Original Paper

Prevalence and Factors Associated With Late Initiation of Antenatal Care Among Women Attending the University Clinics of Kamina: Cross-Sectional Study

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Abstract

Background: Early initiation of antenatal care (ANC) is a key strategy for reducing maternal and perinatal morbidity and mortality. It enables timely detection and management of pregnancy-related complications, identification of high-risk pregnancies, and appropriate referral. Despite its proven benefits, late initiation of ANC remains common in low-resource settings.

Objective: This study aimed to determine the prevalence of late initiation of ANC and identify its associated factors among women attending their first ANC visit at the University Clinics of Kamina, Democratic Republic of the Congo.

Methods: We conducted an analytical cross-sectional study from December 1, 2024, to August 30, 2025, at the University Clinics of Kamina. Consecutive sampling of all eligible women attending their first ANC visit during the study period was performed. The study included 203 women who were pregnant. Data were collected through face-to-face interviews using a structured questionnaire administered electronically through KoBoCollect and were complemented by information extracted from ANC cards. Late initiation of ANC was defined as the first antenatal consultation occurring after 16 weeks of amenorrhea, in accordance with national standards. Data were analyzed using IBM SPSS Statistics (version 23). Logistic regression was used to identify factors associated with late initiation. Variables with $P<.20$ in bivariate analysis were included in the multivariable model. Descriptive statistics were used to estimate prevalence and summarize participant characteristics. No a priori sample size or statistical power calculation was undertaken; the sample consisted of all eligible women who attended their first ANC visit during the study period and consented to participate. Supply-side characteristics of ANC services were not comprehensively assessed.

Results: The prevalence of late ANC initiation (after 16 weeks of amenorrhea) was 63.5% (95% CI 56.9%-70.1%). After multivariable adjustment, the following factors were independently associated with late ANC initiation: extreme maternal age (<20 years or >35 years; adjusted odds ratio [aOR] 3.74, 95% CI 1.07-13.06), low partner educational level (aOR 3.16, 95% CI 1.13-8.80), age of the youngest child (≤2 years; aOR 4.47, 95% CI 1.94-10.29), and unintended pregnancy (aOR 2.46, 95% CI 1.05-5.76). The model demonstrated good discriminatory ability, with an area under the receiver operating characteristic curve of 79.4% (95% CI 0.716-0.873).

Conclusions: Late initiation of ANC was highly prevalent among women attending the University Clinics of Kamina and may adversely affect maternal and perinatal outcomes. The observed associations suggest that interventions should prioritize adolescents and older women, strengthen the involvement of male partners, and improve access to family planning and early pregnancy detection strategies. These findings should be interpreted cautiously given the cross-sectional, single-facility design.

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Keywords: antenatal care; late initiation; associated factors; Kamina; DR Congo

Introduction

Background

Preventable pregnancy-related morbidity and mortality remain unacceptably high, particularly in low- and middle-income countries [1]. The most recent United Nations interagency estimates, covering 2000 to 2023, indicate that approximately 260,000 maternal deaths occurred worldwide in 2023, corresponding to a global maternal mortality ratio of 197 maternal deaths per 100,000 live births. Approximately 70% of maternal deaths occurred in sub-Saharan Africa [2]. Similarly, perinatal mortality remains a major public health concern. In 2019, an estimated 2.0 million babies were stillborn at 28 weeks of gestation or later worldwide. The global stillbirth rate was 13.9 per 1000 births. In 2019, the highest stillbirth rates were observed in West and Central Africa (22.8 per 1000 births; CI 19.8-27.7), followed by Eastern and Southern Africa (20.5 per 1000 births; CI 18.7-23.6) and South Asia (18.2 per 1000 births; CI 17.6-22.1). The stillbirth rate in West and Central Africa was nearly 8 times higher than in Western Europe (2.9; 2.7-3.0) and North America (3.0; 2.6-3.4) [3].

Antenatal care (ANC) enables women who are pregnant to receive services provided by qualified health professionals to ensure maternal and fetal health through screening and preventive interventions. ANC reduces maternal and perinatal morbidity and mortality both directly, through early detection and management of pregnancy-related complications, and indirectly, by identifying high-risk pregnancies and ensuring referral to appropriate levels of care [1,4].

To monitor pregnancy, detect problems early, manage complications, and prevent maternal, fetal, and perinatal adverse outcomes, attendance at ANC services is recommended for all pregnant women. These services encompass all interventions provided by organized health services to pregnant women, including risk screening; prevention and management of conditions threatening maternal and child health; and counseling, support, and health education. In 2016, following the adoption of the Sustainable Development Goals (SDGs), the World Health Organization (WHO) introduced a new ANC model aimed at providing respectful, individualized, and person-centered care at every contact, based on effective integrated clinical practices delivered by skilled personnel [5,6].

In the Democratic Republic of the Congo (DRC), maternal mortality remains high and represents a major public health challenge, with the country far from achieving SDG target 3.1 of 70 maternal deaths per 100,000 live births. The most recent WHO and United Nations interagency estimates cover 2000 to 2023 and represent the current internationally comparable estimates of maternal mortality. In the DRC, the estimated maternal mortality ratio was 427 maternal deaths per 100,000 live births in 2023 (uncertainty interval 283-775), illustrating the continuing need to strengthen the continuum of maternal health care [2]. Between 2018 and 2022, 52,429 maternal deaths were recorded in health facilities, corresponding to an average of 29 deaths per day. This situation reflects, among other factors, the low quality of antenatal, obstetric, and postnatal care, as most maternal and perinatal deaths are preventable through quality ANC [7-9].

Globally, between 2007 and 2014, only 64% of women who are pregnant completed the 4 ANC contacts previously recommended by WHO, indicating persistent gaps in both use and quality of care [1]. In many low- and middle-income countries, late initiation of ANC—particularly after 16 weeks of amenorrhea—remains common and has been associated with less timely receipt of recommended pregnancy-related services and interventions [10]. Among biological contributors to adverse pregnancy outcomes, inherited thrombophilias (eg, Factor V Leiden, prothrombin G20210A, MTHFR variants, and platelet antigen or factor XIII polymorphisms) have been linked to recurrent pregnancy loss and other complications and may interact with delayed ANC to worsen maternal-fetal outcomes [11,12]. Recognizing these conditions is important for comprehensive antenatal risk assessment and management.

According to the 2023 to 2024 Demographic and Health Survey (DHS) conducted in the DRC, first ANC visits were often late: half of the women attended after 20 weeks of amenorrhea, only 21% during the first trimester, and 53% between the fourth and sixth months of pregnancy, contrary to the recommended timing of 12 to 16 weeks [5]. In Kamina, studies addressing these issues remain scarce. However, despite the national data, there is little evidence at the facility level in semirural areas such as Kamina. Although existing studies confirm the late start of ANC, none have comprehensively assessed the determinants of late ANC initiation in this specific semirural context.

Research Question

Among women attending their first ANC visit at the University Clinics of Kamina, what proportion initiate ANC after 16 weeks of amenorrhea, and which measured individual and household characteristics are associated with late initiation?

Objectives

This motivated the present study, which aimed to estimate the prevalence of late initiation of ANC and identify its main associated factors.

Methods

Study Design and Setting

This was a facility-based analytical cross-sectional study conducted from December 1, 2024, to August 30, 2025,

at the University Clinics of Kamina, a referral facility for maternal health care in the urban-rural Kamina Health Zone, Haut-Lomami Province, DRC. In an analytical cross-sectional design, exposure characteristics and the outcome are assessed in the same study population over a defined period, allowing estimation of prevalence and examination of statistical associations but not establishment of temporal sequence or causality.

Study Population and Eligibility

The source population comprised women attending the University Clinics of Kamina for their first ANC contact during the study period. Eligibility was assessed before invitation to participate.

Inclusion criteria were (1) being pregnant, and (2) attending the facility for the first ANC visit during the study period. Written informed consent was obtained only after eligibility had been established.

Women who did not meet the eligibility criteria were excluded. Refusal to participate was not considered an eligibility criterion; it was recorded as nonparticipation after an eligible woman had been invited.

The study population consisted of women attending the University Clinics of Kamina for their first ANC visit.

Sample Size

A consecutive sampling approach was used, including all eligible women attending their first ANC visit during the study period who provided informed consent. No a priori sample size calculation or statistical power estimation was undertaken. The final sample of 203 participants therefore represents the eligible women recruited during the predefined study period who consented to participate.

Variables and Operational Definition of Late First ANC Visit

The primary outcome was late initiation of ANC, defined as the first ANC contact occurring after 16 weeks of amenorrhea. This threshold is in line with national guidelines concerning ANC. The explanatory variables included sociodemographic, obstetric, household, and selected perceived access-related characteristics collected using the study questionnaire and ANC cards. ANC cards are paper-based records retained by women and used by health care providers to document pregnancy history, clinical assessments, test results, preventive interventions, and follow-up during ANC.

Recruitment and Data Collection Procedure

Eligible women were identified at the ANC service when they presented for their first ANC contact. After eligibility was assessed, an authorized member of the research team explained the study objectives, procedures, voluntary nature of participation, confidentiality protections, and the right to decline without consequences for care. Written informed consent was then obtained before data collection. Data were collected through face-to-face interviews using a structured questionnaire administered electronically through KoBoCollect. Additional information was extracted from ANC cards. Because the questionnaire was interviewer-administered, participants did not need to complete it independently.

Data Analysis

Collected data were analyzed using SPSS Statistics (version 23; IBM Corp). The analysis included descriptive statistics (means, frequencies, and proportions) and bivariate and multivariate analyses to identify factors associated with late initiation of the first ANC visit. Measures of association were considered statistically significant when the P value was <.05. Variables with P<.20 in the bivariate analysis were included in the multivariate logistic regression, which allowed identification of the factors associated with late initiation of ANC. For conciseness, only univariate and multivariate results are presented in this article.

Ethical Considerations

Administrative authorization to conduct this study was obtained from the management of the University Clinics of Kamina. Participants were informed about the study, their participation was voluntary, and written informed consent was obtained. Confidentiality was ensured through anonymous data collection and restricted data access. Approval from an ethics committee was not obtained due to the absence of such a committee in the province.

Results

Overview

Among the 203 women, 129 (63.5%; CI 56.9%-70.1%) initiated ANC late. The mean gestational age at first contact was 18.5 (SD 5.9) weeks of amenorrhea, with extremes ranging from 4 to 36 weeks of amenorrhea (Table 1).

Table 1. Distribution of women according to the timing of their first antenatal care (ANC) visit (N=203).

Time of first ANC visit	Participants
>16 weeks of amenorrhea, n (%; 95% CI)	129 (63.5; 56.9-70.1)
≤16 weeks of amenorrhea, n (%; 95% CI)	74 (36.5; 29.9-43.1)
Gestational age at first ANC visit (weeks), mean (SD; range)	18.5 (5.9; 4-36)

Most women were aged 20 to 34 years. The median maternal age was 27 (IQR 24-32; range 18-44) years. The majority had no income-generating activity, were married, and had secondary level of education. Most partners had a university education and an income-generating occupation (Table 2).

Table 2. Sociodemographic characteristics of study participants (N=203).

Variables	Participants, n (%; 95% CI)
Maternal age (years)[a]	
<20	4 (2; 0.1-3.9)
20-34	173 (85.2; 80.3-90.1)
>35	26 (12.8; 8.2-17.4)
Maternal income-generating activity	
Yes	81 (39.9; 33.2-46.6)
No	122 (60.1; 53.4-66.8)
Marital status	
Married	199 (98; 96.1-99.9)
Unmarried	4 (2; 0.1-3.9)
Maternal educational level	
No formal or primary education	5 (2.5; 0.3-4.6)
Secondary education	120 (59.1; 52.3-65.9)
University education	78 (38.4; 31.7-45.1)
Partner's educational level (n=199)	
Secondary education	49 (24.6; 18.6-30.6)
University education	150 (75.4; 69.4-81.4)
Partner's income-generating activity (n=199)	
Yes	191 (96; 93.3-98.7)
No	8 (4; 1.3-6.7)

[a]The median maternal age was 27 (IQR 24-32; range 18-44) years.

Among participants (N=203), 32.5% (66/203) were nulliparous, and 36.9% (75/203) were paucigravida (2 to 3 pregnancies). A history of abortion was reported by 28.1% (57/203) of women and stillbirth or intrauterine fetal death by 6.9% (14/203). Overall, 62% (85/137) had a youngest child aged ≤2 years, with a median age of 2 (IQR 1-3) years (Table 3).

A substantial proportion of pregnancies were described as unintended. Most women reported awareness of the importance of early ANC and family support. However, 28.6% (135/203) reported fear or anxiety related to seeking care. No influence of religious or cultural beliefs was reported. Most women lived within 5 km of the facility and did not perceive ANC cost as a barrier (Table 4).

After adjustment, 4 factors remained significantly associated with late initiation of ANC: extreme maternal age (<20 or ≥35 years, P=.04), low partner education, age of the youngest child ≤2 years, and unintended pregnancy. Other variables were not statistically associated (Table 5).

Table 3. Obstetric characteristics of the study participants (N=203).

Variables	Participants, n (%; 95% CI)	Participants, median (IQR)	Participants, range
Parity		1 (0-3)	0-9
0	66 (32.5; 26.1-38.9)		
1	41 (20.2; 14.7-25.7)		
2-3	52 (25.6; 19.6-31.6)		
≥4	44 (21.7; 16.0-27.4)		
Gravidity		3 (1-5)	1-12
1	55 (27.1; 21.0-33.2)		
2-3	75 (36.9; 30.3-43.5)		
≥4	73 (36; 29.4-42.6)		
History of abortion	57 (28.1; 21.9-34.3)	—[a]	—
History of stillbirth	14 (6.9; 3.4-10.4)	—	—
Age of the youngest child (years; n=137)		2 (1-3)	—
>2	52 (38; 29.9-46.1)		
≤2	85 (62; 53.9-70.1)		

[a]Not applicable.

Table 4. Background factors related to antenatal care (ANC) initiation among participants (N=203).

Background factors	Participants, n (%)
Intended pregnancy	124 (61.1)
Knowledge of the importance of early ANC initiation	140 (69)
Participation in awareness-raising sessions on the importance of early ANC initiation	135 (66.5)
Fear or anxiety about attending ANC	58 (28.6)
Influence of religious or cultural beliefs	0 (0)
Family support	158 (77.8)
Perceived high cost of ANC	16 (7.9)

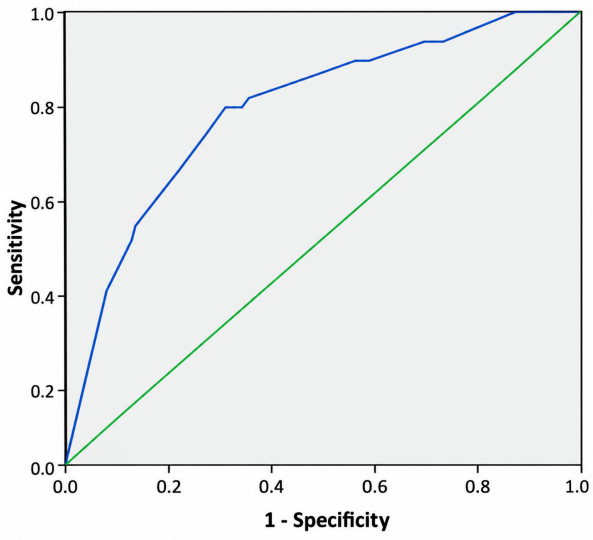
Table 5. Factors associated with delayed initiation of first antenatal care visit in multivariable analysis.

Variables	Adjusted odds ratio (95% CI)	*P* value
Maternal age (years)		.04
20-34	Reference	
<20 or ≥35	3.74 (1.07-13.06)	
Partner's educational level		.03
University	Reference	
Secondary	3.16 (1.13-8.80)	
Age of the youngest child (years)		<.001
>2	Reference	
≤2	4.47 (1.94-10.29)	
Pregnancy planning		.04
Intended	Reference	
Unintended	2.46 (1.05-5.76)	

Predictive Model Performance

The model demonstrated good discriminatory ability, with an area under the receiver operating characteristic curve of 79.4% (95% CI 71.6%-87.3%; Figure 1).

Figure 1. Predictive model performance of late antenatal care at University Clinics of Kamina.



Discussion

Principal Findings

In this facility-based study, 63.5% (123/203) of women attending their first ANC visit initiated care after 16 weeks of amenorrhea. In total, 4 measured characteristics were independently associated with late initiation: maternal age <20 or ≥35 years, lower educational attainment of the partner, a youngest child aged ≤2 years, and unintended pregnancy. The findings are consistent with evidence from several sub-Saharan African settings, but direct comparisons

are limited by differences in study populations, definitions, sampling strategies, and health system contexts. They should therefore be interpreted within the limitations of a single-facility cross-sectional study.

Gestational Age at Initiation of ANC

The prevalence observed in Kamina is similar to estimates reported in several African settings, including Ethiopia, Rwanda, the Gambia and DRC, although differences in definitions, populations and health system contexts limit direct comparison [9,10,13-16]. For example, Teshale et al [13] analyzed the 2019 Ethiopia Performance Monitoring for Action cross-sectional, nationally representative household survey and included 709 women who were pregnant; late booking was identified using survey data and multivariable logistic regression. Nigatu and Birhan [14] conducted a secondary analysis of the 2019 to 2020 Gambian DHS, including 5310 weighted observations and using multilevel logistic regression to account for the clustered survey design. Tadele et al [15] conducted a facility-based cross-sectional study in 4 public hospitals in Jimma Zone, Ethiopia, including 409 participants selected by systematic random sampling and analyzed with logistic regression. These methodological differences are important when comparing prevalence estimates. The 2023 to 2024 DRC DHS also indicates substantial delay in first ANC attendance nationally [5].

Early initiation of ANC allows confirmation of pregnancy, accurate estimation of gestational age, classification of women according to standard or specialized care needs, identification of risk factors, screening and treatment of conditions, provision of preventive interventions, and delivery of appropriate counseling. Conversely, late initiation of ANC prevents pregnant women from achieving the recommended number of visits and from receiving all essential interventions in a timely manner.

Factors Associated with Delayed Initiation of ANC

The association between extreme maternal age and late initiation may reflect different mechanisms in younger and older women. Adolescents may face delayed recognition or disclosure of pregnancy, stigma, limited reproductive health information, or reduced autonomy. Older women may perceive early ANC as less necessary because of previous pregnancy experience or may face competing domestic responsibilities. These explanations are hypotheses rather than causal conclusions because the relevant mechanisms were not directly measured in the present study.

Debelo and Danusa [9] also reported a higher risk among adolescents, while women aged 20 to 24 years had a significantly lower risk, as did those aged 25 to 29 years. In a 2007-2018 study from Guinea, Sidibe et al [17] analyzed trends and factors associated with delayed first ANC attendance using population-level data. Across these studies, the age patterns were not identical, supporting the interpretation that age-related associations may vary with social and health system context. Delayed initiation among adolescents has also been documented in sub-Saharan Africa and South Africa, where studies have used population-based or facility-based cross-sectional designs [18,19]. These findings support further investigation of age-specific barriers without assuming a single mechanism.

The partner's educational level also influenced the timing of ANC initiation. Women whose partners had a secondary level of education were more likely to initiate ANC late compared with those whose partners had a university education. The 2023 to 2024 DRC DHS provides nationally representative evidence on education and maternal health service use [5]. Studies by Yadav and Kalotra [20] in India and Okyere et al [21] in sub-Saharan Africa corroborate this association, attributing it to a better understanding of maternal health needs, improved socioeconomic status, and reduced gender inequalities [22,23]. Educated partners are more likely to support the need for quality health care through a better understanding of maternal health needs, improved communication, and financial capacity. This finding reinforces the importance of male involvement strategies in maternal health programs. Partner education was associated with ANC timing. However, the large difference between university education among partners (150/203, 75.4%) and among women themselves (n=78, 38.4%) warrants a broader gender-sensitive interpretation. Partner education may facilitate health information and support, but educational asymmetry can also coexist with unequal decision-making power, financial dependence, or constraints on reproductive autonomy. The study did not measure these dimensions and therefore cannot determine which mechanisms explain the observed association. Unintended pregnancy was also a significant determinant of delayed ANC initiation. This finding is consistent with reports by Teshale et al [13], Nigatu and Birhan [14], and Tadele et al [15]. These authors emphasize the role of lack of preparation, reluctance to disclose pregnancy, and fear of social judgment in delaying ANC initiation, reasons that can also justify our results. This finding should not be interpreted as assigning responsibility for delayed care to women. Pregnancy intention is shaped by contraceptive access, contraceptive failure, partner preferences, fertility intentions, social circumstances, and reproductive autonomy. The present study did not assess coercive control, forced sex, contraceptive decision-making, or the circumstances in which pregnancy occurred. Consequently, the association should be interpreted as a marker of pregnancy circumstances rather than as evidence that women with unintended pregnancies are individually responsible for delayed care.

Women whose youngest child was ≤2 years old had higher odds of late initiation. This finding indicates a strong association between closely spaced pregnancies and late use of prenatal care. Possible explanations include increased domestic workload related to caring for a young child, postpartum fatigue, and the unplanned nature of closely spaced pregnancies. Another potential explanation is reliance on lactational amenorrhea as a form of pregnancy prevention. When breastfeeding becomes less frequent as the older child begins to consume complementary or solid foods, ovulation may resume; pregnancy can therefore occur before a woman

recognizes a missed menstrual period, particularly when menstruation has not yet returned regularly. In such circumstances, pregnancy recognition and the decision to initiate ANC may be delayed. This mechanism was not assessed directly in the present study and should be considered a hypothesis. Previous studies, including the DHS in the DRC [5] and that of Teshale et al [13], have similarly identified short interpregnancy intervals as a major risk factor for delayed initiation of ANC. In the case of a short interpregnancy interval, mothers take care of their youngest child who is still too young, and sometimes feel ashamed in front of those around them. A new pregnancy occurring while a woman is breastfeeding a baby is considered taboo and would be detrimental to her health, according to certain local customs. In some settings, social norms surrounding closely spaced pregnancies may also affect disclosure and care seeking. These possible mechanisms were not directly measured and should be considered hypotheses for future research.

Interestingly, no participant reported an influence of religious or cultural beliefs on the initiation of prenatal consultations. This finding is unexpected in the context of sub-Saharan Africa and may reflect measurement limitations or social desirability bias, particularly if respondents perceived that reporting such influences could be viewed negatively. The result may also reflect the characteristics of the sample, which was recruited at an urban referral facility and was predominantly composed of educated women. Thus, the absence of reported influence should not be interpreted as evidence that religious or cultural factors have no role in ANC use. Future studies should use more detailed, culturally sensitive measures and, where appropriate, qualitative methods to explore how beliefs and social norms may shape the timing of ANC initiation.

Limitations and Potential Sources of Bias

This study has certain limitations that must be taken into account. The cross-sectional design does not allow for establishing causal relationships between the identified factors and late initiation of ANC. The associations observed should therefore be interpreted with caution. The study was conducted in a single referral facility (University Clinics of Kamina), which may limit the generalization of the results to the wider population, particularly to women who do not access health care facilities or who attend primary care centers.

The study primarily measured individual, household, and selected perceived access-related characteristics. It did not comprehensively assess supply-side factors such as waiting time, personnel availability, privacy, confidentiality, cleanliness, respectful maternity care, previous experiences of abuse or disrespect, availability of medicines, or perceived quality of services. These factors may influence willingness and ability to attend ANC and represent an important area for future research. A more complete explanatory framework should therefore integrate individual, household, community, and health system determinants.

Data collection was partly based on self-reported information obtained through interviews, which may be subject to recall bias, especially regarding obstetric history and the timing of pregnancy-related events. Furthermore, social desirability bias may have influenced responses to sensitive questions such as pregnancy planning, knowledge of prenatal care, or perceived barriers to accessing care. The study included all women admitted for their first prenatal visit during the study period who agreed to participate. Certain aspects were not comprehensively measured: characteristics of care provision, reproductive autonomy, coercion, couple-level decision-making, and past experiences of disrespectful or abusive care. The relatively small sample size may have limited the statistical power to detect associations with less common variables and may explain the wide confidence intervals observed for certain estimates. In addition, the study did not assess women's experiences of domestic or family violence, intimate partner violence, coercive control, or forced sex. Consequently, violence and coercion cannot be excluded as explanatory factors for pregnancy circumstances, reproductive decision-making, or delayed ANC initiation. Finally, this study did not assess or test for inherited thrombophilias or related genetic procoagulant conditions (eg, Factor V Leiden, prothrombin G20210A, MTHFR variants, human platelet antigen, and factor XIII mutations), which have been associated with recurrent pregnancy loss and other adverse outcomes in regional studies [11,12]. The absence of such biological data limits our ability to consider these conditions as potential confounders or contributors to the observed associations. Despite these limitations, this study provides valuable facility-based evidence on late ANC initiation in a semirural setting of the DRC.

Implications for Practice and Research

Programs aiming to reduce late ANC initiation should avoid focusing exclusively on changing women's behavior. Interventions should combine accessible community information with confidential and respectful services, adolescent-friendly care, supportive partner engagement that does not undermine women's autonomy, accessible contraception and birth spacing services, and improvements in the quality and acceptability of maternity services. Future studies should use multicenter designs and include measures of respectful maternity care, previous service experiences, privacy, waiting time, cost, reproductive autonomy, contraceptive access, gender relations, and social support.

Conclusions

Late initiation of the first ANC visit was highly prevalent among women attending the University Clinics of Kamina. Extreme maternal age, lower partner educational level, age of the youngest child ≤2 years, and unintended pregnancy were independently associated with late ANC initiation. Given the cross-sectional design and the imprecision of some estimates, these associations should be interpreted cautiously and should not be considered causal. Community-based strategies to promote early ANC, male partner involvement, family planning, and early pregnancy recognition may be appropriate, with particular attention to adolescents, older

women, and women with closely spaced pregnancies. Further multicenter studies including primary care users and women not attending ANC, with larger samples and more detailed behavioral, sociocultural, and biological assessments, are needed to assess the external validity and better clarify the factors associated with delayed ANC initiation.

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Generative AI Use

Generative AI tools ChatGPT and Claude were used to facilitate the linguistic revision of the manuscript, and the authors remain responsible for the scientific content, accuracy, and final version.

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Data Availability

The data collected and analyzed in this study are available in the manuscript and from the corresponding author on reasonable request.

Authors' Contributions

The study was designed by IBK and BMD. All authors participated in data collection. Data analysis was performed by BMD and IBK. The manuscript was written by BMD and MKA. UE, NLJ, and IBK contributed to the revision of the manuscript. The final version was validated by IBK.

Conflicts of Interest

None declared.

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Abbreviations

ANC: antenatal care
DHS: Demographic and Health Survey
DRC: Democratic Republic of the Congo
SDG: Sustainable Development Goal
WHO: World Health Organization

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