0.53) **	0.57(0.36-0.92) *	1.02(0.77-1.33) *
20-34	0.64(0.47-0.87) *	0.47(0.33-0.68) **	0.69(0.43-1.10)	1.07(0.82-1.39) *
35+	**Ref.**	**Ref.**	**Ref.**	**Ref.**
Total children ever born				
≤ 2	1.19(1.04-1.38) *	1.44(1.24-1.66) **	1.42(1.22-1.66) **	0.87(0.76-1.01)
2+	**Ref.**	**Ref.**	**Ref.**	**Ref.**
Intake Vitamin A during pregnancy				
No	0.66(0.58-0.75) **	0.60(0.53-0.69) **	0.71(0.61-0.83) **	1.07(0.95-1.21)
Yes	**Ref.**	**Ref.**	**Ref.**	**Ref.**
Wealth index				
Poor	**Ref.**	**Ref.**	**Ref.**	**Ref.**
Middle	1.62(1.41-1.88) **	1.89(1.64-2.19) **	2.44(2.07-2.88) **	0.64(0.56-0.74) **
Rich	3.09(2.53-3.78) **	4.40(3.55-5.44) **	6.13(4.43-8.90) **	0.80(0.66-0.98) *

∗∗P-value < 0.001, ∗P-value < 0.05

Wealth status was inversely associated with it. In our country, till now a greater part of women do not have any health facility, they deliver their children at home with unskilled or nonprofessional attendants [18,19] According to a study on facility-based delivery, education of the respondents, education of the partner, residence, division, religion, wealth index, and age at first birth were significant variables in the use of maternal health care among Bangladeshi women [33]. An analogous study directed by Banik (2017) in the Rajshahi district pronounced that distance emerges from work as a key constraint factor in accessing healthcare facilities [34]. In comparison to studies that cover multiple regions or countries, our study's focus on the distinct divisions of Bangladesh provides a more localized perspective. This approach is valuable as it recognizes the regional nuances that play a significant role in shaping healthcare utilization patterns. By highlighting variations in maternal health care service (such as ANC, FBCB, SBA, and PNC) utilization across divisions, our research contributes to the development of targeted interventions that can address specific regional disparities. Previous study also supports these findings [24]. Women with fewer children (≤ 2) have higher odds of utilizing ANC, FBCB, and SBA services compared to those with more children. This suggests the need for targeted interventions to ensure access to maternal healthcare for women with larger families [5]. Women who did not intake vitamin A during pregnancy have lower odds of utilizing ANC, FBCB, and SBA services. This highlights the importance of nutritional factors in maternal health [11]. Moreover, while some prior

studies have examined demographic and socioeconomic factors such as education and wealth index, our study expands on these analyses by considering additional variables such as age at first birth, total children ever born, and even the intake of vitamin A during pregnancy. These traced variables enable us to draw more comprehensive insights into the multifaceted determinants that influence maternal healthcare service utilization. These findings also indicate the existence of disparities in the utilization of ANC, FBCB, and SBA by reproductive women whose educational status, age at first birth, parity, vitamin A intake, and economic status are deprived. Some previous studies found alike results for pregnant women, with household wealth, educational level of the woman and husband, accessibility to health facilities, birth preparedness, and ethnicities as social determinants related to maternal healthcare service utilization [27-28, 31]. This study revealed socio-economic factors associated with the utilization of antenatal care (ANC) were living in the Northern (Rajshahi) or Central (Dhaka) division, educational status, husband's educational status, and higher economic strata. The socio-economic factors associated with facility-based childbirth and skilled birth attendance were the same as ANC. Although there were no significant differences in residential areas, the presence of antenatal care was strongly related to the utilization of maternal healthcare services among reproductive women. However, these results also provide strong evidence that sociodemographic disparities exist in receiving adequate ANC in Bangladesh. Our study makes significant and unique contributions to the field of maternal healthcare utilization, particularly in the context of Facility-Based Childbirth (FBCB). By digging deeply into the factors that influence FBCB utilization in Bangladesh, we offer novel insights that build upon existing research and introduce new dimensions to the discourse. In comparison to a recent study based on data from the 2014 BDHS, our results signify a higher increase in facility-based delivery prevalence, in absolute terms, this is really high (from 14.7% in 2007 to 28.7% in 2011, 37.4% in 2014 and 50.6% in 2017-18) [12,24,32]. This inconsistent state has drawn the attention of top-notch scholars like Sen and has been attached to recent progress in economic and educational standings and the overall advance in social transformation and national health markers [35]. In this study, approximately half of the reproductive women chose to give birth at a facility, and most chose a facility in the public quarter. Furthermore, due to the high cost of delivery, women from economically disadvantaged backgrounds reportedly choose to give birth at home. In addition, young age pregnant women often live in rural and regional areas, and they prefer to give birth in public facilities, which pointed out the challenges of access to antenatal care [36]. Finally, the results demonstrate significant urban-rural and socioeconomic inequalities affecting facility-based deliveries in Bangladesh. Targeted interventions are needed to reduce such inequities.

The results of our study specify that as maternal education level increased, so did the use of maternal healthcare services. This conclusion is credible because women who receive higher education will know more about and be more aware of ANC services. This result is aligned with former research conducted in other low-income countries and in rural Bangladesh [28,37,38]. However, our findings contradict some other studies [39,40]. Educated mothers are more likely to have adequate knowledge about safe pregnancy and are eager to receive modern healthcare facilities. It was found that the husband's education is also a crucial determinant for the utilization of ANC among women in adjusted model analysis, which is harmonized with earlier studies [27,28]. Our outcomes also revealed that the highest level of educational achievement in women and their husbands was associated with higher rates of delivery from SBA. In the present literature, the significant association of SBA utilization with education is entirely apparent. Education sustains healthy régimes and positive selections by raising health perception and the likelihood of pursuing high-quality healthcare advantages. A recent study from Ghana discovered factors associated with the use of skilled birth attendance, prominence that the mother's educational attainment was significantly associated with the use of skilled delivery services [41]. On the other hand, higher education associated with wealth status highlighted that highly educated women are more likely to have a better job which makes them financially independent and helps them to make choices like whether to custom SBA during delivery. A previous study by Kibria et *al.* (2017) supports these findings [42]. According to this analysis, substantial regional, educational, and wealth-related disparities persist in skilled delivery care access in Bangladesh However, further qualitative exploration is warranted to know the in-depth scenario of why SBA utilization is lower among women with low socioeconomic status in Bangladesh. The present study also found that the Poorest women had the greatest PNC coverage at 71.5% and 73.7% of mothers were uneducated. In the present study, division, women and husband's education, age at first birth, total children ever born, and respondent's wealth index seem to play roles in shaping PNC utilization patterns. Notably, husband's education and wealth index categories show stronger associations with PNC visits in comparison to other factors. These observations coincided with a study conducted in Ethiopia which reported a significant influence of respondent education and urban residence on the utilization of maternal health care services [27]. Some of the results of this study are similar to others reported, which have highlighted the importance of effective, efficient, and accessible maternal healthcare services [29]. Our study, on the other hand, exclusively centers on PNC visits, allowing for a more refined analysis of the factors that specifically impact postnatal care utilization.

The present study explored several important inequities across divisions, education levels, wealth, age, and other factors were identified. Place of residence emerged as a significant predictor, with higher odds of service use observed in certain divisions like Khulna, Rangpur, Dhaka, and Rajshahi compared to Sylhet even after adjustment. Maternal education played a strong role, where higher levels showed the maximum advantage for ANC, FBCB, and SBA. However, a higher husband's education was associated with lower ANC in some cases, suggesting complex gender dynamics. Wealth stood out as a dominant influence, with middle and rich categories uniformly enjoying 2-6 times higher odds than the poor. Younger age at first birth and

more children posed barriers to some services. Vitamin A intake acted as a proxy for antenatal care, linked to a 30-40% raised likelihood of facility processes. No intake during pregnancy indicated restricted access. Certain variations were seen across services. For example, PNC norms favored disadvantaged groups in odds, hinting at inequitable targeting. Disparities by residence also differed between urban-rural or divisions. Overall, the regression analysis provided robust evidence that intersecting socioeconomic determinants drive inequalities in maternal healthcare utilization patterns even after controlling for confounders. Strategies must tackle disadvantages based on geography, education, economic standing, and other tracer indicators.

VI. CONCLUSION

In conclusion, the study's results suggest that various demographic and socioeconomic factors play a crucial role in maternal healthcare utilization among reproductive women in Bangladesh. Geographic location, education of both the mother and husband, age at first birth, total number of children, intake of Vitamin A during pregnancy, and household wealth all contribute to the likelihood of accessing maternal healthcare services. These findings underscore the need for targeted interventions to improve access to maternal healthcare services, particularly among disadvantaged groups, and are consistent with prior research in this area. The path forged by this study leads to continued investigations, policy evolution, and societal transformation. As we conclude this chapter, it is with the hope that our work will serve as a foundation, a guiding star, and a catalyst for a healthier, more equitable future for mothers and families alike.

LIMITATIONS

While the provided study on the demographic and socioeconomic correlates of maternal healthcare utilization in Bangladesh provides valuable insights, it is important to acknowledge its limitations to interpret the results appropriately and guide future research:

- *Cross-Sectional Design:*
  The study employs a cross-sectional design, which captures data at a single point in time. This design limits the ability to establish causal relationships between variables. Longitudinal or cohort studies would be better suited to assess causal associations.

- *Data Source:*
  The study's findings are based on self-reported data from survey respondents. Self-reporting can introduce recall bias, and respondents may not always provide accurate information, especially regarding past events or behaviors.

- *Selection Bias:*
  The study may suffer from selection bias because it relies on data from women who were reachable and willing to participate in the survey. This could lead to an underrepresentation of certain groups, such as marginalized or hard-to-reach populations.

- *Social Desirability Bias:*
  Respondents might provide answers they perceive as socially desirable, which can lead to overreporting of positive behaviors (e.g., ANC visits) and underreporting of negative behaviors (e.g., not taking vitamin A). This bias can affect the validity of the results.

- *Missing Variables:*
  The study focuses on a specific set of demographic and socioeconomic variables. There may be other unmeasured or omitted variables that could confound the relationships under investigation. For example, cultural and community factors could also influence maternal healthcare utilization.

- *Temporal Changes:*
  The study's data might not reflect recent changes in maternal healthcare policies, infrastructure, or socioeconomic conditions in Bangladesh. Therefore, the findings may not accurately represent the current state of maternal healthcare utilization.

- *Statistical Power:*
  Although statistically significant associations are reported, the clinical significance of these findings should also be considered. Small effect sizes, even if statistically significant, may have limited practical relevance.

In conclusion, this study contributes important insights into maternal healthcare utilization in Bangladesh. However, these limitations should be considered when interpreting the findings and designing future research to address these shortcomings.

- *Data Availability*
  In this study, we used data from the Bangladesh Demographic Health Survey (BDHS), 2017-18, which is available from https://dhsprogram.com/data/available-datasets.cfm.

- *Conflicts of Interest*
  The author declares no conflict of interest for this research.

LIST OF ABBREVIATIONS

- ANC - Antenatal Care
- FBCB - Facility-Based Childbirth
- SBA - Skilled Birth Attendance
- PNC - Postnatal Checkup
- CI - Confidence Interval
- OR - Odds Ratio
- AOR - Adjusted Odds Ratio

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