

ORIGINAL RESEARCH ARTICLE

Determinants of early antenatal care booking in Kisumu, Kenya: A hospital-based cross-sectional study applying the Andersen-Newman health service utilization model

DOI: 10.29063/ajrh2026/v30i19.3

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Abstract

Starting antenatal care early is important for healthy pregnancies. In 2016, the World Health Organization updated its antenatal care guidelines, recommending that pregnant women begin antenatal care by 12 weeks of gestation. Kenya adopted this model in 2022, yet only 29% of women initiate antenatal care early, compared with 37.5% in Sub-Saharan Africa. This study used a cross-sectional design to examine the proportion of women who booked antenatal care early and the factors associated with early booking. The study used Andersen-Newman's health services utilization model as its conceptual framework. A sample of 292 women was selected through systematic random sampling at Jaramogi Oginga Odinga Teaching and Referral Hospital in Kisumu, Kenya. Data was collected using questionnaires and the Kenya Mother and Child Health Handbooks. Analyses included descriptive statistics, the Mann-Whitney U test, the chi-square test, and multivariable logistic regression. The median time to booking antenatal care was 20.0 weeks (IQR: 16.0–24.0), and only 34.2% of women booked early. The most significant predictor of early antenatal care booking was receiving information from healthcare providers (AOR = 1.96; 95% CI: 1.06–3.71; P = 0.036). This study recommends improving healthcare providers' messaging to address social influences from family and friends and to encourage early ANC booking. (*Afr J Reprod Health* 2026; 30 [19]:28-40).

Keywords: Antenatal Care; Health Education; Kenya; Pregnancy; Sub-Saharan Africa; World Health Organization

Résumé

Un suivi prénatal précoce est essentiel au bon déroulement de la grossesse. En 2016, l'Organisation mondiale de la Santé a actualisé ses directives en la matière, recommandant aux femmes enceintes de commencer ce suivi avant la 12^e semaine de gestation. Bien que le Kenya ait adopté ce modèle en 2022, seules 29 % des femmes entament leur suivi prénatal précocement, contre 37,5 % en Afrique subsaharienne. Cette étude transversale visait à déterminer la proportion de femmes ayant commencé leur suivi prénatal tôt ainsi que les facteurs associés à cette démarche précoce. Elle s'est appuyée sur le modèle d'utilisation des services de santé d'Andersen-Newman comme cadre conceptuel. Un échantillon de 292 femmes a été constitué par tirage au sort systématique au sein de l'hôpital universitaire de référence Jaramogi Oginga Odinga, à Kisumu (Kenya). Les données ont été recueillies au moyen de questionnaires et des carnets de santé maternelle et infantile du Kenya. Les analyses ont porté sur des statistiques descriptives, le test U de Mann-Whitney, le test du chi carré et la régression logistique multivariée. Le délai médian avant l'inscription au suivi prénatal était de 20,0 semaines (intervalle interquartile : 16,0–24,0), et seules 34,2 % des femmes ont commencé ce suivi précocement. Le facteur prédictif le plus significatif d'une inscription précoce était la réception d'informations de la part des prestataires de soins (rapport de cotes ajusté [RCA] = 1,96 ; IC à 95 % : 1,06–3,71 ; p = 0,036). L'étude préconise d'améliorer la communication des prestataires de soins afin de prendre en compte les influences sociales émanant de la famille et de l'entourage, et d'encourager ainsi une inscription précoce au suivi prénatal. (*Afr J Reprod Health* 2026; 30 [19]:28-40).

Mots-clés: Soins prénatals ; Éducation pour la santé ; Kenya ; Grossesse ; Afrique subsaharienne ; Organisation mondiale de la Santé

Introduction

Antenatal care (ANC) is recognized globally as a fundamental component of ensuring the health and safety of both the mother and the fetus.¹ In 2016, the

World Health Organization (WHO) revised its antenatal guidelines to propose a new model in which the initial appointment occurs before the twelfth week of pregnancy.¹ This model includes scheduling the first appointment before the end of

the twelfth week.¹ This change marks a significant departure from the sixteen-week standard set by the Focused Antenatal Care (FANC) model, which has been in use since 2002.¹ To make antenatal clinic appointments more meaningful and woman-centered, the WHO replaced the term “antenatal care visit” with “antenatal care contact”.¹

Booking ANC early is crucial for several reasons.¹ It helps accurately determine gestational age through obstetric ultrasound and enables the timely start of essential screening and diagnostic tests. It also ensures accurate categorization of pregnancy risk, enabling timely delivery of supplements and preventive care.^{1,2} Ultimately, this leads to improved pregnancy experiences and the best possible outcomes for both mother and baby.^{1,3}

Despite the updated recommendation, nearly all countries in Sub-Saharan Africa (SSA) still face delays in ANC booking.⁴ Only 37.5% of women start ANC in their first trimester, while just under 8.2% delay until the third trimester.⁴ The average time to the first ANC varies across countries, with the Democratic Republic of Congo and Ghana both at 5.4 months, Congo at 5.3 months, Malawi at 5.3 months, Lesotho at 5 months, and Gambia at 5 months.⁴ However, in Gabon (3.9 months), Senegal (4.2 months), Niger (4.3 months), and Nigeria (4.3 months), ANC initiation occurs somewhat earlier.⁴ Although Kenya adopted the new ANC model in 2022, recent Demographic and Health Survey data indicate that only 29% of women start ANC on time.⁵ This persistent pattern of late ANC booking in SSA often results in reduced ANC health standards.^{1,4,6} This is because key interventions such as screening, diet counseling, and vaccinations are most effective when provided during the first 12 weeks of pregnancy.^{1,2} Initiating ANC early facilitates prompt assessment of pregnancy risks using tools such as the Modified Coupland's Scoring System.⁷ This enables healthcare providers to classify pregnancies by risk level, thereby delivering individualized, specialized antenatal care.⁷

A systematic review of African countries identified key factors that delay antenatal care booking.⁶ These include rural residence, maternal age under 25, limited education, first pregnancies, unplanned pregnancies, and maternal employment. These factors are typically grouped into

predisposing, enabling, and need factors.^{8–11} Other studies across Ethiopia, Nigeria, Ghana, and Southern African nations also identify long distances to antenatal clinics and the absence of partner support as contributors to delayed initiation of antenatal care.^{8,12–14} Late ANC booking is common among vulnerable groups, especially adolescent women, with rates of 19.4% in Nigeria and 47% in Uganda.^{15,16} Factors such as the adolescent woman's age, her partner's age, whether she has ever given birth, her decision-making power over antenatal care attendance, and daily income are frequently associated with delayed antenatal care.^{15,16} Additionally, in Tanzania, fear of being denied ANC services because they lack a partner to accompany them to the antenatal clinic leads to late booking among young women.¹⁷

Late ANC booking remains a widespread and ongoing issue, as demographic and health survey data across SSA show an overall pooled prevalence of about 37.5% for first-trimester ANC contact.^{4,6} To address this, research is needed to identify the primary causes. However, demographic health surveys of the general population often miss important details about hospital-based factors, such as service quality and patient experience, especially in busy urban clinical environments. For example, patients at a tertiary hospital may face long queues or encounter fewer friendly staff. Identifying these facility-specific issues can greatly enhance early ANC booking. Ultimately, these localized findings enable us to create interventions that broader health data alone cannot offer.

Objectives

This study investigated how often women at Jaramogi Oginga Odinga Teaching and Referral Hospital in Kisumu, Kenya, booked early antenatal care and identified the factors influencing this early booking.

Conceptual framework and variables

Andersen and Newman's health services utilization model guided the conceptual framework for this study (Figure 1).^{9–11} This framework categorized factors associated with early ANC booking into three groups, which served as the study's explanatory variables. These groups included predisposing

factors such as maternal age, marital status, parity, education, and religion. Enabling factors that represent logistical and resource barriers to ANC included occupation, residence, partner education, decision-maker for ANC attendance, time to reach the antenatal clinic, waiting time, source of ANC information, and health insurance coverage. Lastly, the need factor objectively reflected the clinical indication for the first antenatal care appointment, which, for this study, was the pregnancy risk category. The three categories of factors were predictive of the outcome variable, the pregnancy duration in weeks at the time of the first ANC appointment.

Methods

Study design and setting

A hospital-based cross-sectional study was conducted at Jaramogi Oginga Odinga Teaching and Referral Hospital in Kisumu, Kenya. This facility was selected because it is a referral hospital, making it an ideal setting for analyzing ANC booking patterns among women and their associated factors.

Study population

The target group for this study included postpartum women hospitalized during the study period. We focused on the postpartum ward because most women who attend ANC clinics also deliver in the hospital's maternity department.

Selection criteria

Women aged 15 to 49 years in the postpartum period who could communicate in Kiswahili or English and provided consent were included. Additionally, a woman was included if she had a Kenya Mother and Child Health Handbook to verify her last normal menstrual period and to estimate gestational age at the first ANC appointment. The study excluded clinically unstable women.

Sample size

The sample size was calculated using the single-population proportion formula.¹⁸ The 20% prevalence of early ANC booking was estimated

from a previous study.¹⁹ To account for anticipated nonresponse and refusals to participate, the study used a 10% attrition rate, resulting in a final sample of 292.

Sampling method

The study used systematic random sampling. The sampling interval was calculated by dividing the estimated total eligible population of 1486, based on admission records from the previous three months in the postpartum ward, by the required sample size of 292, resulting in an interval of 5. To maintain randomness, the starting point, which was the 3rd participant, was selected using a random number generator. From there, every 5th eligible mother was recruited from the daily admission list until the required sample size of 292 was achieved.

Participant flow

A total of 1764 women were approached between April 2025 and July 2025. Systematic random sampling was used throughout the study. The selected women were screened for final inclusion. However, 213 women declined to participate, and 91 were excluded because they were unwell or did not have the Kenya Mother and Child Health Handbook. The required sample size of 292 women was achieved among eligible participants who consented.

Data collection tools and measurement

The questionnaire was divided into three sections: predisposing, enabling, and need factors. It was then pilot-tested to improve the quality of data collection. Finally, the questionnaire was administered to collect data. Additionally, the Kenya Mother and Child Health Handbook was reviewed to confirm the dates of the woman's first ANC appointment and her last normal menstrual period, which helped estimate gestational age.

For the dependent outcome, a binary variable was used. Based on the 2016 WHO updated antenatal guidelines, "early ANC booking" was coded as 1, indicating that the mother started ANC at 12 completed weeks of pregnancy or earlier.¹ "Late ANC booking" was coded as 0, indicating that ANC started after 12 completed weeks.¹ The risk category of each pregnancy was assessed using the

modified Coopland's scoring system, which allowed evaluation of a mother's antenatal risk status and added an important clinical dimension to the analysis of the study's findings.⁷

Measures to reduce bias in the study

To minimize information bias, a woman's recall of her last normal menstrual period (LNMP) and the date of her first ANC appointment were not used alone. Instead, these dates were confirmed using records in the Kenya Mother and Child Health Handbook. When cross-checked with clinical records in the MCH handbook, LNMP-based dating closely matches ultrasound dating, with a difference of 0.2 to 2.8 days. This provides an appropriate estimate of gestational age when a first-trimester ultrasound is unavailable.²⁰

Second, selection bias was reduced through systematic random sampling. Finally, a logistic regression model accounted for confounding factors.

Data management

All data was collected electronically using the Open Data Kit application. Thereafter, it was transferred to the OnaData online database for storage and management.

Statistical analysis

Both descriptive and inferential statistics were used. Gestational age at the first ANC appointment was reported using the median, range, and interquartile range. To examine bivariate associations, a chi-square test was conducted. Subsequently, a multivariable logistic regression analysis was performed to identify the most important explanatory variable. This regression model proved appropriate for the study, as confirmed by a likelihood ratio test indicating that the independent variables significantly improved the model's performance ($P < 0.001$). Additionally, the regression model for the collected data showed a good fit ($P = 0.41$). The acceptable discriminatory power ($P = 0.76$) also supported this.

Compliance with ethics and approval

During the study, the Declaration of Helsinki was followed.²¹ All participants provided informed

consent. In Kenya, an adolescent woman who has delivered can give consent to participate in a study.²²

Privacy was maintained, identities were safeguarded, and personal data was not disclosed for all participants throughout the study. Initial approval for the study was received from the School of Graduate Studies at Maseno University in Kisumu, Kenya. Later, the study obtained ethical clearance from the hospital's Institutional Scientific and Ethical Review Committee. Finally, the Kenya National Commission for Science, Technology, and Innovation authorized the study, and the reference permit number was NACOSTI/P/25/417736.

Results

A total of 292 postpartum women were enrolled in the study, and a complete response rate was achieved. The Andersen and Newman's health services utilization model guided the presentation of this study's descriptive and inferential findings.

Descriptive findings

Predisposing factors

The study population was predominantly adult women (75.0%, $n = 219$) aged 20–49 years, with adolescents (15–19 years) accounting for 25.0% ($n = 73$). Social stability was high, with 64.7% ($n = 189$) of participants married. Educational attainment varied among the women. While 32.2% ($n = 94$) had completed secondary school, 14.4% ($n = 42$) had finished primary education, 44.5% ($n = 130$) had achieved post-secondary qualifications, and only 8.9% ($n = 26$) had no formal schooling. The majority of the women in the study identified as Christians (97.9%, $n = 286$) (Table 1).

Enabling factors

Enabling factors presented notable challenges, with unemployment affecting 94.2% ($n = 275$) of the women. Despite these economic barriers, 83.6% ($n = 244$) of the women had government health insurance coverage. A significant finding in ANC health communication was that only 36.3% ($n = 106$) of women received guidance on ANC attendance from a trained healthcare provider. In contrast, 63.7% ($n = 186$) relied on informal sources, including

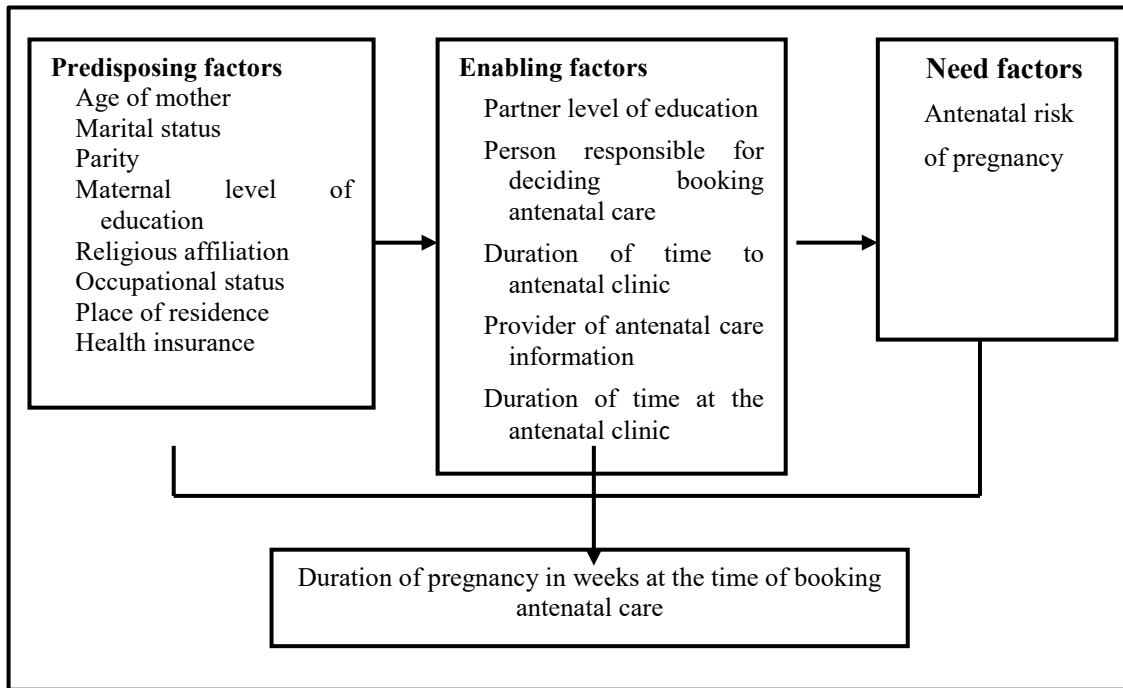


Figure 1: Conceptual framework based on the Andersen and Newman Behavioral Model.

the media, peer discussions, or family advice. Waiting times affected access to antenatal clinics, with 52.4% (n=153) of women experiencing 2–3-hour delays at their appointments. In contrast, 43.8% (n=128) were attended to within the first hour (Table 1).

Need factors

According to Andersen and Newman's health services utilization model, perceived and evaluated health needs were assessed using the modified Copland's scoring system. This clinical assessment categorized 29.8% (n=87) of women as high risk, another 40.7% (n=119) as moderate risk, and 29.5% (n=86) as low risk. These categories are important because they indicate the clinical thresholds that, in theory, should encourage early antenatal care-seeking behavior (see Table 1).

Gestational age at first ANC contact

The analysis of gestational age at initial ANC contact showed a suboptimal start, with a median of 20.0 weeks (IQR: 16.0–24.0). Consequently, only 34.2% (n=100) initiated ANC early (≤ 12 weeks), whereas 65.8% (n=192) initiated ANC in the late second or third trimester (Table 2).

Inferential findings

Bivariate analysis

Chi-square tests identified several variables significantly associated with the timing of ANC initiation ($p < 0.05$). Women living in rural areas were more likely to start care later than those in urban areas ($p = 0.049$). Parity was also important, as women with higher parity (≥ 5) tended to initiate ANC even later ($p = 0.008$). Women reporting shorter waiting times (0–1 hour) and those who received information from healthcare providers were significantly more likely to book ANC earlier ($p = 0.003$ for both) (Table 3).

Multivariable logistic regression

Even after adjusting for potential confounders in the multivariable logistic regression, information sources remained statistically significant. Women who obtained ANC information directly from a healthcare provider were 1.96 times more likely to book early than those who relied on other informal sources (AOR=1.96; 95% CI: 1.06–3.71, $p = 0.036$). Although variables such as parity and pregnancy risk category showed notable odds ratios, they did not

Table 1: Predisposing, enabling, and risk factors of women at Jaramogi Oginga Odinga Teaching and Referral Hospital, Kisumu, Kenya

Explanatory variable	Group	n	%
Maternal age	Adult women	219	75.0
	Adolescent women	73	25.0
Marital status	Married	189	64.7
	Single/Others	103	35.3
Parity	1-2	187	64.0
	3-4	82	28.1
	≥5	23	7.9
Maternal educational level	Secondary school	94	32.2
	Primary school	42	14.4
	Post-secondary	130	44.5
	No formal education	26	8.9
Religion	Christian	286	97.9
	Muslim	6	2.1
Occupation	Unemployed	275	94.2
	Employed	17	5.8
Residence	Rural	167	57.2
	Urban	125	42.8
Partner educational level	Post-secondary	129	68.6
	Primary	33	17.6
	Secondary	26	13.8
Decision maker for ANC	Others	76	26.1
	Self	140	47.8
	Partner	76	26.1
Waiting time at the clinic	2-3 hours	153	52.4
	0-1 hours	128	43.8
	≥ 4 hours	11	3.8
ANC information source	Others	186	63.7
	Healthcare provider	106	36.3
Healthcare insurance cover	Government insurance	244	83.6
	None	39	13.3
	Private insurance	9	3.1
Risk level of pregnancy	Low risk	86	29.5
	Moderate risk	119	40.7
	High risk	87	29.8

Note: ANC = antenatal care; n = number; % = percentage; Total N = 292

Table 2: Measures of central tendency and gestational age at the first ANC contact (early ≤ 12 weeks, late >12 weeks) of women at Jaramogi Oginga Odinga Teaching and Referral Hospital, Kisumu, Kenya

Variable	Value	Frequency (n)	Percentage (%)
Median	20.0 weeks	-	-
Range	4.0-38.0	-	-
Interquartile range	8.0 (16.0-24.0)	-	-
Early ≤12 weeks	-	100	34.2
Late >12 weeks	-	192	65.8
Total	-	292	100

Note: n = number; % = percentage

Table 3: Chi-square test for factors associated with gestational age at first ANC contact of women at Jaramogi Oginga Odinga Teaching and Referral Hospital, Kisumu, Kenya

Independent variable	Group	Total (n)	Early (n)	Early (%)	Late (n)	Late (%)	χ^2 Value	P-Value
Age group	Adolescent women (15-19)	73	19	26.0	54	74.0	0.53	0.466
	Adult women (20-49)	219	81	37.0	138	63.0		
Marital status	Married	189	68	36.0	121	64.0	10.6	0.005
	Single/Others	103	32	31.1	71	68.9		
Parity group	1-2	187	55	29.4	132	70.6	9.79	0.008
	3-4	82	27	32.9	55	67.1		
	≥5	23	18	78.3	5	21.7		
Maternal education	Post-secondary	130	41	31.5	89	68.5	8.92	0.012
	Secondary school	94	30	31.9	64	68.1		
	Primary school	42	20	47.6	22	52.4		
	No formal education	26	9	34.6	17	65.4		
Religion	Christian	286	98	34.3	188	65.7	0.23	0.630
	Muslim	6	2	33.3	4	66.7		
Occupation	Employed	17	5	29.4	12	70.6	0.35	0.552
	Unemployed	275	95	34.5	180	65.5		
Residence	Rural	167	64	38.3	103	61.7	3.88	0.049
	Urban	125	36	28.8	89	71.2		
Partner education	Post-secondary	129	44	34.1	85	65.9	1.45	0.695
Decision maker	Primary school	33	12	36.4	21	63.6	1.89	0.388
	Secondary school	26	8	30.8	18	69.2		
	Others	76	51	67.1	25	32.9		
	Partner	76	6	7.9	70	92.1		
Wait time	Self	140	43	30.7	97	69.3	8.29	0.003
	0-1 hours	128	44	34.4	84	65.6		
	2-3 hours	153	54	35.3	99	64.7		
Source of ANC information	≥4 hours	11	2	18.2	9	81.8	8.82	0.003
	Healthcare provider	106	31	29.2	75	70.8		
	Others	186	69	37.1	117	62.9		
Insurance	Government insurance	244	80	32.8	164	67.2	1.77	0.412
	None	39	18	46.2	21	53.8		
Risk score category	Private insurance	9	2	22.2	7	77.8	7.29	0.026
	High risk	87	25	28.7	62	71.3		
	Low risk	86	49	57.0	37	43.0		
	Moderate risk	119	26	21.8	93	78.2		

Note: ANC = antenatal care; Early (n) = number of those who initiated antenatal care early ≤ 12 weeks; Early (%) = percentage of those who initiated antenatal care early; Late (n) = number of those who initiated antenatal care late > 12 weeks; Late (%) = percentage of those who initiated antenatal care late

Table 4: Multivariable logistic regression for factors influencing early booking (≤ 12 weeks) of women at Jaramogi Oginga Odinga Teaching and Referral Hospital, Kisumu, Kenya

Explanatory factor	Group	AOR (95% CI)	P-Value
Age of mother	Adult women	Ref	
	Adolescent women	0.97 (0.72–1.37)	0.141
Marital status	Married	Ref	
	Single/Others	0.86 (0.45–1.66)	0.651
Parity	1–2	Ref	
	3–4	1.06 (0.70–1.62)	0.777
	≥ 5	1.85 (0.62–5.54)	0.272
Maternal educational level	Post-secondary	Ref	
	Primary school	0.79 (0.40–1.59)	0.511
	Secondary school	0.92 (0.49–1.75)	0.810
Occupation	Unemployed	Ref	
	Employed	0.80 (0.60–1.07)	0.722
Residence	Rural	Ref	
	Urban	1.11 (0.58–2.10)	0.749
Partner educational level	Post-secondary	Ref	
	No formal education	1.16 (0.68–1.99)	0.584
	Primary school	1.24 (0.53–2.95)	0.619
	Secondary school	1.63 (0.65–4.11)	0.302
Decision maker for ANC attendance	Self	Ref	
	Partner	0.63 (0.19–2.24)	0.466
	Others	1.16 (0.65–2.06)	0.615
Distance to a healthcare facility	No problem	Ref	
	Big problem	1.52 (0.86–2.69)	0.142
Waiting time at the clinic in hours	0–1	Ref	
	2–3	0.71 (0.40–1.27)	0.246
	≥ 4	0.90 (0.26–3.12)	0.860
Source of ANC information	Others	Ref	
	Media	1.40 (0.36–4.98)	0.611
	Healthcare provider	1.96 (1.06–3.71)	0.036
Healthcare insurance cover	Health insurance	Ref	
	Private insurance	1.19 (0.85–1.67)	0.836
	Others	1.32 (0.63–2.77)	0.456
Pregnancy risk	Low	Ref	
	Moderate	1.04 (0.53–2.02)	0.912
	High	1.71 (0.88–3.33)	0.107

Note: ANC = antenatal care; AOR = adjusted odds ratio; CI = confidence interval; Ref = reference

reach statistical significance after adjustment, suggesting that information is a primary independent factor in early ANC health-seeking behavior in this setting (Table 4).

Discussion

This study offers a hospital-focused perspective, making a valuable contribution to research on early ANC booking in Kenya and SSA. Importantly, it found no significant associations between common predisposing factors, such as maternal education and

age, and enabling factors, such as household income and residence, and early ANC booking at Jaramogi Oginga Odinga Teaching and Referral Hospital in Kisumu, Kenya. This contrasts with systematic reviews and demographic health survey data from various African countries, which consistently identify these factors as key determinants of early ANC booking across Sub-Saharan Africa.^{4,5,13}

The study highlights a significant finding regarding late ANC booking. The majority of women (65.8%, 192 out of 292) initiated their first ANC contact after the WHO-recommended 12

weeks of gestation. The median time to the first ANC contact was 20.0 weeks, with an interquartile range of 16.0 to 24.0 weeks.

In the multivariable logistic regression, the source of ANC information was the primary determinant of early ANC booking. Specifically, women who received antenatal education from healthcare providers were nearly twice as likely to book early as those who relied on informal sources such as family and friends (AOR=1.96; 95% CI: 1.06–3.71; $P=0.036$) (Table 4). This significant finding indicates that informational barriers are more influential than traditional predisposing or enabling factors in this population. While the multivariable analysis ultimately identified ANC information as the primary determinant of early ANC booking, the initial bivariate analysis identified several other important factors. These factors included maternal education, residence, pregnancy risk score category, marital status, and parity. These factors should be discussed, as they are likely to have influenced the decision to book early.

The initial significance of maternal education ($p=0.012$) and residence ($p=0.049$) (Table 3) suggests that these socio-demographic factors influence decision-making, consistent with surveys such as the Kenya Demographic and Health Survey.⁵ However, their lack of significance in the final multivariable model indicates that information from antenatal healthcare providers is the dominant factor, outweighing the predictive power of education and residence. This emphasizes that higher levels of education or urban residence do not, in themselves, ensure early booking unless pregnant women receive accurate, authoritative health guidance about ANC attendance.

The notable association between pregnancy risk category and booking time ($p=0.026$) (Table 3) indicates that perceived medical necessity encourages early first antenatal care contact. However, because this significance disappears in the final multivariate model, it shows that being high-risk alone doesn't ensure early booking without specific health interventions.⁸ This aligns with findings from Ethiopia, where, despite the high perceived importance of ANC and awareness of its complications, only 32.6% of women initiated ANC before the 12th week of pregnancy.⁸

The significance of marital status ($p=0.005$) and parity group ($p=0.008$) in the bivariate analysis aligns with findings from countries such as Tanzania, where pregnant women with two or three prior pregnancies are 15% less likely to initiate ANC early than first-time mothers.¹⁹ Additionally, being single is associated with a higher likelihood of late booking.¹⁹ A Nigerian study finds that earlier initiation of ANC correlates with employment, health insurance, and financial inclusion.²³ Higher partner education and perceiving the distance to the health facility as manageable also notably reduce delays.²³ Nonetheless, the key factor remains an informational intervention from an antenatal healthcare provider. The Malawi study supports this, showing that women trust midwives most for antenatal education.²⁴ Another study in Malawi further indicates that the professional information on ANC received by women is important because most of them perceive that early pregnancy is only for those who are ill.²⁵ These beliefs, along with barriers such as long distances and negative provider attitudes, further contribute to delays in starting ANC.^{24,25}

An analysis of antenatal booking patterns at this national teaching and referral hospital in Western Kenya shows that 65.8% of women delay their first ANC contact, indicating a high prevalence of late initiation of antenatal care. The median booking time was 20.0 weeks (IQR: 16.0–24.0). These results exceed WHO guidelines, which recommend ANC booking before 12 completed weeks of pregnancy.¹ This finding aligns with another study conducted at a different Kenyan tertiary hospital, which documented that 65% of women booked late.²⁶ This pattern of late ANC booking narrows the optimal window for important interventions and compromises the quality of care for women attending antenatal clinics.¹ These findings highlight a significant challenge in achieving national antenatal goals, even after Kenya adopted the revised WHO guidelines in 2022.⁵ This issue reflects widespread problems across the continent, with a recent analysis and systematic review showing an early booking rate of only 37.5% across Africa.^{4,6}

In our regression model, early ANC booking was not associated with the typical predisposing or

enabling factors. Commonly cited barriers, such as maternal education, residence, insurance coverage, and perceived distance to the facility, were not independently significant. This contrasts with the prevalent narrative in SSA literature on early ANC booking, which emphasizes predisposing and enabling factors as the primary issues.^{6,13} Recent findings from Ghana, a multicountry study in Southern African nations, and research from Kenya and Ethiopia highlight low education levels, socioeconomic challenges, and lengthy travel times as key barriers.^{12,14,26,27}

Our findings suggest that this urban group has mostly moved past the primary predisposing and enabling factors that affect antenatal care-seeking in low-resource or rural contexts. In contrast, a study conducted in an urban area of South Africa identified healthcare workers' behaviour, negative attitudes, operational management issues, and participants' socio-economic status as key factors affecting ANC booking.²⁸ The widespread health insurance coverage and centralized access through the tertiary health facility suggest that these elements have addressed the main predisposing and enabling factors. Consequently, the primary obstacle has shifted from resource availability to behavioral aspects, particularly the source of information about early ANC. This study revealed a notable information gap, in contrast to the usual focus on predisposing and enabling factors associated with early ANC booking. Notably, 66.4% of women relied on informal sources such as family, friends, and the media, with this reliance often influenced by cultural perceptions. For example, a study in Malawi found that many pregnant women thought first-trimester contacts were only needed if they experienced illnesses like headaches or HIV.²⁵ In contrast, others believed a pregnancy was "too small" in the early stages to need antenatal care.²⁵ This emphasizes the crucial role of the source of ANC information, which was the only significant factor explaining behavior in this urban Kenyan context.

Women who received information from a healthcare provider were nearly twice as likely to book early for antenatal care (AOR = 1.96; 95% CI: 1.06–3.71; P = 0.036) (Table 4). This strongly indicates that the main barrier to early booking is a

lack of authoritative, formal health communication, consistent with a study in Malawi that shows official antenatal attendance information, education, and communication encourage timely and optimal ANC attendance.²⁴ A study in Ethiopia indicates that awareness of the best time to schedule ANC contributes to early booking.²⁹ Well-informed women are more likely to start antenatal care within the recommended period than those who lack information.²⁹ This effect may be due to improved access to such information, which increases a woman's understanding and awareness of the advantages of timely booking. This finding aligns with research from several SSA countries, including Nigeria, Uganda, Somalia, and Ghana.^{15,16,30,31} It shows that relying on informal social networks often leads to incorrect information about when to schedule the first ANC contact. This dependence tends to support existing cultural norms that promote late booking for antenatal care, as illustrated in a South African study. The study in South Africa shows that, despite receiving health education, pregnant women often arrive late for antenatal booking because they rely on information from spiritual leaders.³² In Cameroon, similar norms exist, where early ANC is considered less important because pregnancy is viewed as a normal health condition or not a serious issue needing urgent medical care.³³

The study's findings align with research from countries such as Malawi and Cameroon, showing that effective ANC education and communication strategies promote early booking.^{24,33,34} An Indian study found that women participating in a culturally grounded, healthcare-professional-led multimedia ANC campaign were much more likely to book early ANC.³⁵ In Bangladesh, women often cite the lack of information about when to start ANC as a reason for delaying their bookings. Women are more receptive to receiving personalized messages from healthcare providers that motivate early ANC registration.¹⁸ This approach's effectiveness stems from its capacity to inform women about the crucial advantages of early booking, thereby empowering them to prioritize their initial ANC contact.²⁹ Such findings emphasize the importance of a formal, authoritative communication strategy from healthcare

professionals to address behavioral and social barriers to early ANC booking, as seen in Nigeria and Malawi.^{23,24}

Strengths and limitations

The Andersen-Newman Behavioural Model of Health Services Utilization served as the guiding conceptual framework for this study. It was crucial in categorizing, analyzing, and organizing the factors associated with early antenatal care booking. The study's relevance is heightened by its examination of early ANC booking compared with the latest WHO ANC guidelines. This alignment offers up-to-date evidence consistent with current WHO recommendations.

However, the study also faced certain limitations. The hospital's urban setting probably caused selection bias, meaning the women involved might have had higher socioeconomic status and easier access to antenatal care services. This possible bias might explain why certain key enabling factors, such as proximity to the facility or insurance coverage, did not show significance in the study's results. As a result, this limits the external validity of the findings, especially regarding primary or rural health clinics.

Another limitation concerns how the outcome factor was measured. To minimize recall bias, the Kenya Mother and Child Health Handbook was used to determine gestational age at the initial ANC contact. However, this relied on the mother's last normal menstrual period. Using only this method, without confirming it with a first-trimester pregnancy ultrasound, which most women did not have, introduces potential measurement errors in estimating gestational age at the first antenatal care contact. Such inaccuracies could have affected the precision of the study's 12-week gestation cutoff for early antenatal care booking.

Implication for policy and practice

This study highlights the urgent need for context-specific strategies and policies to improve the communication of information about antenatal attendance to women. It found that in urban areas like this, improvements in infrastructure and maternal health policies have effectively addressed many of the predisposing and enabling factors that

promote early ANC booking. Public health policy should go beyond merely increasing the number of antenatal clinics. Instead, it should prioritize enhancing communication and education to encourage women to book early, as demonstrated by studies in Nigeria and Malawi.

The discovery that ANC information from healthcare providers is strongly associated with early ANC booking (AOR=1.96; P=0.036) emphasizes the important role of healthcare professionals in providing both information and encouragement for timely ANC. This points to the need to enhance the immediacy and quality of health messages delivered by healthcare workers during the initial weeks of pregnancy.

Unanswered questions and future research

Qualitative research is essential for understanding how the source and quality of ANC information affect a mother's decision to book early ANC. Additionally, comparative studies across primary, secondary, and tertiary care levels are needed to confirm our finding that informational barriers are more significant than structural barriers.

Conclusion

Late ANC booking contributes to a major public health crisis among women attending Jaramogi Oginga Odinga Teaching and Referral Hospital in Kisumu, Kenya. 34.2% of women booked early for antenatal care, with a median gestational age of 20.0 weeks (IQR: 16-24). This study emphasizes that the source of ANC information is an important explanatory factor for early initiation of antenatal care. Health education provided by a healthcare professional increases the likelihood of starting ANC early compared to informal sources such as friends and family.

This evidence reveals a significant change in the urban environment, in which traditional predisposing and enabling factors are less impactful for early ANC. The primary obstacle to early booking has shifted from these factors to the source of ANC information. Public health strategies and hospital interventions should prioritize enhancing the clarity and effectiveness of healthcare professionals' communication regarding early antenatal attendance. This approach will

address the persistent influence of social networks such as friends and family, and provide women with the information needed to ensure timely initiation.

Authors' contribution

RNK: Conceptualization, methodology, data collection, formal analysis, initial manuscript writing, and editing. JO: Conceptualization, supervision, and review. PNM: Conceptualization, supervision, and review. We confirm that all listed authors have reviewed and approved the final version of this manuscript for submission and publication.

Conflicts of interest

The corresponding author's thesis for the Master of Medicine in Obstetrics and Gynaecology forms the basis of this manuscript.

Acknowledgements

We thank Dr. Gwer S.O., Dr. Muruka K., Dr. Wameyo A., Dr. Ayumba A., Dr. Katumba J., and Dr. Ayieko J. from the Department of Obstetrics and Gynecology at Maseno University in Kisumu, Kenya, for assisting the corresponding author in completing his postgraduate dissertation, which served as the basis for this manuscript. We sincerely thank the School of Graduate Studies at Maseno University and the Jaramogi Oginga Odinga Teaching and Referral Hospital, both in Kisumu, Kenya, for allowing us to conduct this study. Finally, we appreciate the women who participated in this study.

Data availability

Data can be obtained from the corresponding author upon request

References

- World Health Organization. WHO recommendations on antenatal care for a positive pregnancy experience. 2016.
- World Health Organization. Introduction Standards for Maternal and Neonatal Care What are the Standards for Maternal and Neonatal Care? Why implement the Standards for Maternal and Neonatal Care? How are the Standards for Maternal and Neonatal Care structured? [Internet]. 2007. Available from: <http://whqlibdoc.who.int/hq/2003/>
- World Health Organization. Trends in maternal mortality estimates 2000 to 2023. 2025.
- Dansou J, Dake FAA, Ntoimo LFC. Variations in initiation of first antenatal care among women of reproductive age in sub-Saharan Africa: an event history analysis approach. *Reproductive Health*. 2025 Dec 1;22(1). doi:10.1186/s12978-025-02140-9 PubMed PMID: 41121377.
- Kenya demographic and health survey, 2022. Kenya National Bureau of Statistics ; ICF; 2023.
- Abdo R, Demelash M, Seid AM, Mussema A. First trimester antenatal care contact in Africa: a systematic review and meta-analysis of prevalence and contributing factors. *BMC Pregnancy Childbirth*. 2023 Dec 1;23(1). doi:10.1186/s12884-023-06034-1 PubMed PMID: 37858033.
- Biradar B, Mathew M, Ramesh N. Utilizing Modified Coopland's Scoring System to Identify and Predict the Outcome of High-Risk Pregnancies in Resource-Limited Settings: A Retrospective Review. *Cureus*. 2024 Aug 1. doi:10.7759/cureus.65965
- Tesfaye G, Chojenta C, Smith R, Loxton D. Application of the Andersen-Newman model of health care utilization to understand antenatal care use in Kersa District, Eastern Ethiopia. *PLoS One*. 2018 Dec 1;13(12). doi:10.1371/journal.pone.0208729 PubMed PMID: 30521640.
- Çandereli ZÖ, Mumcu G. Mapping the Evolution of Andersen's Behavioural Model in Healthcare: A Bibliometric Analysis. *International Journal of Health Management and Tourism*. 2025 Jul 25;10(2):265–93. doi:10.31201/ijhmt.1696650
- Andersen RM. National Health Surveys and the Behavioral Model of Health Services Use. *Med Care* [Internet]. 2008;46(7). Available from: https://journals.lww.com/lww-medicalcare/fulltext/2008/07000/national_health_surveys_and_the_behavioral_model.2.aspx
- Andersen R, Newman JF. Societal and individual determinants of medical care utilization in the United States. *Milbank Quarterly*. 2005;83(4). doi:10.1111/j.1468-0009.2005.00428.x
- Gbene J, Takase MA, Ayangba V, Azumah Abanga W, Hamza AS, Alechana JA, et al. Predictors of Late Antenatal Care Initiation: A Multicentre Cross-Sectional Study in Ghana. *SAGE Open Nurs*. 2024 Jan 1;10. doi:10.1177/23779608241299345
- Adewuyi EO, Auta A, Adewuyi MI, Philip AA, Olutase V, Zhao Y, et al. Antenatal care utilisation and receipt of its components in Nigeria: Assessing disparities between rural and urban areas—A nationwide population-based study. *PLoS One*. 2024 Jul 1;19(7). doi:10.1371/journal.pone.0307316 PubMed PMID: 39008484.
- Selebano KM, Ataguba JE. Decomposing socio-economic inequalities in antenatal care utilisation in 12 Southern African Development Community countries. *SSM*

- Popul Health. 2022 Mar 1;17. doi:10.1016/j.ssmph.2021.101004
15. Fagbamigbe AF, Olaseinde O, Fagbamigbe OS. Timing of first antenatal care contact, its associated factors and state-level analysis in Nigeria: a cross-sectional assessment of compliance with the WHO guidelines. *BMJ Open*. 2021 Sep 1;11(9):e047835. doi:10.1136/bmjopen-2020-047835
 16. Kayemba V, Kabagenyi A, Ndugga P, Wasswa R, Waiswa P. Timing and Quality of Antenatal Care Among Adolescent Mothers in a Rural Community, Uganda. *Adolesc Health Med Ther*. 2023 Feb;Volume 14:45–61. doi:10.2147/ahmt.s374296 PubMed PMID: 36817571.
 17. Mgata S, Maluka SO. Factors for late initiation of antenatal care in Dar es Salaam, Tanzania: A qualitative study. *BMC Pregnancy Childbirth*. 2019 Nov 12;19(1). doi:10.1186/s12884-019-2576-0 PubMed PMID: 31718586.
 18. Arifin WN. Introduction to sample size calculation. *Education in Medicine Journal*. 2013 Jun 1;5(2). doi:10.5959/eimj.v5i2.130
 19. Moshi F V. Prevalence and factors which influence early antenatal booking among women of reproductive age in Tanzania: An analysis of data from the 2015-16 Tanzania Demographic Health Survey and Malaria Indicators Survey. *PLoS ONE*. Public Library of Science; 2021. doi:10.1371/journal.pone.0249337 PubMed PMID: 33822797.
 20. Macaulay S, Buchmann EJ, Dunger DB, Norris SA. Reliability and validity of last menstrual period for gestational age estimation in a low-to-middle-income setting. *Journal of Obstetrics and Gynaecology Research*. 2019 Jan 1;45(1):217–25. doi:10.1111/jog.13801 PubMed PMID: 30191629.
 21. Association WM. World Medical Association Declaration of Helsinki: Ethical Principles for Medical Research Involving Human Participants. *JAMA*. 2025 Jan 7;333(1):71–4. doi:10.1001/jama.2024.21972
 22. Guidelines for Conducting Adolescent HIV Sexual and Reproductive Health Research in Kenya. 2015 May.
 23. Solanke BL, Oyediran OO, Opadere AA, Bankole TO, Olupooye OO, Boku UI. What predicts delayed first antenatal care contact among primiparous women? Findings from a cross-sectional study in Nigeria. *BMC Pregnancy Childbirth*. 2022 Dec 1;22(1). doi:10.1186/s12884-022-05079-y PubMed PMID: 36199063.
 24. Lungu GG, Chodzaza E, Kamanga M, Chikazinga W, Jere D. Status of information, education, and communication as perceived by clients receiving antenatal care at Chiradzulu District Hospital in Malawi. *BMC Womens Health*. 2023 Dec 1;23(1). doi:10.1186/s12905-023-02209-2 PubMed PMID: 36759826.
 25. Nyando M, Makombe D, Mboma A, Mwakilama E, Nyirenda L. Perceptions of pregnant women on antenatal care visit during their first trimester at area 25 health center in Lilongwe, Malawi – a qualitative study. *BMC Womens Health*. 2023 Dec 1;23(1). doi:10.1186/s12905-023-02800-7 PubMed PMID: 38049740.
 26. Jemutai F, Impwii DK. Determinants of Early Antenatal Care Booking among Pregnant Women attending Embu Teaching and Referral Hospital, Kenya: A Cross-sectional Survey. *Int J Health Sci Res*. 2024 Jan 19;14(1):275–82. doi:10.52403/ijhsr.20240135
 27. Asmare AA, Tegegne AS, Belay DB. Joint predictors of antenatal care contacts and timing of antenatal care initiation among women of reproductive age in Ethiopia. *PLoS One*. 2025 Nov 1;20(11 November). doi:10.1371/journal.pone.0330873 PubMed PMID: 41202041.
 28. Mlambo SP, Ibeziako OJ. Causes of delayed antenatal care at an urban community health centre in Gauteng, South Africa. *South African Family Practice*. 2024;67. doi:10.4102/safp.v67i1.6093 PubMed PMID: 40336433.
 29. Tesfu AA, Aweke AM, Gela GB, Wudineh KG, Beyene FY. Factors associated with timely initiation of antenatal care among pregnant women in Bahir Dar city, Northwest Ethiopia: Cross-sectional study. *Nurs Open*. 2022 Mar 1;9(2):1210–7. doi:10.1002/nop.2.1162 PubMed PMID: 34951142.
 30. Abuosi AA, Anaba EA, Daniels AA, Baku AAA, Akazili J. Determinants of early antenatal care visits among women of reproductive age in Ghana: evidence from the recent Maternal Health Survey. *BMC Pregnancy Childbirth*. 2024 Dec 1;24(1). doi:10.1186/s12884-024-06490-3 PubMed PMID: 38658859.
 31. Mohamoud AM, Mohamed SM, Hussein AM, Omar MA, Ismail BM, Mohamed RA, et al. Knowledge Attitude and Practice towards Antenatal Care among Pregnant Women Attending for Antenatal Care in SOS Hospital at Hiliwa District, Benadir Region, Somalia. *Health N Hav*. 2022;14(04):377–91. doi:10.4236/health.2022.144030
 32. Maluleke-Ngomane SH, Ramavhoya TI. Perspectives of primary healthcare nurses on cultural practices contributing to late antenatal booking in South Africa. *Health SA Gesondheid*. 2025;30. doi:10.4102/hsag.v30i0.2997
 33. Warri D, George A. Perceptions of pregnant women of reasons for late initiation of antenatal care: A qualitative interview study. *BMC Pregnancy Childbirth*. 2020 Feb 3;20(1). doi:10.1186/s12884-020-2746-0 PubMed PMID: 32013894.
 34. Chimatiro CS, Hajison P, Chipeta E, Muula AS. Understanding barriers preventing pregnant women from starting antenatal clinic in the first trimester of pregnancy in Ntcheu District-Malawi. *Reprod Health*. 2018 Sep 21;15(1). doi:10.1186/s12978-018-0605-5 PubMed PMID: 30241542.
 35. Abraham A, P RK, Alagappan K, Manjula K, Manjunatha M, Sharada T, et al. Impact of a targeted multimedia campaign on maternal health awareness and service utilisation in rural Karnataka, Southern India: An experimental study. *Afr J Reprod Health*. 2025 Dec 1;29(12):192–203. doi:10.29063/ajrh2025/v29i12.1