Advanced International Journal for Research (AIJFR)
E-ISSN: 3048-7641 ● Website: www.aijfr.com ● Email: editor@aijfr.com

Knowledge, attitudes, and practices of antenatal care among first-time pregnant women in rural communities of Tamale: A cross-sectional study.

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Abstract

Introduction

In Ghana, maternal mortality is still a major public health issue that requires constant work to meet the Sustainable Development Goal (SDG) target of bringing the ratio down to 70 deaths for every 100,000 live births by 2030. Although some progress has been made, wide disparities persist between urban and rural areas. Rural communities experience disproportionately higher maternal mortality rates, partly due to lower access to skilled birth attendance estimated at only 43% in rural settings compared to 74% in urban areas. These differences are often linked to limited access to timely and quality antenatal care, shortages of trained healthcare personnel, inadequate health infrastructure, and socio-cultural factors that influence maternal health-seeking behaviours. Addressing these rural-urban gaps is critical to improving maternal health outcomes and reducing preventable deaths in Ghana. The study's goal was to determine the knowledge, attitude and practice of first-time pregnant women regarding antenatal care (ANC) services in the rural communities of Tamale Metropolis.

Method

A facility-based cross-sectional study was conducted among first-time pregnant women in rural communities of Tamale Metropolis. Using a probabilistic sampling technique, we sampled 408 first-time pregnant women from three health centres. The dependent variables (initiation of ANC) and independent variables were tested for correlations using bivariate analysis at a 95% CI and 5% significance level (p = 0.05).

Results

The knowledge level, and attitude level of the respondents toward ANC were revealed to be 81.6%, and 97.1%, respectively. Early initiation of ANC was found to be 8.3% (at 95% CI: 5.4% to 11.0%) among the respondents. The result revealed that 19.2% of respondents with Junior High School education were

more likely to have early initiation of ANC services compared to 4.1% of respondents with no formal education (X^2= 56.082, p < 0.001). Moreover, 100.0% of respondents who were single had a higher likelihood of starting ANC services early, compared to 89.4% of respondents who were married (X^2 = 9.906, p = 0.002). The result showed that 20.0% respondents who were Christians had a higher likelihood of starting ANC services early as compared to 7.4% of respondents who were Muslims (X^2 = 5.770, p = 0.016). It was further revealed that 24.1% of respondents who were public had a higher likelihood of starting ANC services early, compared to 5.2% of respondents who were farmers (X^2 = 15.742, p = 0.003). The result also showed that 36.4% of respondents who earn a monthly income of GHC 1001.00 or more had a higher likelihood of starting ANC services early compared to 6.7% of respondents who earn a monthly income of GHC1000.00 or less (X^2 = 23.918, p < 0.001).

Conclusion

According to the study, the first-time pregnant women had high knowledge, and attitude level toward ANC. However, most of the respondents had late initiation of ANC services. There is therefore the need to address all the barriers that prevent first-time pregnant women from initiating ANC early.

Keywords: Knowledge, Attitude, Practice, and Antenatal Care

1. Introduction

Maternal mortality, defined as the death of a woman while pregnant or within 42 days after delivery from causes related to or aggravated by the pregnancy or its management, remains a major public health concern in low- and middle-income countries (LMICs) (1). The loss of a mother during pregnancy, childbirth, or the postpartum period is not only a devastating family tragedy but also has lasting social, emotional, and economic repercussions for the surviving children, partner, and the wider community (2). Despite notable global progress, an estimated 295,000 maternal deaths occurred in 2017, with Sub-Saharan Africa (SSA) and South Asia accounting for the majority (3). In SSA, maternal mortality ratios remain disproportionately high, reaching 542 deaths per 100,000 live births in 2015, compared to only 12 per 100,000 in high-income countries (4).

In Ghana, maternal mortality continues to pose a significant challenge despite gradual reductions over recent decades (5). According to the Ghana Statistical Service (2018), the maternal mortality ratio was estimated at 350 deaths per 100,000 live births in 2017, with postpartum hemorrhage, hypertensive disorders, infections, and delivery complications as the leading causes (6). Rural areas bear a disproportionate burden, with lower skilled birth attendance (43%) compared to urban areas (74%) (7). Pregnant women in rural Ghana are more likely to experience obstetric complications and face barriers to accessing timely and skilled care (8). Although national coverage of at least four antenatal care (ANC) visits exceeds the global average, disparities persist, with rural women less likely to receive timely and adequate ANC services (9).

Antenatal care serves as a critical gateway to the health system, offering opportunities for health promotion, prevention, and early detection of complications (10). The WHO recommends that the first ANC contact occur within the first 12 weeks of pregnancy, followed by a minimum of eight contacts to optimize maternal and new-born outcomes (11). Early initiation of ANC allows healthcare providers to detect and manage conditions such as anaemia, infections, congenital abnormalities, and pregnancy-induced hypertension before they pose risks to maternal health (12). However, evidence shows that less than half of pregnant women in many developing countries attend their first ANC visit within the recommended time frame, with rates in Africa ranging from 14.5% in Mozambique to 68.6% in Liberia (13).

In Ghana, utilization of ANC services is shaped by a complex interplay of factors, including maternal education, household wealth, marital status, distance to health facilities, transportation availability, and decision-making autonomy (14). Cultural norms and religious beliefs also influence attendance, with some families preferring traditional or spiritual care over biomedical services (15). First-time pregnant women in rural areas may be particularly vulnerable to delays in ANC initiation and inadequate follow-up, as they may lack prior experience, accurate knowledge, or supportive networks to guide timely health-seeking behaviour (16).

The Three Delays Model (Thaddeus & Maine, 1994) offers a useful lens for understanding barriers to maternal care, highlighting delays in deciding to seek care, reaching a facility, and receiving appropriate treatment (17). In the context of ANC, the first delay—shaped by knowledge, attitudes, and perceptions of pregnancy risk—is especially critical (18). Poor knowledge of ANC benefits, misconceptions about pregnancy, and cultural reluctance to disclose pregnancy early can all lead to late initiation of care (19).

Although several studies have examined ANC utilization in Ghana, there is limited evidence focusing specifically on the knowledge, attitudes, and practices (KAP) of first-time pregnant women in rural communities, particularly in the Tamale Metropolis. Understanding these KAP dimensions is essential for designing interventions that address informational gaps, reshape perceptions, and promote positive maternal health behaviours. In order to reduce rural-urban disparities, inform maternal health policy, and to assist Ghana in reaching the Sustainable Development Goal (SDG) of lowering maternal mortality before 2030 to less than 70 per 100,000 live births, this study intends to determine the knowledge, attitude and practice regarding ANC among first-time pregnant women in rural Tamale.

Methodology

Study design

A facility-based analytical cross-sectional study design was used with a quantitative approach among first-time pregnant women who attended ANC at government health centers within the rural areas of Tamale Metropolis. The design allowed for the simultaneous collection and analysis of data on both exposures and outcomes at a single point in time, thereby enabling the identification of significant relationships and patterns. The quantitative approach helped to generates numerical data that was analysed statistically, facilitating clear interpretation and presentation of results in the form of frequencies, percentages, measures of association, and significance levels.

Study settings

The study was conducted at the three-government health centers (Bilpeila Health Center, and Nyohini Health Center and Vitting Health Center) in the Tamale metropolis**.** Tamale, the capital of Ghana's Northern Region, is predominantly occupied by people from the Mole-Dagomba linguistic group. The city is home of about 371,351 people. Out of this number 185,995 are males and 185,356 are females. It serves as a nodal city, acting as both the commercial center for the five northern regions and a focal point of convergence. Bilpeila Health Center, and Nyohini Health Center and Vitting Health Center were purposively selected because they are among the primary healthcare facilities serving rural and peri-urban communities within the Tamale Metropolis. The maternal health service utilization patterns in these facilities reflect significant disparities compared to urban centres. Moreover, the facilities represent different catchment areas with diverse socio-economic and cultural characteristics, enabling the capture of varied experiences and barriers faced by expectant mothers.

Study population

First-time pregnant women aged 15 – 49 years who were attended ANC between May 2022 to August, 2022 at the chosen facilities were eligible to participate in the study. All first-mothers who were available during the three-month period of the study and provided oral consent were allowed to respond to the survey.

Sample size calculation

The Cochran's formula was used to determine the number of first-time mothers recruited for the study. An estimated 59% proportion of first-time pregnant women' attitude toward ANC services (20) was used. Margin of error of 0.05 was used. Using the Cochran's formula:

$$n = \frac{z^2 pq}{d^2} \quad (1)$$

n represent the sample size, and z being 95% confidence interval

p = estimated proportion of first-time pregnant women's attitude toward ANC services = 59%

q = 1 – p = 0.41

Substituting the values into the formula;

$$= \frac{(1.96)^2(0.59)(0.41)}{(0.05)^2} = \frac{3.8416(0.2419)}{0.0025} = \frac{0.92928}{0.0025} = 371.71 \simeq 372$$

Considering 10% of nonresponse (37), the total sample size was 409.

Sampling techniques

The average number of first-time pregnant women who access ANC services in three months was obtained from the in-charges of each facility. This helped to determine the number of participants to be recruited into the study. The number of participants from each facility were calculated by using proportionate to size methods. Selection of first-time pregnant women to respond to the questionnaire was done using a simple random sampling method. Using this method, all first-time pregnant women at the health facility

had an opportunity to be selected for the study. Papers labeled "Yes" or "No" were folded and placed inside a box. All first-time pregnant women present at the time of the study were required to choose a sheet from the box.

A first-time pregnant woman who selected a sheet bearing the word "Yes" was assessed after providing informed consent. Conversely, a first-time pregnant who selected a sheet bearing the word "No" was not allowed to participate in the study. Before data collection, all respondents were informed of the study's goals, advantages, and risks. During data collection, first-time pregnant women who met the inclusion criteria were assessed.

Data collection tools and techniques

Self-administered questionnaire was used to collect data from first time pregnant women in rural areas of Tamale Metropolis. The questionnaire was designed in alignment with the study's objectives, with the literature review for each objective guiding the formulation of relevant questions. It was divided into four (4) sections: Section A focused on the socio-demographic characteristics of respondents, while Section B contained questions assessing respondents' knowledge of antenatal care (ANC). 'Section C' contained questions that dealt with the attitude of respondents toward ANC. 'Section D' dealt with factors that influence early ANC initiation among respondents.

Data analysis

The data was analysed using version 24 of the Statistical Package for the Social Sciences (SPSS). Data on socio-demographic characteristics of all respondents were represented with descriptive statistics which consists of frequencies and percentages. Inferential statistics was used for establishing association between variables and outcomes. Level of knowledge and attitude were grouped based on raw scores. Pearson's correlation analysis was performed where applicable at a significance level of $p \leq 0.05$. Additionally, cross-tabulations were conducted to examine the relationships between the dependent and independent variables.

Assessment of respondents' knowledge level on ANC services

The study used 32 items to assess respondents' knowledge on ANC services. A correct response was awarded one point, while an incorrect response was assigned zero points. The knowledge level of the respondents on ANC services were grouped into two. The first group was inadequate knowledge, thus if a respondent scored below 78% (less than 26 points). The second part was adequate knowledge: if a respondent scored 80-100% (26 – 32 points).

Assessment of attitude of respondents towards ANC services.

The study employed 19 items to assess respondents' attitudes toward ANC services. Each correct response was awarded one point, while each incorrect response received zero points. The attitude level of the respondents towards ANC services were grouped into two. The first part was called poor attitude, thus if

a respondents scored below 53% (less than 11 points). The second part was title good attitude, thus if a respondents scored 54-100% (11 – 19 points).

Assessment of timing of ANC services

The timing of ANC services was verified from respondents' ANC book. The timing of the ANC initiation was grouped into two. The first group was early initiation, thus when a respondent initiates ANC visit within the first trimester. The second group was late initiation thus, if a respondents initiate ANC visit after first trimester.

Ethical consideration

Ethical clearance was obtained from Kwame Nkrumah University of Science and Technology, Committee on Human Research, Publication and Ethics (CHRPE/AP/389/22). Afterwards, permission was taken from the Municipal Director of Health Services and the three facilities' in-charges before starting the study. Oral consent was obtained from respondents prior to their inclusion in the study. They were informed about the study's purpose, procedures, potential risks, and benefits, as well as the eligibility criteria. Participation was entirely voluntary, allowing respondents to decide whether to take part. Confidentiality was strictly maintained, and all information provided was used exclusively for academic purposes.

Results

Socio-demographic characteristics of respondent

The study recruited 409 participants to answer the questionnaire. However, 408 participants fully participated in the study. The study took place at Nyohini Health Center, Vittin Health Center, and Bilpeila Health Center. A total of 136 (33.3%) respondents were taken from each Health Center. The study found that 130 respondents (31.9%) were aged between 26 and 30 years. The mean age was 29.07 years, with a standard deviation of 5.055 years.

Moreover, the majority of the respondents 70 (41.7%) had no formal education. It was revealed that the majority of the respondents 322 (78.9%), and 324 (79.4%) were married, and Dagomba respectively. Muslims 378 (92.6%) form the majority of the respondents. More than half of the respondents 213 (52.2%) had farming as their occupation. Almost half of the respondents 193 (47.3%) partner's occupation was farming. The findings also indicated that the majority of respondents, 381 (93.4%), possessed National Health Insurance Scheme (NHIS) cards. The monthly income of the majority of the respondents was less than or equal to GHC 1000.0. Detailed information is provided in Table 1.

Table 1: Socio demographic characteristics of respondents (n = 408)

Variable	Frequency (n)	Percentage (%)
Health Center		
Nyohini Health Center	136	33.3
Vittin Health Center	136	33.3
Bilpeila Health Center	136	33.3
Age (years)		
≤ 20	18	4.4
21 – 25	93	22.8
26 – 30	130	31.9
31 – 35	124	30.4
36 – 40	43	10.5
Educational level		
No formal education	170	41.7
Informal education	75	18.4
Primary	91	22.3
Junior High School	26	6.4
Senior High School/Vocational	26	6.4
Tertiary	20	4.9
Marital status		
Single	86	21.1
Married	322	78.9
Ethnicity		
Dagomba	324	79.4
Frafra	22	5.4
Mamprusi	12	2.9
*Others	50	12.3
Religion		
Christianity	30	7.4
Muslims	378	92.6
Occupation		
Farmer	213	52.2
Trader	44	10.8
Unemployed	56	13.7
Public servant	29	7.1
House wife	66	16.2
Partner's occupation		
Farmer	193	47.3
Trader	81	19.9
Unemployed	30	7.4
Public servant	57	14.0

**Others	47	11.5
Registered with NHIS		
Registered	381	93.4
Not registered	27	6.6
Monthly income		
≤ GHC 1000.0	386	94.6
≥ GHC 1001.00	22	5.4

*Others: Bimoba, Bruiser, Dagaati, Ewe, Fulani, Gonja, Hausa, Komkomba, Mosi, Nanumba, and Wala.
**Others: Barbar, Driver, Electrician, Mechanic, and Plumber.

Knowledge level of respondents on ANC

Majority of 81.6% (at 95% CI: 78.2% to 85.5%) the respondents demonstrated adequate knowledge of ANC. Nonetheless, 18.4% (at 95% CI: 14.5% to 21.8% of the participants showed inadequate knowledge of ANC (Table 2).

Table 2: Knowledge level of respondents on ANC

Scores (Point)	Rating	Frequency (n)	Percentage (%)
≤ 25	Inadequate Knowledge	75	18.4
26 – 32	Adequate knowledge	333	81.6
Total		408	100.0

Source: Field survey, June 2022

Distribution of knowledge level of ANC among respondents' characteristics

The findings of the study revealed that 28.7% pregnant women who attend ANC services at Nyohini Health Center had a higher likelihood of inadequate knowledge of ANC, compared to 4.4% of respondents who attend ANC services at Bilpeila Health Center. There was significant association between the health facility respondents attend and the knowledge level of ANC ($X^2 = 28.523$, $p < 0.001$).
Furthermore, the result of the study indicated 57.7% respondents with Junior High School education had a higher likelihood of possessing inadequate knowledge of ANC compared to 7.7% of respondents with Senior High School education. Nonetheless, 90.0% of respondents with tertiary education had a higher likelihood of adequate knowledge of ANC compared to 42.3% of respondents with Junior High School education. There were a significant association between knowledge level on ANC and respondents' educational level ($X^2 = 32.904$, $p < 0.001$).

The result showed that 90.7% of respondents who were single had a higher likelihood of possessing adequate knowledge of ANC as compared to 79.2% of respondents who were married. There was a significant association between knowledge level of ANC and respondents' marital ($X^2 = 5.988$, $p = 0.0014$) (Table 3).

Table 3: Distribution of knowledge level of ANC among respondents' characteristics (n = 408)

Variable	Knowledge level of ANC		Chi-Square (P-value)
	Inadequate Knowledge	Adequate Knowledge	
	n (%)	n (%)	
Health Center			**28.523 (< 0.001)**
Nyohini Health Center	39(28.7)	97(71.3)	
Vittin Health Center	30(22.1)	106(77.9)	
Bilpeila Health Center	6(4.4)	130(95.6)	
Age (years)			
≤ 20	6(33.3)	12(66.7)	6.715 (0.243)
21 – 25	22(23.7)	71(76.3)	
26 – 30	20(15.4)	110(76.3)	
31 – 35	22(17.7)	102(82.3)	
36 – 40	5(12.2)	36(87.8)	
Educational level			
No formal education	34(20.0)	136(80.0)	**32.904 (< 0.001)**
Informal education	10(13.3)	65(86.7)	
Primary	12(13.2)	79(86.8)	
Junior High School	15(57.7)	11(42.3)	
Senior High School/Vocational	2(7.7)	24(92.3)	
Tertiary	2(10.0)	18(90.0)	
Marital status			
Single	8(9.3)	78(90.7)	**5.988 (0.014)**
Married	67(20.8)	255(79.2)	
Ethnicity			
Dagomba	60(18.5)	264(81.5)	1.578 (1.578)
Frafra	3(13.6)	19(86.4)	
Mamprusi	1(8.3)	11(91.7)	
*Others	11(22.0)	39(78.0)	
Religion			
Christianity	5(16.7)	25(83.3)	0.064 (0.801)
Muslims	70(18.5)	308(81.5)	
Occupation			
Farmer	32(15.0)	181(85.0)	6.517 (0.164)
Trader	11(25.0)	33(75.0)	
Unemployed	13(23.2)	43(76.8)	
Public servant	3(10.3)	26(89.7)	
Housewife	16(24.2)	50(75.8)	
Monthly income			

≤ GHC 1000.0	73(18.9)	313(81.1)	1.338
≥ GHC 1001.00	2(9.1)	20(90.9)	(0.247)

Source: Field survey, June 2022

1.1.1 Attitude level of respondents toward ANC

It was revealed that 97.1% (at 95% CI: 95.3% to 98.8%) of the respondents had good attitude towards ANC. Nevertheless, 2.9% (at 95% CI: 1.2% to 4.7%) of the respondents demonstrated a poor attitude toward ANC (Table 4).

Table 4: Respondents' attitude level toward ANC

Scores (Point)	Rating	Frequency (n)	Percentage (%)
≤ 10	Poor attitude	12	2.9
11 – 19	Good Attitude	396	97.1
Total		408	100.0

Source: Filed survey, June 2022

Distribution of attitude level toward ANC among respondents' characteristics

It was found that 5.9% of respondents who attend ANC services at Nyohini Health Center had a higher likelihood to have poor attitudes toward ANC as compared to 2.9% of respondents who attend ANC at Bilpeila Health Center. A significant association was revealed between facility respondent attend and attitude toward ANC ($X^2 = 8.242$, $p = 0.016$).

Moreover, the result showed that 5.6% of respondents aged 25 years and below had a higher likelihood to have poor attitudes toward ANC as compared to 2.4% of respondents aged 36 to 40 years. However, 97.6% respondents aged 36 to 40 years and above had a higher likelihood to have good attitude towards ANC compared to 94.4% of respondents aged 20 years and below. A significant association was respondents' age and attitude toward ANC ($X^2 = 4.202$, $p = 0.521$).

The result showed that 3.4% of respondents who are married had a higher likelihood to have poor attitudes toward ANC, compared to 1.2% of respondents who were single. No significant association was found between respondents' marital status and attitude towards ANC ($X^2 = 1.207$, $p = 0.272$) (Table 5).

Table 5: Distribution of attitude levels toward ANC among respondents' characteristics (n = 408)

Variable	Attitude Towards ANC		Chi-Square (P-value)
	Poor Attitude	Good Attitude	
	n (%)	n (%)	
Health Center			**8.242 (0.016)**
Nyohini Health Center	8(5.9)	128(94.1)	
Vittin Health Center	4(2.9)	132(97.1)	
Bilpeila Health Center	0(0.0)	136(100.0)	
Age (years)			
≤ 20	1(5.6)	17(94.4)	1.431
21 – 25	4(4.3)	89(95.7)	(0.921)

26 – 30	3(2.3)	127(97.7)	
31 – 35	3(2.4)	121(97.6)	
36 – 40	1(2.4)	40(97.6)	
Educational level			
No formal education	6(3.5)	164(96.5)	4.202 (0.521)
Informal education	1(1.3)	74(98.7)	
Primary	2(2.2)	89(97.8)	
Junior High School	2(7.7)	24(92.3)	
Senior High School/Vocational	0(0.0)	26(100.0)	
Tertiary	1(5.0)	19(95.0)	
Marital status			
Single	1(1.2)	85(98.8)	1.207 (0.272)
Married	11(3.4)	311(96.6)	
Ethnicity			
Dagomba	11(3.4)	313(96.6)	3.638 (0.303)
Frafra	0(0.0)	22(100.0)	
Mamprusi	1(8.3)	11(91.7)	
*Others	0(0.0)	50(100.0)	
Religion			
Christianity	0(0.0)	30(100.0)	0.981 (0.322)
Muslims	12(3.2)	366(96.8)	
Occupation			
Farmer	6(2.8)	207(97.2)	3.471 (0.482)
Trader	1(2.3)	43(97.7)	
Unemployed	1(1.8)	55(98.2)	
Public servant	0(0.0)	29(100.0)	
Housewife	4(6.1)	62(93.9)	
Monthly income			
≤ GHC 1000.0	12(3.1)	374(96.9)	
≥ GHC 1001.00	0(0.0)	22(100.0)	
Registered with NHIS			
Registered	11(2.9)	370(97.1)	0.059 (0.808)
Not registered	1(3.7)	26(96.3)	

Source: Field survey, June 2022

1.2 Timing of ANC initiation

The result of the study found that 8.3% (at 95% CI: 5.4% to 11.0%) of the respondents had early initiation of ANC services. The majority of the respondents 91.7% (at 95% CI: 89.0% to 94.6%) had late initiation of ANC services (Figure 1). The result also found that the majority of the respondents 359(88.0%) initiated ANC services in the second trimester. Figures 2 and Figure represent the timing of ANC initiation, and the trimesters respondents-initiated ANC.

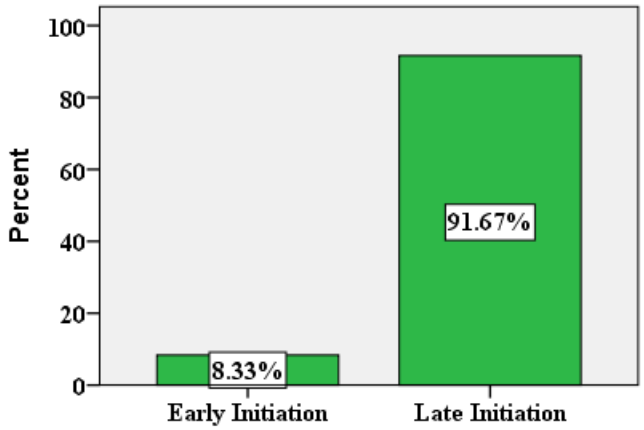

Figure 1: Timing of ANC initiation among respondents

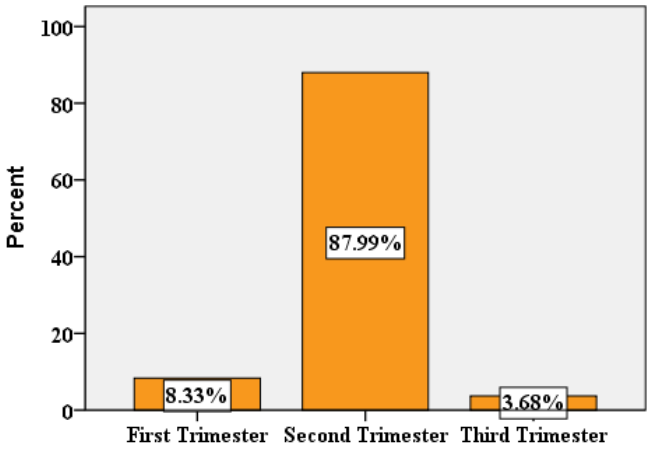

Figure 2: The trimester in which respondents-initiated ANC services.

Timing of ANC initiation distributed among respondents' characteristics

The study showed that 19.2% of respondents with Junior High School education possessed a greater probability of starting ANC services early, compared to 4.1% of respondents with no formal education. However, 96.2% of respondents with Senior High School/Vocational education had a greater chance of starting ANC services early, compared to 90.7% of respondents with Senior High School. A significant association was revealed between respondents' educational and the timing of ANC initiation (X^2= 56.082, $p < 0.001$).

Moreover, 100.0% of respondents who were single had possessed a probability of starting ANC services early, compared to 89.4% of respondents who were married. A significant relationship was revealed between respondents' marital status and the timing of ANC initiation ($X^2 = 9.906$, $p = 0.002$).

The study revealed that 20.0% respondents who were Christians had a greater chance of starting ANC services early, compared to 7.4% of respondents who were Muslims. Regilion of respondents showed significant association with timing of ANC initiation ($X^2 = 5.770$, $p = 0.016$).

The result showed that 24.1% of respondents who were public servants had a greater probability of starting ANC services early, compared to 5.2% of respondents who were farmers. Respondents' occupation showed a significant association with the timing of ANC initiation ($X^2 = 15.742$, $p = 0.003$).
The result also showed that 36.4% of respondents who earn a monthly income of GHC 1001.00 or more (36.4%) had a greater chance of having early initiation of ANC services compared to 6.7% of respondents who earn a monthly income of GHC1000.00 or less. Respondents' monthly income showed statistically significant association with the timing of ANC initiation ($X^2 = 23.918$, $p < 0.001$) (Table 6).

Table 6: Timing of ANC initiation distributed according to socio-demographic data of respondents (n = 408)

Variable	Timing of ANC initiation		Chi-Square (P-value)
	Early initiation	Late initiation	
	n (%)	n (%)	
Health Center			1.604 (0.448)
Nyohini Health Center	8(5.9)	128(94.1)	
Vittin Health Center	13(9.6)	123(90.4)	
Bilpeila Health Center	13(9.6)	123(90.4)	
Age (years)			
≤ 20	2(11.1)	16(88.9)	5.070 (0.407)
21 – 25	3(3.2)	90(96.8)	
26 – 30	11(8.5)	119(91.5)	
31 – 35	14(11.3)	110(88.7)	
36 – 40	4(9.8)	37(90.2)	
Educational level			
No formal education	7(4.1)	163(95.9)	**56.082 (<0.001)**
Informal education	7(9.3)	68(90.7)	
Primary	4(4.4)	87(95.6)	
Junior High School	5(19.2)	21(80.8)	
Senior High School/Vocational	1(3.8)	25(96.2)	
Tertiary	10(50.0)	10(50.0)	
Marital status			
Single	0(0.0)	86(100.0)	**9.906 (0.002)**
Married	34(10.6)	288(89.4)	
Ethnicity			
Dagomba	25(7.7)	299(92.3)	5.354 (0.148)
Frafra	0(0.0)	22(100.0)	
Mamprusi	2(16.7)	10(83.3)	
*Others	7(14.0)	43(86.0)	
Religion			

Christianity	6(20.0)	24(80.0)	**5.770**
Muslims	28(7.4)	350(92.6)	**(0.016)**
Occupation			
Farmer	11(5.2)	202(94.8)	**15.742**
Trader	7(15.9)	37(84.1)	**(0.003)**
Unemployed	4(7.1)	52(92.9)	
Public servant	7(24.1)	22(75.9)	
Housewife	5(7.6)	61(92.4)	
Monthly income			
≤ GHC 1000.0	26(6.7)	360(93.3)	**23.918**
≥ GHC 1001.00	8(36.4)	14(63.6)	**(<0.001)**
Registered with NHIS			
Registered	34(8.9)	347(91.1)	2.628
Not registered	0(0.0)	27(100.0)	(0.105)
Knowledge level			
Inadequate knowledge	7(9.3)	68(90.7)	0.120
Adequate knowledge	27(8.1)	306(91.9)	(0.729)
Attitude level			
Poor Attitude	0(0.0)	12(100.0)	1.124
Good Attitude	24(8.6)	362(91.4)	(0.289)

Source: Field survey, June 2022

Discussion

Knowledge level of first-time pregnant women on ANC services

The overall knowledge level of respondents on ANC was 81.6%. This is higher than a study conducted by Amosu et al. (2011) in South West Zone of Nigeria. In their study, they found that first-time pregnant women possessed insufficient knowledge on ANC services. The result of the current study supports the findings of a study that found that pregnant women in Malawi had a 96.0% knowledge level of ANC (22). It is also similar to a study conducted by Eunice (2019) conducted at Tarkwa Nsuaem Municipality which found that the majority of pregnant adolescents had adequate knowledge of ANC. This similarity may be attributed to easy access to accurate and comprehensive information about ANC through healthcare providers, educational materials, and community resources can significantly improve knowledge levels.

The current study found that 81.6% of first-time pregnant women in rural Tamale had adequate knowledge of ANC. This high knowledge level is consistent with findings across sub-Saharan Africa (24). For instance, a rural Ghanaian study in 2020 reported that women with at least basic education were 4.47 times more likely to have good ANC knowledge compared to those with no education (25). Similarly, systematic surveys in Ghana indicate that a majority begin ANC in the first trimester and engage in four or more visits, with higher education correlating with early initiation and proper utilization (26).

Educational attainment profoundly shaped knowledge. Respondents with junior high school education had much higher rates of inadequate ANC knowledge (57.7%), while those with tertiary education had overwhelmingly adequate knowledge (90.0%) ($p < 0.001$). This aligns with broader evidence: higher

education is a strong predictor of both ANC knowledge and service utilization across Africa (27). Educated women are also more likely to interpret health information, seek timely care, and act on recommendations.

An intriguing finding emerged regarding marital status: 90.7% of single respondents had adequate knowledge compared to 79.2% of married respondents (p = 0.0014). While few studies in Ghana explicitly compare knowledge by marital status, this may reflect greater autonomy among single women in seeking and assimilating health information, whereas married women—especially in rural, patriarchal settings—may rely on partners or family for healthcare decisions, potentially delaying self-motivated information-seeking (28).

Attitude of first-time pregnant women towards ANC services

Most of (97.1%) the participant in the current study had a good attitude toward ANC. This is higher than what was reported by Rosliza & Muhamad (2015) among Orang Asli women in Jempol, Negeria Sembilan. They found that 53.8% (95% CI, 44.3 – 63.1%) of first-time mothers demonstrated a good attitude towards ANC. The result of the current study is also in line with the assertion of Igbokwe (2012) who found that the attitude toward ANC by pregnant women in Enugu State, Nigeria was positive. In a comparable study, almost all the women attending ANC at the Shukura Community Hospital had a positive attitude towards ANC 371 (91.6%) (31). Theses similarities may be due to compassionate and respectful interactions with healthcare professionals during ANC visits can create a positive attitude. When women feel valued and heard, they are more likely to have a favourable outlook on ANC. Besides, community-based initiatives that promote ANC and its benefits can create a supportive environment that fosters a positive attitude.

Attitudes varied modestly by age: those aged 25 and under showed a slightly higher rate of poor attitudes (5.6%) compared to older groups, whereas all respondents aged 41 and above had uniformly positive attitudes. However, this difference did not reach statistical significance (p = 0.521). Similar trends were observed in rural Ethiopia, where older women demonstrated more favourable attitudes toward ANC uptake, often due to greater decision-making power and prior reproductive experiences. While statistically non-significant in your study, the pattern may warrant further exploration—with targeted qualitative work to understand how age-related life experiences influence ANC perceptions.

When comparing marital status, 3.4% of married respondents exhibited poor attitudes, relative to 1.2% of single respondents (p = 0.272), again not statistically significant. This nuanced difference may reflect that single woman—despite potential social stigmas—may be more proactive in seeking support and information, whereas married women may rely on partner or family guidance. However, lack of a clear pattern aligns with less systematic evidence connecting marital status directly to attitude across existing literature.

Timing of ANC initiation

The results of this study found that 8.3% (95% CI: 5.4% to 11.0%) of the respondents had early initiation of ANC services within the first trimester of pregnancy. This is comparable to a study conducted among women in south-eastern Nigeria which showed that women usually report late for ANC due to the belief that there are no advantages to early booking, as ANC is perceived primarily as curative rather than preventive (Akejuet al., 2016). The result of Zeleke et al. (2022) is higher than the finding of this study.

In their research, 38.0% (95% CI: 37.8–38.2) of ANC visits were initiated on time; rates varied by country, ranging from 14.5% in Mozambique to 68.6% in Liberia. Early ANC coverage increased from an estimated 40.9% in 1990 to 58.5% in 2013, but it only increased from 17.7% in 1990 to 24.9% in 2013, which is still relatively low in sub-Saharan Africa (34). This late ANC initiation may be due to denial or unplanned pregnancy. Some women may deny or not recognize their pregnancy until late stages, especially if it was unplanned or unexpected. Similarly, women residing in remote areas often face difficulties in accessing healthcare facilities for ANC services, primarily due to geographic barriers and limited transportation options.

A previous study in LMICs revealed a broad range of ANC timely initiation, ranging from 12.9% to 89.6% (13). One possible explanation for this variation across nations is the use of different cut-off points to define early initiation of ANC (some defined it based on the cut-off point of 12 weeks of gestation, while others defined it based on 16 weeks) (35). As a result, women may perceive different times for booking ANC (36). However, this study defined timely initiation ANC according to the WHO definition, using the same definition for all of the countries that were part of the analysis. In order to obtain enough ANC visits and detect and treat any possible issues in the early stages of pregnancy, the WHO advises women to schedule their first ANC visit within 12 weeks of gestation (37).

The result of the current study is lower than what was reported by Amoako (2021) at East Akim Municipality of Ghana. According to the study's findings, 58.0% of participants registered for ANC for the first time during the first trimester of pregnancy. The results of the 2017 Maternal Health Survey, which showed that 64% of mothers had their first ANC visit in the first trimester, are also lower than those of the current study (39). This difference may be attributable to the fear of pregnancy, or a lack of understanding about ANC can deter women from seeking care promptly.

Asundep et al. (2014) also reported that 61% of mothers in the Ashanti region of Ghana initiated ANC during the first trimester of pregnancy which is higher than the finding of this current research. Early ANC visits are necessary for the early identification, management, and avoidance of conditions that could negatively impact the expectant mother and her unborn child.

Additionally, 359 (88.0%) of the respondents in the current study started ANC services in the second trimester, which was the majority. This is in line with a study conducted by Vuoche (2017) which reported that about 39.6% of pregnant women initiated ANC in the first trimester, 54.0% initiated ANC in the second trimester and 6.1% initiated ANC in the third trimester among women in the Buipeila Sub-District of the Northern region of Ghana. The difference in early initiation between the current study and that of the one conducted at Buipeila Sub-District may be because the current study combined other areas. It agrees with the findings of Sadique (2018) conducted at two health centers at Tamale Metropolis. Among the participants, the majority (69.9%) started ANC late, at thirteen weeks or later, whereas three out of ten (30.1%) women started at or before twelve weeks.

The late initiation of first-time mothers in the study area is not commendable. The fundamental causes of late ANC attendance should be investigated further, especially in Ghana's five Northern regions and among communities that are economically disadvantaged. These kinds of insights are crucial for directing the development of focused interventions meant to promote and assist early ANC attendance.

Strength and limitations of the study

The study was able to determine the knowledge, attitude, and practice of ANC among first-time pregnant women in Tamale Metropolis. However, the cross-sectional design used could not establish causation. As a result, the conclusions drawn in the study are limited to associations and not causal effects. Again, the approach employed to measure the reason for late antenatal initiation was quantitative, which could not assess the respondents believe, or perceptions for late ANC initiation. Additionally, recall bias may have occurred, as respondents were required to remember and report details about their attitudes toward ANC services.

Conclusion

The analytical cross-sectional study shed light on the knowledge, attitude, and practice of first-time pregnant women regarding ANC in rural communities of Tamale Metropolis. The knowledge, and attitude level toward ANC were high among the respondents. However, most of the first-time pregnant women had late initiation of ANC services. In order to improve the prompt initiation of ANC in Ghana's Northern Region, the Tamale Regional Health Directorate should carry out focused intervention efforts that address the factors that have been identified.
This can be accomplished by promoting family planning to avoid unintended pregnancies, especially in rural areas, and providing community-based information and education on the timing and significance of attending prenatal care.

List of abbreviations

ANC	:	Antenatal Care
CI	:	Confidence Interval
KAP	:	Knowledge, Attitudes, and Practices
LMICs	:	Low- and Middle-Income Countries
SPSS	:	Statistical Package for the Social Sciences
SSA	:	Sub-Saharan Africa
UNFPA	:	United Nations Population Fund
WHO	:	World Health Organization

Declarations

Ethical approval and consent to participate

The study has been approved by KNUST Ethical Review Board (CHRPE/AP/389/22) and all respondents provided verbal informed consent to participate.

Consent for publication

Not application

Availability of data materials

The datasets from the current research are available from the corresponding author on reasonable request.

Competing interests

Not applicable

Clinical trial number

Not applicable

Funding

The study received no external funding

Authors' contributions

The study's design, data collection, analysis, interpretation, and manuscript writing were all aided by EA, LMAB, and MR. KB, FMD, and YDT helped write the manuscript, interpret the data, and design the study. The final manuscript has been read and approved by all authors.

Acknowledgements

We are grateful to the authorities of Tamale Metropolis for the cooperation during the period of the study.

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