

Determinants of Antenatal Care Utilization among Women of Reproductive Age in Rural Northern Nigeria: Evidence from Bagwai Local Government Area, Kano State

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Abstract

Background: Antenatal care (ANC) is an important component of maternal healthcare and contributes to the early detection and management of pregnancy-related complications. However, continuity of ANC remains suboptimal in many rural settings in northern Nigeria.

Objective: To assess antenatal care utilization and its determinants among women of reproductive age in Bagwai Local Government Area, Kano State, Nigeria.

Methods: A community-based cross-sectional study was conducted among 238 women of reproductive age selected using a multistage sampling technique. Descriptive statistics, Chi-square tests and Binary logistic regression were conducted were used for data analysis. Statistical significance was set at $p < 0.05$.

Results: Awareness of ANC services was high (93.3%). Among women who were aware of ANC, 94.1% attended ANC during their last pregnancy. Of the 209 ANC attendees, 58.9% completed four or more visits. In multivariable analysis, women with parity 1–4 had higher odds of completing four or more ANC visits compared with those with parity ≥ 5 (AOR = 3.83; 95% CI: 1.74–8.44; $p = 0.001$). Women residing less than 30 minutes from a health facility also had higher odds of completing four or more visits (AOR = 2.60; 95% CI: 1.23–5.50; $p = 0.013$). Women younger than 25 years had lower odds of completing four or more visits compared with those aged ≥ 25 years (AOR = 0.32; 95% CI: 0.12–0.86; $p = 0.023$), while women with no formal or primary education had lower odds than those with secondary or tertiary education (AOR = 0.29; 95% CI: 0.16–0.56; $p < 0.001$). Marital type was not independently associated with ANC utilization.

Conclusion: Interventions should focus on improving female education, supporting younger and high-parity women, strengthening primary healthcare services, and reducing geographical barriers to repeated ANC attendance.

Keywords: Antenatal care; utilization; determinants; parity; education; rural women; northern Nigeria.

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Introduction

Maternal mortality continues to be a significant global health issue and a reflection of disparities in healthcare access and quality. According to the World Health Organization, over 90% of global maternal deaths occur in low- and lower-middle-income countries¹. Countries with extremely high maternal mortality rates include South Sudan (1,223 deaths per 100,000 live births), Chad (1,063 deaths), and Nigeria (1,047 deaths)². The United Nations Inter-Agency Estimates¹ reported that although global maternal mortality declined by approximately 40% between 2000 and 2023, an estimated 260,000 women still died from pregnancy- and childbirth-related causes in 2023, with Sub-Saharan Africa accounting for approximately 70% of these deaths.^{1,3}

Nigeria remains one of the countries most severely affected by maternal mortality, with a maternal mortality ratio of 1,047 per 100,000 live births.⁴ This burden underscores the importance of strengthening maternal healthcare across the continuum of pregnancy, childbirth, and the postnatal period.⁵ Antenatal care (ANC) is a key component of maternal healthcare, providing opportunities for early identification and management of pregnancy-related complications, health education, nutritional support, and preparation for childbirth.⁶

The earlier WHO Focused Antenatal Care (FANC) model recommended at least four ANC visits during pregnancy.⁷ In 2016, WHO replaced this with a minimum of eight ANC contacts to improve care quality and the pregnancy experience.^{8–10} The current model recommends initiation of ANC within the first 12 weeks of gestation, followed by contacts at 20, 26, 30, 34, 36, 38, and 40 weeks.¹

Despite these recommendations, ANC utilization remains suboptimal in many low-resource settings. Approximately 69% of pregnant women in Sub-Saharan Africa receive at least one ANC visit, while many do

not achieve the recommended number of contacts.¹¹ Coverage of at least four ANC visits is particularly low in West and Central Africa (56%) compared with high-income regions.³ Maternal education, socioeconomic status, geographic accessibility, and other sociodemographic and behavioral factors have been identified as important determinants of ANC utilization.^{12,13}

In Nigeria, the NDHS 2023 reported that 63% of women with a live birth in the two years preceding the survey received ANC from a skilled provider. However, only 43% of live births and 51% of stillbirths were delivered in health facilities, and less than half received skilled attendance at birth¹⁴. These figures highlight persistent inequalities between awareness and actual utilization of maternal health services.

Improving ANC utilization is essential to Nigeria's progress towards Sustainable Development Goal 3, which seeks to reduce the maternal mortality ratio to fewer than 70 per 100,000 live births by 2030.³ This study therefore assessed ANC awareness and utilization and identified factors associated with completing at least four ANC visits among women of reproductive age in Bagwai Local Government Area, Kano State, to provide locally relevant evidence for maternal health interventions in rural northern Nigeria.

Nigeria faces a significant challenge in achieving Sustainable Development Goal (SDG) 3, which aims to reduce maternal mortality to fewer than 70 per 100,000 live births by 2030³. Improving ANC coverage and adherence is crucial for reaching this goal, as ANC remains the main platform for preventing complications and ensuring safe deliveries. This study examined ANC awareness, utilization, and factors influencing attendance among women of reproductive age in Bagwai Local Government Area, Kano State, to provide locally relevant evidence to guide maternal health interventions in rural northern Nigeria.

Methods**Study area**

The study was conducted in Bagwai LGA, located in northern Kano State, Nigeria, between latitudes 11°48'N and 12°03'N, and longitudes 8°20'E and 8°40'E. It is bordered by Tsanyawa to the north, Gwarzo to the east, Ghari to the west, and Bichi to the south, with its headquarters in Bagwai town. The area falls within the Sudan savanna zone, characterized by a tropical continental climate with distinct wet and dry seasons. The main occupations include farming, fishing, and trading, supported by Watari Dam, which supplies water for irrigation and domestic use. The population is primarily Hausa and Fulani, and Islam is the predominant religion.

Study population

Women of reproductive age who were permanent residents of Bagwai Local Government Area and who had experienced at least one pregnancy were eligible to participate in the study. Eligible women were required to have resided in the selected community for at least six months prior to the study and to provide informed consent.

Women who were temporary visitors to the selected communities, those who had never been pregnant, and women who were too ill to participate in the interview at the time of data collection were excluded from the study.

Study Design

This was a community-based cross-sectional study.

Sample size estimation

The following sample size formula was employed

$$n = Z^2 p(1-p)/d^2 \text{ }^{15}.$$

with $Z=1.96$ (95% confidence) and absolute precision $d=0.05$

Using an expected prevalence, $p= 63\%$ of women receive ANC from a skilled provider¹⁴

$$N= 1.96 \times 1.96 \times 0.63(1-0.63)/0.05^2$$

$$=3.84 \times 0.63 \times 0.37/0.0025$$

$$=358$$

To account for an anticipated 10% non-response, 10% of the calculated sample size was added:

$$0.10 \times 358 = 35.8$$

$$= 358 + 35.8 = 393.8$$

The final target sample size was therefore approximately 394 participants. However, 238 eligible women ultimately participated in the study, representing 60.4% of the target sample size.

Sampling Technique

Participants were selected using a multistage sampling technique covering different wards within Bagwai LGA. House numbering and household listing were done initially to get the total number of household heads. This formed our sampling frame. Systematic random sampling was employed to sample the eligible households. The number of eligible households was divided by the sample size to determine the sampling interval. A random start was made using a random sampling method. Sampling continued systematically at the specified interval throughout the data-collection period. Of the targeted 394 participants, 238 consented and completed the study.

Data collection

Data were collected in December 2025 using a structured interviewer-administered questionnaire that captured sociodemographic characteristics, ANC attendance, and barriers to utilization. Data were collected by medical students who were trained on how to collect the data and come up with a uniform interpretation of terms.

Data analysis

Data were entered into an Excel spreadsheet and subsequently exported to SPSS version 25¹⁶. Data were analyzed using descriptive statistics and chi-square tests to assess the associations between ANC utilization and independent variables, including education, age, parity, and distance to the facility. Binary logistic regression

was performed to identify independent predictors of completing at least four ANC visits. Variables considered clinically relevant and/or associated with the outcome at the bivariate level were entered into the multivariable model. Adjusted odds ratios (AORs) with 95% confidence intervals were reported, and statistical significance was set at $p < 0.05$.

Ethical Considerations

Ethical approval was obtained from the Research and Ethics Committee of the Kano State Ministry of Health (NHREC/17/03/2018). Permission was also obtained from the District Head of Bagwai and the Chairman of the Local Government Area. Written informed consent was obtained from all participants before data collection. Participants were assured of confidentiality, anonymity, and their right to withdraw from the study at any time without penalty.

Results

Table 1: Socio-Demographic Characteristics of Respondents (n = 238)

VARIABLE	FREQUENCY(n)	PERCENTAGE(%)
Age group		
<25	34	14.3
≥ 25	204	85.7
Mean	32.3	
±8.9yrs		
Occupation		
Petty trader	171	71.8
Housewife	28	11.8
Farmers	12	5.0
others	27	11.3
Husbands' occupation		
Farmer	105	44.1
Artisan	66	27.7
Civil servant	27	11.3
others	40	16.8
Level of education		
Primary	80	33.6
Secondary	105	44.1
Tertiary	8	3.4
No formal education	45	18.9
Type of marriage		
Monogamous	147	61.8
Polygamous	91	38.2
Number of times married		
Once	190	79.8
More than once	48	20.2

Table 2: Obstetric History of Respondents(n=238)

Variable	Frequency (n)	Percentage (%)
Age at first pregnancy (years)		
≤17	87	36.6
≥18	151	63.4
Parity		
≤4	75	31.5
5 & above	163	68.5
Mean 6.16 ± 3.5		
Current pregnancy status		
Pregnant	31	13.0
Not pregnant	207	87.0
History of stillbirth		
Yes	43	18.1
No	195	81.9
History of miscarriage		
Yes	58	24.4
No	180	75.6

Table 3: Awareness and Utilization of Antenatal Care (ANC)

Variable	Frequency (n)	Percentage (%)
Awareness of ANC services		
Yes	222	93.3
No	16	6.7
Attended ANC during last pregnancy(n=222)		
Yes	209	94.1
No	13	5.9
Number of ANC visits during last pregnancy (n=209)		
<4	86	41.1
≥4	123	58.9
Place of ANC(n=209)		
Government PHC	179	85.6
Private/Other	30	14.4
Distance from ANC facility		
<30 minutes	58	26.1
≥30 minutes	164	57.2
Reasons for not attending ANC(n=13)		

Variable	Frequency (n)	Percentage (%)
No perceived need	9	69.2
Cultural restrictions	3	23.1
Distance/transport	4	30.8
Financial constraint	4	30.8
Husband's permission	5	38.5
Lack of facility in the community	2	15.4
Don't know how to access the service	3	23.1

* Percentages exceed 100% because multiple responses were allowed

Table 4: Delivery and Postnatal Practices

Variable	Frequency (n)	Percentage (%)
Place of last delivery (n= 238)		
Home	167	70.2
Health facility	71	29.8
Reasons for home delivery (n = 167)		
Traditional belief	79	47.3
Easy access / convenience	79	47.3
Cost	9	5.4
Skilled assistance at birth (n= 238)		
No assistance	83	34.9
Traditional birth attendant	31	13.0
Health professional**	64	26.9
Relative / friend	60	25.2
Attended PNC after last delivery (n = 238)		
Yes	138	58.0
No	100	42.0
PNC services received (n= 138)		
Immunization for baby	54	39.1
Blood pressure measurement	13	9.4
Examination of abdomen	10	7.2
Examination of child	25	18.1
Family-planning education	7	5.1
Breastfeeding education	10	7.2
Treatment / review of problems	7	5.1

* Percentages exceed 100% because multiple responses were allowed.

** Health professional includes doctors, nurses, and midwives.

Table 5: Factors Associated with Adequate ANC Utilization

Variable	χ^2	df	p-value
Age (<25 vs ≥25 years)	0.440	1	0.507
Educational level (No formal/Primary vs Secondary/Tertiary)	24.534	1	<0.001
Marital type (Monogamous vs Polygamous)	5.277	1	0.022
Parity (1–4 vs ≥5)	12.142	1	<0.001
Distance to health facility (<30 vs ≥30 minutes)	8.237	1	0.004
Occupation	1.450	3	0.694

Table 6: Multivariable Logistic Regression Analysis of Factors Associated with Adequate ANC Utilization

Predictor	Category	AOR	95% CI	P-value
Age (years)	<25	0.32	0.12–0.86	0.023
	≥25	1.00	Reference	
Educational level	No formal/Primary	0.29	0.16–0.56	<0.001
	Secondary/Tertiary	1.00	Reference	
Marital type	Monogamous	1.63	0.85–3.14	0.144
	Polygamous	1.00	Reference	
Parity	1–4	3.83	1.74–8.44	0.001
	≥5	1.00	Reference	
Distance to health facility	<30 minutes	2.60	1.23–5.50	0.013
	≥30 minutes	1.00	Reference	

In total, 238 women were successfully interviewed, giving a response rate of 60.4%. This shortfall is acknowledged as a study limitation. The mean age of the respondents was 32.3 ± 8.9 years, with the majority (85.7%) aged 25 years or older. Most respondents were petty traders (71.8%), while farming was the predominant occupation among their husbands (44.1%). Regarding educational attainment, 44.1% had secondary education, 33.6% had primary education, 18.9% had no formal education, and only 3.4% had tertiary education. Most respondents were in monogamous marriages (61.8%), and 79.8% had been married only once (Table 1).

Regarding obstetric characteristics, 36.6% of respondents had their first pregnancy at age 17 or younger. The mean parity was 6.16 ± 3.5 , with more than two-thirds (68.5%) having a parity of five or more. At the time of the study, 13.0% of respondents were pregnant. A history of stillbirth was reported by 18.1% of respondents, while 24.4% had experienced a miscarriage. (Table 2)

Awareness of antenatal care (ANC) services was high, with 222 (93.3%) respondents reporting awareness of ANC services. Among these women, 209 (94.1%) attended ANC during their last pregnancy. Of the 209 ANC attendees, 123 (58.9%) had four or more ANC visits, while 86 (41.1%) had fewer than four visits. Most ANC attendees (85.6%) received care at government primary healthcare facilities.

Among the 13 women who did not attend ANC, the most commonly reported reason was a perceived lack of need for ANC (69.2%). Other barriers included lack of husband's permission (38.5%), distance or transportation difficulties (30.8%), financial constraints (30.8%), cultural restrictions (23.1%), lack of knowledge about how to access ANC services (23.1%), and absence of a health facility in the community (15.4%).(Table 3)

Most respondents (70.2%) delivered at home, mainly due to traditional beliefs and convenience. Roughly two-thirds (73.1%) had no skilled assistance at delivery, while 26.9% were assisted by health professionals. Postnatal care attendance was moderate (58.0%), with infant immunization being the most common service received (39.1%). (Table 4)

Bivariate analysis showed that educational level, marital type, parity, and distance to the

health facility were significantly associated with adequate ANC utilization. Adequate ANC utilization was substantially higher among women with secondary or tertiary education than among those with no formal or primary education (75.5% vs. 41.7%; $\chi^2 = 24.534$, $p < 0.001$). Women with parity 1–4 were also more likely to have adequate ANC utilization than those with parity ≥ 5 (76.1% vs. 50.7%; $\chi^2 = 12.142$, $p < 0.001$). Similarly, adequate ANC utilization was higher among women residing < 30 minutes from a health facility than among those residing ≥ 30 minutes away (75.0% vs. 52.9%; $\chi^2 = 8.237$, $p = 0.004$). Women in monogamous marriages had higher adequate ANC utilization than those in polygamous marriages (64.9% vs. 48.7%; $\chi^2 = 5.277$, $p = 0.022$). Age ($\chi^2 = 0.440$, $p = 0.507$) and occupation ($\chi^2 = 1.450$, $p = 0.694$) were not significantly associated with adequate ANC utilization at the bivariate level.

In the multivariable logistic regression analysis, age, educational level, parity, and distance to the health facility remained independently associated with adequate ANC utilization. Women with parity of 1–4 had nearly four times the odds of adequate ANC utilization compared with women with parity ≥ 5 (AOR = 3.83; 95% CI: 1.74–8.44; $p = 0.001$). Similarly, women residing less than 30 minutes from a health facility had approximately 2.6 times the odds of adequate ANC utilization compared with those residing ≥ 30 minutes away (AOR = 2.60; 95% CI: 1.23–5.50; $p = 0.013$). Women aged < 25 years had lower odds of adequate ANC utilization compared with those aged ≥ 25 years (AOR = 0.32; 95% CI: 0.12–0.86; $p = 0.023$). Likewise, women with no formal or primary education had lower odds of adequate ANC utilization than those with secondary or tertiary education (AOR = 0.29; 95% CI: 0.16–0.56; $p < 0.001$). Marital type was not independently associated with adequate ANC utilization (AOR = 1.63; 95% CI: 0.85–3.14; $p = 0.144$).

Discussion

This study assessed antenatal care (ANC) utilization and its determinants among women of reproductive age in rural Bagwai Local Government Area of Kano State. Awareness and initial uptake of ANC were high, with 93.3% of respondents being aware of ANC services and 94.1% of those aware reporting attendance during their last pregnancy. However, among women who attended ANC, only 58.9% had four or more visits. This indicates that high awareness and initial contact with ANC services do not necessarily translate into continuity of care. Similar gaps between initial ANC attendance and completion of the recommended number of visits have been reported in Nigeria, Ghana, and Uganda.^{14,17,18}

The high level of ANC awareness observed in this study may reflect the contribution of health education and maternal health promotion through primary healthcare services. Indeed, most women who utilized ANC received care at government primary healthcare facilities, underscoring the important role of PHC facilities in delivering maternal health services in rural communities. Nevertheless, the finding that a substantial proportion of women did not complete four ANC visits suggests that awareness alone is insufficient to ensure adequate utilization. Accessibility, socioeconomic circumstances, reproductive experience, and other household-level factors may influence continued attendance.

Educational attainment was strongly associated with ANC utilization. Women with no formal or only primary education had approximately 71% lower adjusted odds of having four or more ANC visits compared with women who had secondary or tertiary education (AOR = 0.29; 95% CI: 0.16–0.56). This is consistent with evidence from Nigeria and other sub-Saharan African settings demonstrating greater utilization of maternal healthcare among women with higher educational attainment.^{19–21} Education may improve health literacy and women's understanding of the preventive value of ANC, including the importance of continued attendance even in the absence of pregnancy-related symptoms. Education may also enhance women's ability to obtain and interpret health information and participate in decisions concerning their healthcare. The finding reinforces the broader

maternal health benefits of improving female education, particularly in rural communities

Parity was another important independent predictor. Women with a parity of 1–4 had nearly four times the adjusted odds of having four or more ANC visits compared with women with a parity of five or more (AOR = 3.83; 95% CI: 1.74–8.44). This finding agrees with previous studies showing that women with higher parity are less likely to utilize ANC services consistently.^{19,22–24}

High-parity women may perceive themselves as experienced with pregnancy and consequently consider repeated ANC visits less necessary, particularly in the absence of complications. Competing responsibilities associated with caring for several children may also make repeated clinic attendance more difficult. These findings suggest that health education during community outreach and ANC contacts should specifically emphasize that previous uncomplicated pregnancies do not eliminate the need for appropriate care in subsequent pregnancies.

Distance to the health facility remained independently associated with adequate ANC utilization. Women living closer to an ANC facility were more likely to complete at least four visits, supporting evidence that distance remains a major barrier to maternal healthcare in rural settings. Travel over long distances may impose transportation costs, require substantial time away from household or income-generating activities, and become particularly difficult as pregnancy advances.^{25–27} The importance of proximity in this study therefore points to the need to strengthen maternal health services at primary healthcare facilities, improve outreach to underserved communities, and address transportation barriers for women living far from health facilities.

Age was not significantly associated with adequate ANC utilization at the bivariate level but became significant after adjustment for other factors. The emergence of this association after adjustment suggests that the relationship between age and ANC utilization may have been influenced by other characteristics, particularly parity, education, marital structure, and geographical accessibility. Younger women may have less experience navigating maternal healthcare services and may also have less autonomy or fewer resources to facilitate

repeated attendance. This finding highlights the importance of ensuring that younger women receive appropriate support and counselling to maintain ANC attendance throughout pregnancy. Marital type was significantly associated with ANC utilization at the bivariate level, with women in monogamous marriages having higher utilization than those in polygamous marriages. However, this association was attenuated and was no longer statistically significant after adjustment for other factors (AOR = 1.63; 95% CI: 0.85–3.14). This suggests that the observed crude association between marital structure and ANC utilization may be partly explained by differences in other characteristics such as education, parity, age, or accessibility rather than marital type itself. However, other studies have revealed a relationship between household or marital characteristics and maternal healthcare utilization²⁸. Differences in household decision-making, competing responsibilities, and access to financial or spousal support may contribute to this association. However, these mechanisms were not directly assessed in the present study and should therefore be interpreted cautiously. Consequently, marital type should not be interpreted as an independent determinant of ANC utilization in this study.

Among women who did not attend ANC, lack of perceived need was the most frequently reported reason. Other reported barriers included lack of husband's permission, distance or transportation difficulties, financial constraints, cultural restrictions, and limited knowledge of how to access services. Although the number of ANC non-attendees was small, these findings illustrate the range of individual, household, sociocultural, and health-system factors that may influence maternal healthcare utilization. The role of husbands' permission is particularly relevant in settings where household healthcare decisions may involve male partners. This matches findings from studies in northern Nigeria and other patriarchal societies where male approval continues to be a key factor influencing maternal health service use^{20,29,30}. Increasing male involvement and couple-centered health education could therefore promote women's autonomy and boost ANC participation.

Despite the high level of ANC awareness and attendance observed, a substantial disconnect remained between antenatal care and subsequent

delivery practices. Most respondents delivered their last child at home, and only a minority were assisted by a health professional. The findings also demonstrate that contact with ANC services does not necessarily translate into facility-based delivery or skilled attendance at birth. Despite relatively high ANC attendance, home delivery remained common in the study population, with traditional beliefs and convenience influencing the choice of place of delivery. More than 50% of births in developing countries occur at home³¹. This aligns with findings in Kaduna,³² where over half (51.9%) of the rural women delivered at home. This finding, however, differs from that of Johnson et al. in southwestern Nigeria, where 64.9% of the last deliveries occurred in health facilities.³³ Most maternal and neonatal deaths are linked to the preference for delivering outside of hospitals³⁴. Many of these deaths could be prevented with access to skilled birth attendants^{35,36}. Access to health facilities from one's residence significantly determines where delivery occurs.¹⁹ A study in the Eastern Region of Ghana reported that each additional kilometer of distance decreased the likelihood of women giving birth in health facilities by 6.7%.³⁷

Overall, the findings demonstrate that completion of four or more ANC visits in this rural population was influenced by interacting educational, reproductive, demographic, and geographical factors. Higher educational attainment, lower parity, age of 25 years or older, and shorter travel time to a health facility were independently associated with greater ANC utilization. Interventions aimed at improving continuity of ANC should therefore extend beyond increasing awareness and address barriers to repeated attendance, with particular attention to women with limited education, high parity, younger women, and those living farther from health facilities. Addressing these determinants is essential for improving maternal health outcomes and achieving SDG 3 targets in Nigeria

Discussion

This study demonstrates an important gap between awareness of antenatal care (ANC) and sustained utilization among women in rural northern Nigeria. Although awareness and initial attendance were high, continuation of care was less consistent. This pattern suggests that awareness alone may not be sufficient to ensure continued ANC attendance. Similar gaps between

initial access and continued utilization have been reported in Nigeria, Ghana, and Uganda.^{14,17,18} The finding is particularly important in the context of the current WHO recommendation of eight ANC contacts, which requires substantially greater continuity of care than the former four-visit Focused Antenatal Care model.¹⁰

The observed gap between awareness and continued attendance may reflect barriers that arise after women have recognized the importance of ANC. Geographic accessibility, financial constraints, cultural considerations, and the need for spousal permission were among the barriers reported by respondents. Studies in northern Nigeria and Ghana have similarly identified traditional beliefs and limited accessibility as important constraints to maternal healthcare utilization.^{22,23} These findings suggest that interventions focused solely on increasing awareness may have limited impact unless the practical and sociocultural barriers.

Maternal education emerged as an important independent predictor of completing at least four ANC visits. This is consistent with evidence from Nigeria and other sub-Saharan African settings demonstrating greater utilization of maternal healthcare among women with higher educational attainment.^{19–21} Education may improve health literacy and women's understanding of the preventive value of ANC, including the importance of continued attendance even in the absence of pregnancy-related symptoms. Education may also enhance women's ability to obtain and interpret health information and participate in decisions concerning their healthcare. The finding reinforces the broader maternal health benefits of improving female education, particularly in rural communities.

Marital structure was also associated with ANC utilization, with women in monogamous marriages more likely to complete at least four visits. Similar relationships between household or marital characteristics and maternal healthcare utilization have been reported elsewhere.²⁸ Differences in household decision-making, competing responsibilities, and access to financial or spousal support may contribute to this association. However, these mechanisms were not directly assessed in the present study and should therefore be interpreted cautiously. Nevertheless, the finding highlights the potential

importance of household context in influencing women's ability to maintain ANC attendance.

Parity was another important predictor of ANC utilization, with lower-parity women demonstrating better continuity of attendance. This finding agrees with previous studies showing that women with higher parity are less likely to utilize ANC services consistently.^{19,22–24} High-parity women may perceive themselves as experienced following previous pregnancies and consequently consider repeated ANC attendance less necessary, particularly when previous pregnancies were uncomplicated. They may also face greater childcare and household responsibilities, making repeated visits to health facilities more difficult. Maternal health education should therefore emphasize that each pregnancy carries potential risks irrespective of previous pregnancy experience.

Geographical accessibility was particularly important in determining ANC utilization. Women living closer to an ANC facility were more likely to complete at least four visits, supporting evidence that distance remains a major barrier to maternal healthcare in rural settings. Travel over long distances may impose transportation costs, require substantial time away from household or income-generating activities, and become particularly difficult as pregnancy advances.^{25–27} The importance of proximity in this study therefore points to the need to strengthen maternal health services at primary healthcare facilities, improve outreach to underserved communities, and address transportation barriers for women living far from health facilities.

The findings also demonstrate that contact with ANC services does not necessarily translate into facility-based delivery or skilled attendance at birth. Despite relatively high ANC attendance, home delivery remained common in the study population, with traditional beliefs and convenience influencing the choice of place of delivery. More than 50% of births in developing countries occur at home³¹. This aligns with findings in Kaduna,³² where over half (51.9%) of the rural women delivered at

home. This finding, however, differs from that of Johnson et al. in southwestern Nigeria, where 64.9% of the last deliveries occurred in health facilities.³³ Most maternal and neonatal deaths are linked to the preference for delivering outside of hospitals³⁴. Many of these deaths could be prevented with access to skilled birth attendants^{35,36}. Access to health facilities from one's residence significantly determines where delivery occurs.¹⁹ A study in the Eastern Region of Ghana reported that each additional kilometer of distance decreased the likelihood of women giving birth in health facilities by 6.7%.³⁷

Several respondents pointed out that the lack of their husbands' permission or support affects their ability to attend ANC, highlighting ongoing gender-related barriers to maternal healthcare access in northern Nigeria. In many households, women need their husbands' approval to seek care, and the absence of permission can delay or hinder ANC attendance. This matches findings from studies in northern Nigeria and other patriarchal societies where male approval continues to be a key factor influencing maternal health service use^{20,29,30}. Increasing male involvement and couple-centered health education could therefore promote women's autonomy and boost ANC participation.

Limitation

This study has several limitations. First, the cross-sectional design precludes causal inference regarding the identified factors associated with ANC utilization. Second, information on previous pregnancies and ANC attendance was self-reported and may therefore be subject to recall and social desirability bias. In addition, 238 of the targeted 394 participants were recruited, representing 60.4% of the planned sample size. This shortfall may have reduced the statistical power of the study and introduced selection bias if women who participated differed systematically from those who did not. Finally, ANC utilization was assessed

based on completion of at least four visits, reflecting the former WHO Focused Antenatal Care model rather than the current recommendation of eight ANC contacts. These limitations should be considered when interpreting the findings.

Conclusion

Although ANC awareness and initial attendance were high, continuity of care remained suboptimal. Educational attainment, parity, age, and proximity to health facilities were independent determinants of completing four or more ANC visits. Interventions should therefore prioritize women with limited education, high parity, younger women, and those living farther from health facilities, while strengthening primary healthcare services and reducing barriers to repeated ANC attendance.

Conflict of Interest Statement

The authors declare no conflict of interest relevant to this study.

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