

Prevalence and factors associated with late initiation of antenatal care among pregnant women in Rulindo district, Rwanda

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Abstract: Background: Rwanda's maternal mortality rate has declined modestly over the past decade, yet timely antenatal care (ANC) initiation remains suboptimal, with 41% of pregnant women initiating ANC late. Timely ANC is critical to improving maternal and neonatal outcomes. This study aimed to assess the prevalence and determinants of late ANC initiation among pregnant women in Rulindo District, Rwanda.

Methods: A cross-sectional quantitative design was used, surveying 416 pregnant women attending seven health centers from March to May 2025. Data were collected using structured, pre-tested questionnaires administered in Kinyarwanda and analyzed using descriptive statistics, chi-square tests, and multivariate logistic regression ($p \leq 0.05$).

Results: Late ANC initiation (after the first trimester) was reported by 27.6% of participants. The majority were young (50% aged 20–29), rural residents (98.3%), and had low educational attainment, with 63.5% having only primary education and most working as farmers (71.6%). Bivariate analysis identified several significant factors associated with delayed ANC. These included partner alcohol consumption ($\chi^2 = 11.697$, $p = 0.003$), woman's occupation ($\chi^2 = 25.439$, $p = 0.001$), Lack of health insurance at conception ($\chi^2 = 21.197$, $p = 0.001$), absence of decision-making power at home ($\chi^2 = 6.262$, $p = 0.012$), unwanted pregnancy ($\chi^2 = 44.935$, $p = 0.001$), poor knowledge about ANC timing ($\chi^2 = 153.354$, $p = 0.001$), perceived service quality ($\chi^2 = 7.992$, $p = 0.018$), experience of domestic strife ($\chi^2 = 16.999$, $p = 0.001$), and the number of household members ($\chi^2 = 9.177$, $p = 0.01$). Multivariate analysis further revealed that being a farmer (AOR = 5.754, 95% CI: 2.473–13.392, $p = 0.001$), having a partner who do not consume alcohol are less likely (AOR = 0.084, 95% CI: 0.013–0.554, $p = 0.01$), desiring pregnancy later (AOR = 3.470, 95% CI: 1.113–10.814, $p = 0.032$), perceiving care as only "good" rather than "very good" (AOR = 0.383, 95% CI: 0.166–0.881, $p = 0.024$), and living in households with 3–4 members (AOR = 2.511, 95% CI: 1.190–5.299, $p = 0.016$) were all independently associated with delayed ANC initiation.

Conclusion: This study revealed significant prevalence of delayed initiation of antenatal care in Rulindo District. Key determinants include farmer employment, partner alcohol use, negative perceptions of care, and desire of later pregnancy, and number of household members, highlighting the need for targeted community-based interventions.

Keywords: Prevalence, Antenatal Care, Rulindo, Rwanda.

List of abbreviations:

ANC: Antenatal care

aOR: Adjusted odd ratio

FANC: Focused antenatal care

HC: Health Center

MDG: Millennium Development Goal

MMR: Maternal Mortality Ratio

MoH: Ministry of Health

AOR: Adjusted Odd Ratio

RDHS: Rwanda Demographic Health Survey

RHMIS: Rwanda Health management information system

SDG: Sustainable Development Goal

SPSS: Statistical packages for social sciences

UNICEF: United Nations International Children's Emergency Fund

UNPD: United Nations Population Division

VMMC: Voluntary medical male circumcision

WHO: World Health Organization

1. BACKGROUND

Maternal mortality remains a significant global health issue, with 810 women dying daily from preventable complications during pregnancy and childbirth (1). Between 2000 and 2023, the maternal mortality ratio (MMR, number of maternal deaths per 100 000 live births) dropped by about 40% worldwide (2). Approximately 92% of all maternal deaths occurred in low- and lower-middle-income countries in 2023, and most could have been prevented, Sub-Saharan Africa alone accounted for around 70% of maternal deaths (182 000) (2). The region also faces the highest neonatal mortality rate globally, responsible for 41% of all neonatal deaths (3). These statistics underscore the urgent need for improved maternal healthcare, particularly through antenatal care (ANC) services, which can prevent many of these avoidable deaths.

In Sub-Saharan Africa, although 78% of pregnant women receive ANC at least once, only 53% attend the recommended minimum of four ANC visits (4). Delays in initiating ANC are a significant concern, as timely and regular antenatal visits are crucial for detecting and managing potential pregnancy-related complications. Early ANC allows for the provision of essential services, including HIV testing, counselling, vaccinations, and the monitoring of prenatal abnormalities (5). According to the WHO (2016), pregnant women should receive at least eight ANC consultations, with the first visit occurring before the 12-week mark of pregnancy, to ensure optimal maternal and fetal health outcomes.

In Rwanda, maternal health has improved significantly in recent years. However, in 2017, the lifetime risk of maternal mortality in Rwanda was 1 in 94, with 12% of deaths among women of reproductive age attributed to maternal causes (6). The goals of ANC services in Rwanda, as elsewhere, are to promote knowledge of the benefits of prenatal care and ensure a safe pregnancy and birth. ANC services offer opportunities to treat and identify prenatal abnormalities, monitor pregnancies, and provide preventative health services (5,7). Furthermore, ANC plays a critical role in treating and preventing causes of maternal and neonatal morbidity and mortality (8).

Despite these efforts, late initiation of ANC remains a challenge in many parts of Sub-Saharan Africa, including Rwanda. In Rwanda, 41% of pregnant women initiate ANC later than the recommended time (9). This delay in ANC initiation is a contributing factor to maternal and neonatal morbidity and mortality. Research indicates that various factors contribute to delayed ANC initiation in low-resource settings, including lower household income, lower educational levels, greater healthcare costs, unemployment, distance from health facilities, and lack of health insurance (10). These socio-economic barriers, coupled with delays in seeking, reaching, and receiving ANC, hinder the timely utilization of maternal healthcare services (6,10).

In Rwanda, efforts to increase ANC attendance and reduce maternal mortality have been a national priority. Rwanda has made significant progress in achieving Millennium Development Goals (MDGs) 4 and 5, aimed at reducing maternal and under-5 mortality rates. This progress is largely attributed to strengthening the health system through cross-sector partnerships, evidence-based policymaking, community-based care, and robust engagement between local and central government (9). Since 2007, Rwanda has implemented an outreach program for community health workers (CHWs) to promote ANC attendance. These community health professionals play a key role in identifying pregnant women, educating the public about the importance of prenatal care, and encouraging pregnant women to attend ANC services (6).

In 2018, 56% of pregnant women in Rwanda had their first ANC visit before the fourth month of pregnancy, up from 38% in 2010 (6). Despite the high overall ANC service coverage (99%), this figure is still below the WHO's recommended standard of at least eight visits (11). While Rwanda has made significant strides in improving health infrastructure, human resources, and health insurance coverage, barriers to early ANC visits persist, particularly in rural areas such as Rulindo, where delays in ANC initiation are still common. Addressing these barriers and promoting early initiation of ANC is crucial to improving maternal and neonatal health outcomes in Rwanda. Therefore, understanding the prevalence and factors associated with late initiation of ANC in regions like Rulindo is essential to designing targeted interventions that can further reduce maternal and neonatal mortality in Rwanda.

2. METHODOLOGY

Study design

This study employed a cross-sectional design with a quantitative approach to investigate factors associated with late initiation of antenatal care among pregnant women in Rulindo District. The cross-sectional design was selected because it enables simultaneous assessment of both exposure variables and outcomes, allowing for efficient capture of the prevalence of late ANC initiation alongside identification of associated factors within the study population (Tola et al., 2021). This design is particularly suitable for the study's primary objective of determining factors linked to late initiation of antenatal care, while also addressing prevalence as specified in the secondary objectives. For the purposes of this study,

late initiation of antenatal care was operationally defined as a pregnant woman's first visit to a health facility for antenatal care services occurring after 12 weeks of gestation, consistent with established clinical guidelines in Rwanda.

Study setting

This study was conducted in Rulindo District which is located in Northern Province of Rwanda. The district lies roughly halfway between Kigali City and Musanze town. It has a population of about 360,144 populations (188,275 are Male and 171,849 are women) with population density of 635 per km² and area of 566.7 km² (NISR, 2023), it is divided into 17 sectors with 71 Cells and 494 Villages. The district has two Hospitals including Rutongo and Kinihira. Their catchment area consists of 20 Health Centers (Bubangu, Burega, Cyinzuzi, Kajevuba, Kinini, Kiyanza, Masoro, Murambi, Muyanza, Remera-mbogo, Rulindo, Rutonde, Rwahi, Shyorongi, Kinihira, Tare, Butamwa, Mwezi, Mukoma, Mugeru.). According to the Rwanda health management information system report for 2025, it is estimated that 10,008 women in Rulindo will become pregnant in that year (RHMIS, 2025).

Target population

The study population comprised the pregnant women of reproductive age (15-49 years) who attended antenatal care (ANC) at health centers within the Rutongo District Hospital and Kinihira Provincial Hospital catchment area and reside in one of its sectors between March 26th and May 31th, 2025.

Inclusion criteria

The study included the pregnant women of reproductive age (15-49 years) attending ANC services during their second and third trimesters. Participants had an individual antenatal care card that records the gestational age (the length of time a fetus has been developing in the mother's womb) at their first contact.

Exclusion criteria

All women who were pregnant and of reproductive age who did not possess a personal antenatal care card. Pregnant women who refused to sign a consent form, had mental health disorders, or had other disabilities like eyesight or hearing, were not participated in the study.

Sample size calculation

The sample size was determined using Cochran's sample size formula (1977) (Bartlett et al., 2001)

$$n = \frac{Z^2 p(1-p)}{d^2}$$

Was utilized to determine the sample size for this study, which examines the factors and prevalence of a health-related issue simultaneously. P is the estimated proportion of the population that has a particular characteristic or attribute; (1 - P) is the proportion of the population without the characteristic; d is the margin of error, or the maximum difference between the sample estimate and the true population value; and N is the required sample size. $Z_{\alpha/2}$ is the standard score or the desired level of confidence (e.g., 1.96 for a 95% confidence level).

By applying this formula to have the number of respondents,

n= sample size

P = Prevalence of late booking of ANC (P) is 41% or 0.41) (RDHS,2019-2020)

$Z_{\alpha/2}$ = Critical value of the normal distribution at $\alpha/2$ is equal to 1.96 when a confidence level of 95%, while α is equal to 0.05.

d = Margin of error (5% or 0.05)

$$n = \frac{(1.96)^2 0.41(0.59)}{(0.05)^2}$$

n=371

If we add 10% of sample size that was covered non respondent subjects and then sample size to be used was 408.

Sampling technique

Due to the nature of the research, the target population is unevenly distributed across the research setting (RHMIS, 2025). To obtain a sufficient sample size, a purposive sampling method was employed to select seven health centers within the Rutongo and Kinyira Hospital catchment area. These centers (Kajevuba HC, Buyoga HC, Kiyanza HC, Burega HC, Murambi HC, Masoro HS and Muzanza HC) were chosen based on their high population, low coverage of both first and fourth ANC visits, and high number of home deliveries. A systematic sampling technique (Maduekwe & de Vries, 2019) was used to select study participants from pregnant women attending ANC at these health centers. This involves dividing the total number of newly registered women in ANC at the selected health centers over two months (858) by the sample size (408), resulting in a sampling interval of 2. Therefore, every second participant was eligible for inclusion, with the first participant was randomly selected. Selected health centers and new women registered for ANC during two months were (Kajevuba HC=96, Buyoga HC= 102, Kiyanza HC=111, Burega HC= 111, Murambi HC=108, Masoro HS=207 and Muzanza HC=123

Data collection methods and materials

Data were gathered by using pre- tested questionnaires comprising structured components containing close questions. The primary focus of this study was on utilizing structured questionnaires to gather quantitative data from participants. These questionnaires have been developed based on previous research, specifically targeting factors affecting antenatal care utilization. Utilizing a quantitative approach, the structured questionnaire is deemed the most suitable tool for collecting primary data on the variables under examination (Amin, 2015).

Procedures of data collection

To optimize sample collection within a limited timeframe, seven midwives were trained as data collectors. They received thorough training on the data collection tools, including the questionnaires that was utilized. Subsequently, these trained midwives proceeded to selected health centers affiliated with the specified hospitals for data collection over the study period.

Data collection was scheduled for five days each week, from Monday to Friday. The data collectors were stationed at the health centers, where they approached pregnant women upon identifying eligible participants, the data collectors distributed the questionnaires for completion.

For participants who faced challenges with reading or writing, the data collectors provided assistance by using guided structured questionnaires. Additionally, to ensure accessibility and understanding, the questionnaire was translated into Kinyarwanda, the local language. All interactions and data collection procedures were conducted in Kinyarwanda to facilitate clear communication and comprehension.

Reliability and Validity of Instruments

A pilot study was conducted at Rutongo District Hospital and it includes a minimum of forty patients (10% of the sample size) was analysed to check if all elements of the study were not missed and if all questions are set correctly. The study was considered valid as the Cronbach's alpha is greater than 0.76, which is acceptable (Barbera et al., 2021).

Validity refers to the extent to which the score from a measure represents the variable they are intended to (12). To ensure the instrument's validity, a pilot study was conducted (Mohamad et al., 2015). To determine the content validity index, we followed a systematic approach involving expert review. First, we selected a group of five subject matter experts (13) in reproductive health, research methodology, and clinical practice. This group of experts comprise of two obstetrician and gynecologist, one medical doctor, one experienced midwife, and one experienced researcher. Each expert independently reviewed the research instrument, evaluating each item for its relevance, clarity, and representativeness of the research objectives. The experts rated independently each item on a 3-point scale: 1 (not necessary), 2 (useful but not essential), 3 (essential) (13). The response from all experts were pooled, and the number indicating "essential" for each item was determined. To establish content validity of an individual items we used an internationally reorganized method (content validity ratio (CVR) which is useful in rejection or retention of individual items (13). The Content validity index (CVI) is the mean CVR for all the items included in the final instrument (DeVon et al., 2007; Gilbert & Prion, 2016). The more experts (beyond 50%), perceiving an item as "essential", the greater the extent or degree of its content validity (13).

The CVR was calculated as follows (Lawshe, 1975):

$$CVR = \frac{ne - \frac{N}{2}}{\frac{N}{2}}$$

where:

ne is the number of panelists identifying an item as “essential” and

N is the total number of panelists (N/2 is half the total number of panelists).

Figure 3: Equation to calculate Lawshe’s Content Validity Ratio (CVR).

When all panelists agree an item is “essential,” the CVR is 1.00 (adjusted to 0.99 for ease of manipulation according to Lawshe (14). When the number of panelists rating an item “essential” is more than half, but less than all, the CVR is somewhere between 0 and 0.99, and if none of the raters marks the item as “essential,” the CVR would be 0 (13).

To the content validity of entire instruments, we calculated a CVI which is simply the mean of the CVR values for all items meeting the CVR thresholds of >0.7 and retained for the final instruments (13). The overall CVI of 0.74 was obtained by averaging the CVR scores, indicating good content validity (Gilbert & Prion, 2016). Specifically, items rated 3 or 4 by 4 or more out of 5 experts were considered valid, demonstrating the tool's accuracy and appropriateness for measuring the intended research constructs (15) (16)

Data analysis

Data analysis was conducted using the Statistical Package for Social Sciences (SPSS version 25.0) and Microsoft Excel software to ensure comprehensive statistical evaluation. Initially, descriptive analysis was performed to summarize participant characteristics and study variables using frequencies, percentages, means, and standard deviations as appropriate for the nature of each variable. Bivariate analysis was subsequently conducted using chi-square tests to assess associations between independent variables and the dependent variable (late initiation of antenatal care), with variables demonstrating statistical significance at the bivariate level being considered for inclusion in the multivariate model. Multivariate logistic regression analysis was then performed to examine the simultaneous effects of multiple independent variables on the dependent variable while controlling for potential confounding factors. Adjusted odds ratios (AOR) with 95% confidence intervals were calculated to quantify the strength of associations, and statistical significance was determined using a p-value threshold of ≤0.05. All analyses adhered to appropriate statistical assumptions, and model fitness was evaluated to ensure the validity and reliability of the findings.

Ethical consideration

This research secured endorsement from Mount Kenya University (MKU), ensuring compliance with research ethics. After securing ethical clearance and introduction letter from Mount Kenya University, Rulindo district Authority was contacted through a letter requesting for conducting a study in their localities. Upon approval from Rulindo District, study proceeded with field works. Explicit consent was attained from all participants. The process was conducted in a language (English and Kinyarwanda) that the participants fully understood to make sure they have a clear understanding of the study and its requirements, its goals, methods, possible drawbacks and advantages, and their freedom to discontinue participation at any moment. There was opportunity for participants to ask any questions they may have before voluntarily agreeing to participate.

To maintain confidentiality and safety of data, all study data were kept in secured, password-protected systems. Access to these systems is accessible to authorized personnel, reducing the possibility of data loss or illegal access. Personal identifiers, such as participants' names or other sensitive information, were not collected. Instead, each participant was assigned a unique identifier to protect their identity. Moreover, the data gathered were used solely for study purposes. All findings were reported in an aggregate manner, ensuring that individual participants cannot be identified in the results. Any data to be shared with stakeholders, such as healthcare providers or policymakers, were anonymized, safeguarding the confidentiality of the participants. These measures are designed to uphold the integrity of the study while ensuring respect and privacy for all involved.

3. RESULTS

Sociodemographic characteristics of the study respondents

The study sample of 416 pregnant women from Rulindo District was predominantly rural, with 98.3% residing in rural areas. The majority were between the ages of 20 and 29 (50%), reflecting a young reproductive population. In terms of education, 63.5% had completed primary education, while only 1.4% had university-level education, indicating generally low educational attainment. Most participants were farmers (71.6%), aligning with the rural context. Religiously, the majority identified as Catholic (57.5%). In terms of marital status, just over half were single (51.4%), and 47.8% were married. Regarding their partners, 60.3% of women reported their partners had primary education, and 64.2% worked as farmers. Reproductively, 58.7% had 1–2 previous births, and 83.2% had fewer than two living children. Household sizes were generally moderate, with 43.5% living in households of 3–4 members (Table 1).

Table 1: Sociodemographic characteristics of the study respondents

Variables (n=416)	Categories	Frequency	Percent (%)
Age category	15-19	44	10.6
	20-24	114	27.4
	20-29	94	22.6
	30-34	80	19.2
	35 and above	84	20.2
Residence	Rural	409	98.3
	Urban	7	1.7
Educational level	Illiterate	26	6.3
	Primary	264	63.5
	Secondary	120	28.8
	University	6	1.4
Occupation	House wife	56	13.5
	Farmer	298	71.6
	Public servant	24	5.8
	Private servant	8	1.9
	Self employed	11	2.6
	Other	19	4.6
	Religion	Catholic	239
	7th Day Adventist	22	5.3
	Protestant	80	19.2
	Muslim	2	0.5
	Other	73	17.5
Marital status	Single	214	51.4
	Married	199	47.8
	Widow	2	0.5
	Separated	1	0.2
Education level her partner possesses	Illiterate	11	2.6
	Primary	251	60.3
	Secondary	89	21.4
	University	8	1.9
	I don't know	57	13.7
Occupation her partner work for a living	Farmer	267	64.2
	Public servant	25	6.0
	Private servant	11	2.6
	Self employed	51	12.3
	Others	30	7.2
	I don't know	32	7.7

Parity	1-2	244	58.7
	3-4	130	31.3
	5 and more	41	9.9
Number of living children	Less than 2	346	83.2
	3-4	56	13.5
	5 and more	13	3.1
Number of household members	2 and below	113	27.2
	3-4	181	43.5
	5 and more	122	29.3
Total		416	100.0

Behavioural, knowledge-based, and socio-economic characteristics of the study respondents

The study explored behavioral, knowledge-based, and socio-economic factors influencing the timing of antenatal care (ANC) initiation among 416 pregnant women. A significant proportion of respondents (57%) reported that their partners consumed alcohol, and 32.9% had sought the help of prayer or traditional healers before or during pregnancy. While 15.9% had experienced previous pregnancy complications- most commonly abortion (7.7%)—the vast majority (84.1%) had not. Access to health insurance was high both at conception (95%) and during mid-pregnancy (97.1%).

In terms of autonomy, 72.4% reported being involved in decisions about seeking medical treatment, yet 63.2% said attending ANC required their partner’s approval. Additionally, over half (52.2%) did not go with their partners to the doctor, and only 43.5% reported doing so. The distance to the nearest health center varied, with most women residing within 30–60 minutes (39.7%) or less than 30 minutes (27.2%) away. However, cost remained a factor, with 46.2% spending between 1,000–2,000 RWF on transport.

Pregnancy intention played a role, as only 38% desired the current pregnancy at the time it occurred, with 49.5% wishing it had occurred later. Most women (53.8%) had delivered vaginally in the past, while 36.1% were experiencing their first pregnancy. Awareness regarding ANC was relatively high: 81.5% knew the first ANC visit should occur within the first 12 weeks, and 75.5% understood that at least eight visits are recommended. However, community health worker (CHW) engagement was limited, with 60.3% stating CHWs did not visit their homes during pregnancy.

Notably, 6.5% of respondents reported mistreatment by their partners during pregnancy. In terms of knowledge and perceptions, 67.3% had good awareness and 31.7% had very good awareness of the quality standards of ANC provided at their facilities (Table 2).

Table 2: Behavioural, knowledge-based, and socio-economic characteristics of the study respondents

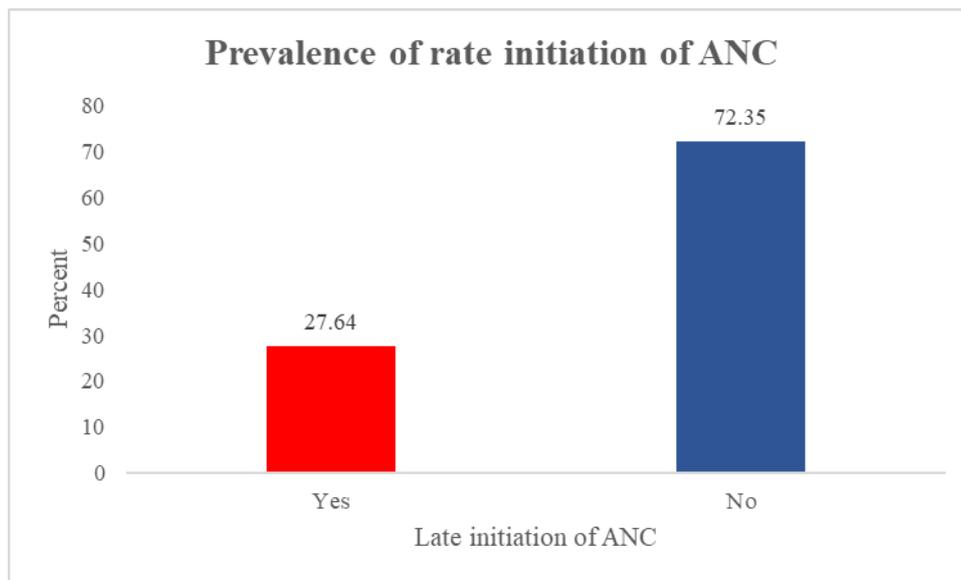
Variables (n=416)	Categories	Frequency	Percent
Her partner drinks alcohol	Yes	237	57.0
	No	145	34.9
	I don't know	34	8.2
Ever sought the advice of a prayer healer or traditional healer before, during, or after this pregnancy	Yes	137	32.9
	No	279	67.1
Previously pregnancy complications	Yes	66	15.9
	No	350	84.1
Name of previous complications	Abortion	32	7.7
	Still birth	5	1.2
	Gestational hypertensive disorder	1	0.2
	Gestational diabetes	1	0.2
	Bleeding under pregnancy	4	1.0
	Other	26	6.3
Health insurance, at the time of conception	Yes	395	95.0
	No	21	5.0

Health insurance, in mid-pregnancy and right now	Yes	404	97.1
	No	12	2.9
Taking part in making decisions about getting medical treatment	Yes	301	72.4
	No	115	27.6
Receiving antenatal care at a health facility requires your partner's approval	Yes	263	63.2
	No	136	32.7
	I don't know him	17	4.1
Go with partner to the doctor when needs antenatal care	Yes	181	43.5
	No	217	52.2
	I don't know him	18	4.3
	Less than 30 min	113	27.2
Distance to the closest health center	30-60 min	165	39.7
	61-120 min	107	25.7
	120 and above	31	7.5
The cost of transportation to the Health Center	Less than 1000 RWF	190	45.7
	1000-2000 RWF	192	46.2
	2001 and above	34	8.2
For the current pregnancy desire to become pregnant	Then	158	38.0
	Later	206	49.5
	No more	52	12.5
Mode of giving birth to the last child	Vaginally	224	53.8
	Caesarian section	42	10.1
	This is my first pregnancy	150	36.1
In terms of weeks, when should a woman begin receiving her first antenatal care	Within the first 12 weeks of gestation	339	81.5
	13-20 weeks	35	8.4
	21-32 weeks	14	3.4
	33 weeks and above	2	0.5
	I don't know	26	6.3
Awareness of the number of visits required for a pregnant woman	At least 8 visits	314	75.5
	4 visits	53	12.7
	I don't know	49	11.8
The CHWs come to your house to talk to you about how important it is to see a doctor while you are pregnant	Yes	165	39.7
	No	251	60.3
Her partner mistreats her while she is pregnant	Yes	27	6.5
	No	368	88.5
	I don't know him	21	5.0
Aware that the standard of antenatal care provided by this medical facility	Bad awareness	4	1.0
	Good awareness	280	67.3
	Very good awareness	132	31.7
Total		416	100.0

The prevalence of late initiation of antenatal care among pregnant women in Rulindo District, Rwanda.

The results of the study on the prevalence and factors associated with late initiation of antenatal care (ANC) among pregnant women in Rulindo District, Rwanda indicate that a significant proportion of women delayed their first ANC visit. Out of the 416 pregnant women surveyed, 115 women (27.64%) initiated their first ANC visit late, 301 women (72.35%) initiated their first ANC visit on time, within the first trimester (Figure 1).

Figure 1: The prevalence of late initiation of antenatal care among pregnant women in Rulindo District, Rwanda.



Factors associated with late initiation of antenatal care among pregnant women in Rulindo District, Rwanda.

Bivariate analysis of Sociodemographic factors associated with late initiation of antenatal care among pregnant women in Rulindo District, Rwanda.

The bivariate analysis examined the association between sociodemographic characteristics and delayed initiation of the first antenatal care (ANC) visit among pregnant women in Rulindo District, Rwanda. Among the variables analyzed, the woman’s level of education showed a statistically significant association with delayed ANC attendance ($\chi^2 = 13.995, p = 0.003$). Similarly, the educational level of the woman's partner was significantly associated with the timing of ANC initiation ($\chi^2 = 15.866, p = 0.003$). The woman’s occupation also emerged as a significant factor ($\chi^2 = 25.439, p = 0.001$). Additionally, the number of household members was significantly associated with ANC timing ($\chi^2 = 9.177, p = 0.01$), with women living in larger households (five members or more) more likely to delay their first ANC visit.

In contrast, several other sociodemographic variables did not show a statistically significant relationship with delayed ANC attendance. These include age category ($\chi^2 = 6.06, p = 0.195$), residence type (rural vs. urban; $\chi^2 = 0.635, p = 0.38$), religion ($\chi^2 = 4.798, p = 0.309$), and marital status ($\chi^2 = 5.15, p = 0.161$). Although proportions varied across categories, these differences were not significant at the conventional 0.05 level. Likewise, the occupation of the partner ($\chi^2 = 0.759, p = 0.224$), parity ($\chi^2 = 4.803, p = 0.091$), and number of living children ($\chi^2 = 4.681, p = 0.096$) did not demonstrate significant associations with delayed ANC (Table 3).

Table 3: Bivariate analysis of Sociodemographic factors associated with late of initiation antenatal care among pregnant women in Rulindo District, Rwanda.

Variables	Categories	Total n (%)	Delayed first ANC		Chi-square (X ²)	p-value
			Yes n (%)	No n (%)		
Age category	15-19	44 (10.6)	16 (13.9)	28 (9.3)	6.06	0.195
	20-24	114 (27.4)	36 (31.3)	78 (25.9)		
	20-29	94 (22.6)	18 (15.7)	76 (25.2)		
	30-34	80 (19.2)	21 (18.3)	59 (19.6)		
	35 and above	84 (20.2)	24 (20.9)	60 (19.9)		
Residence	Rural	409 (98.3)	114 (99.1)	295 (98.0)	0.635	0.38
	Urban	7 (1.7)	1 (0.9)	6 (2.0)		
Educational level	Illiterate	26 (6.3)	15 (13.0)	11 (3.7)	13.995	0.003
	Primary	264 (63.5)	72 (62.6)	192 (63.8)		

	Secondary	120 (28.8)	26 (22.6)	94 (31.2)		
	University	6 (1.4)	2 (1.7)	4 (1.3)		
Religion	Catholic	239 (57.5)	66 (57.4)	173 (57.5)	4.798	0.309
	7th Day Adventist	22 (5.3)	7 (6.1)	15 (5.0)		
	Protestant	80 (19.2)	27 (23.5)	53 (17.6)		
	Muslim	2 (0.5)	1 (0.9)	1 (0.3)		
	Other	73 (17.5)	14 (12.2)	59 (19.6)		
Marital status	Single	214 (51.4)	65 (56.5)	149 (49.5)	5.15	0.161
	Married	199 (47.8)	48 (41.7)	151 (50.2)		
	Widow	2 (0.5)	1 (0.9)	1 (0.3)		
	Separated	1 (0.2)	1 (0.9)	0 (0.0)		
Education level her partner possesses	Illiterate	11 (2.6)	6 (5.2)	5 (1.7)	15.866	0.003
	Primary	251 (60.3)	66 (57.4)	185 (61.5)		
	Secondary	89 (21.4)	17 (14.8)	72 (23.9)		
	University	8 (1.9)	1 (0.9)	7 (2.3)		
	I don't know	57 (13.7)	25 (21.7)	32 (10.6)		
		13.70%	21.70%	10.60%		
Occupation	Housewife	56 (13.5)	31 (27.0)	25 (8.3)	25.439	0.001
	Farmer	298 (71.6)	72 (62.6)	226 (75.1)		
	Others	62 (14.9)	12 (10.4)	50 (16.6)		
Occupation of the partner	Farmer	267 (64.2)	70 (60.9)	197 (65.4)	0.759	0.224
	Other occupations	149 (35.8)	45 (39.1)	104 (34.6)		
Parity	1-2	244 (58.8)	61 (53.0)	183 (61.0)	4.803	0.091
	3-4	130 (31.3)	37 (32.2)	93 (31.0)		
	5 and more	41 (9.9)	17 (14.8)	24 (8.0)		
Number of alive children	Less than 2	346 (83.4)	89 (77.4)	257 (85.7)	4.681	0.096
	2-3	56 (13.5)	20 (17.4)	36 (12.0)		
	5 and more	13 (3.1)	6 (5.2)	7 (2.3)		
Number of household members	2 and below	113 (27.2)	29 (25.2)	84 (27.9)	9.177	0.01
	3-4'	181 (43.5)	40 (34.8)	141 (46.8)		
	5 and more	122 (29.3)	46 (40.0)	76 (25.2)		

Bivariate analysis of Behavioural, knowledge-based, and socio-economic factors associated with late initiation of antenatal care among pregnant women in Rulindo District, Rwanda.

The bivariate analysis revealed several statistically significant behavioral, knowledge-based, and socio-economic factors associated with delayed first antenatal care (ANC) in Rulindo District (table 4). Notably, partner alcohol consumption was strongly associated with late ANC initiation ($\chi^2 = 11.697, p = 0.003$). Women without insurance at the time of conception were significantly more likely to delay their first ANC visit ($\chi^2 = 21.197, p = 0.001$), and this remained true for those lacking insurance during mid-pregnancy and at the time of the survey ($\chi^2 = 13.854, p = 0.001$). Decision-making autonomy also played a significant role. Women who did not participate in making decisions about seeking medical care at home were more likely to delay ANC ($\chi^2 = 6.262, p = 0.012$). Pregnancy intention was another significant predictor; those who reported not wanting any more children were disproportionately represented among those with delayed ANC ($\chi^2 = 44.935, p = 0.001$).

Crucially, knowledge about ANC timing emerged as the most significant determinant. Women who believed the ideal first ANC visit should occur after 13 weeks or who did not know the correct timing were substantially more likely to delay care ($\chi^2 = 153.354, p = 0.001$). Additionally, those with lower perceptions of service quality were more likely to delay ANC ($\chi^2 = 7.992, p = 0.018$). Finally, domestic strife also showed a significant association with ANC timing ($\chi^2 = 16.999, p = 0.001$).

Table 4: Bivariate analysis of Behavioural, knowledge-based, and socio-economic factors associated with late initiation of antenatal care among pregnant women in Rulindo District, Rwanda.

Variables	Categories	Total n (%)	Delayed first ANC		Chi-square (X ²)	p-value
			Yes	No		
Her partner drink alcohol	Yes	237 (57.0)	73 (63.5)	164 (54.5)	11.697	0.003
	No	145 (34.9)	27 (23.5)	118 (39.2)		
	I don't know	34 (8.2)	15 (13.0)	19 (6.3)		
Ever sought the advice of a prayer healer or traditional healer before, during, or after this pregnancy	Yes	137 (32.9)	34 (29.6)	103 (34.2)	0.816	0.216
	No	279 (67.1)	81 (70.4)	198 (65.8)		
Previously been pregnant and encountered any associated pregnancy complications	Yes	66 (15.9)	16 (13.9)	50 (16.6)	0.454	0.304
	No	350 (84.1)	99 (86.1)	251 (83.4)		
Previous complications experienced	Abortion	32 (7.7)	6 (5.2)	26 (8.6)	1.371	0.168
	Other complications	384 (92.3)	109 (94.8)	275 (91.4)		
Possessing health insurance, at the time of conception	Yes	395 (95.0)	100 (87.0)	295	21.197	0.001
	No	21 (5.0)	15 (13.0)	6 (2.0)		
Possessing health insurance, in mid-pregnancy and right now	Yes	404 (97.1)	106 (92.2)	298 (99.0)	13.854	0.001
	No	12 (2.9)	9 (7.8)	3 (1.0)		
Taking part in making decisions about getting medical treatment at home	Yes	301 (72.4)	73 (63.5)	228 (75.7)	6.262	0.012
	No	115 (27.6)	42 (36.5)	73 (24.3)		
Receiving antenatal care at a health facility require your partner's approval	Yes	263 (63.2)	52 (45.2)	211 (70.1)	38.367	0.071
	No	136 (32.7)	49 (42.6)	87 (28.9)		
	I don't know him	17 (4.1)	14 (12.2)	3 (1.0)		
Go with her partner to the doctor when you need antenatal care	Yes	181 (43.5)	32 (27.8)	149 (49.5)	33.474	0.067
	No	217 (52.2)	69 (60.0)	148 (49.2)		
	I don't know him	18 (4.3)	14 (12.2)	4 (1.3)		
How far do you walk to go to the closest health center	Less than 30 min	113 (27.2)	36 (31.3)	77 (25.6)	4.076	0.253
	30-60 min	165 (39.7)	47 (40.9)	118 (39.2)		
	61-120 min	107 (25.7)	22 (19.1)	85 (28.2)		
	120 and above	31 (7.5)	10 (8.7)	21 (7.0)		
The cost of transportation for you to get to the Health Center	Less than 1000 RWF	190 (45.7)	51 (44.3)	139 (46.2)	2.08	0.353
	1000-2000 RWF	192 (46.2)	51 (44.3)	141 (46.8)		
	2001 and above	34 (8.2)	13 (11.3)	21 (7.0)		
For the current pregnancy desire to become pregnant	Then	158 (38.0)	42 (36.5)	116 (38.5)	44.935	0.001
	Later	206 (49.5)	39 (33.9)	167 (55.5)		
	No more	52 (12.5)	34 (29.6)	18 (6.0)		
Mode of giving birth on last child	Vaginally	224 (53.8)	60 (52.2)	164 (54.5)	0.807	0.668
	Caesarian section	42 (10.1)	10 (8.7)	32 (10.6)		
	This is my first pregnancy	150 (36.1)	45 (39.1)	105 (34.9)		
Ideal ANC first visit in terms of weeks	Within 12 weeks	339 (81.5)	50 (43.5)	289 (96.0)	153.354	0.001
	More than 13 weeks	51 (12.3)	45 (39.1)	6 (2.0)		
	Don't know	26 (6.3)	20 (17.4)	6 (2.0)		

Number of appointments at the health center is required of a pregnant woman	At least 8 visits	314 (75.5)	61 (53.0)	253 (84.1)	12	0.565
	4 visits	53 (12.7)	29 (25.5)	24 (8.0)		
	I don't know	49 (11.8)	25 (21.7)	24 (8.0)		
The CHW comes to your house to talk to you about how important it is to see a doctor while you are pregnant	Yes	165 (39.7)	48 (41.7)	117 (38.9)	0.286	0.654
	No	251 (60.3)	67 (58.3)	184 (61.1)		
Her partner mistreats her while she is pregnant (there any domestic strife)	Yes	27 (6.5)	6 (5.2)	21 (7.0)	16.999	0.001
	No	368 (88.5)	95 (82.6)	273 (90.7)		
	I don't know him	21 (5.0)	14 (12.2)	7 (2.3)		
Knowledge about the standard of antenatal care provided by this medical facility	Bad	4 (1.0)	3 (2.6)	1 (0.3)	7.992	0.018
	Good	280 (67.3)	84 (73.0)	196 (65.1)		
	Very good	132 (31.7)	28 (24.3)	104 (34.6)		

Multivariate analysis of the factors associated with late initiation of antenatal care among pregnant women in Rulindo District, Rwanda.

Based on the multivariate analysis results, several factors are significantly associated with late first antenatal care initiation among pregnant women in Rulindo District, Rwanda (Table 5). Women who work as farmers are 5.75 times more likely (aOR=5.754, 95% CI: 2.473-13.392, p=0.001) to delay their first antenatal visit compared to housewives. Conversely, women whose partners do not drink alcohol are significantly less likely to delay care (aOR=0.084, 95% CI: 0.013-0.554, p=0.01), suggesting a protective effect of having a non-drinking partner. Women who desired pregnancy later rather than immediately are more than three times likely to delay antenatal care (aOR=3.47, 95% CI: 1.113-10.814, p=0.032). Additionally, women with good knowledge about antenatal care standards are less likely to delay care compared to those with very good knowledge (aOR=0.383, 95% CI: 0.166-0.881, p=0.024), and those living in households with 3-4 members are 2.5 times more likely to delay care compared to larger households (AOR=2.511, 95% CI: 1.19-5.299, p=0.016).

Table 5: Multivariate analysis of the factors associated with late initiation of antenatal care among pregnant women in Rulindo District, Rwanda.

Variables	Categories	AOR	95% C.I.		P-value
			Lower	Upper	
Educational level	Illiterate	Ref			
	Primary	1.028	0.256	4.131	0.969
	Secondary	0.464	0.095	2.26	0.342
	University	0.138	0.007	2.608	0.187
Occupation	Housewife	Ref			
	Farmer	5.754	2.473	13.392	0.001
	Others	9.69	2.546	36.879	0.081
Educational level of her partner	Illiterate	Ref			
	Primary	0.469	0.046	4.816	0.524
	Secondary	0.516	0.044	6.057	0.598
	University	0.454	0.012	17.821	0.673
Her partner drink alcohol	I don't know	0.156	0.013	1.933	0.148
	Yes	Ref			
	No	0.084	0.013	0.554	0.01
Possessing health insurance, at the time of conception	I don't know	0.211	0.032	1.4	0.107
	Yes	Ref			
	No	1.416	0.108	18.571	0.79

Possessing health insurance, in mid-pregnancy and right now	Yes	Ref			
	No	1.416	0.108	18.571	0.791
Taking part in making decisions about getting medical treatment at home	Yes	Ref			
	No	0.859	0.399	1.848	0.697
	Then	2.135	0.664	6.863	0.203
For the current pregnancy desire to become pregnant	Later	3.47	1.113	10.814	0.032
	No more	Ref			
	Within 12 weeks	Ref			
	More than 13 weeks	0.01	0.003	0.03	0.567
Ideal ANC first visit in terms of weeks	Don't know	0.092	0.025	0.334	0.975
	Yes	Ref			
	No	0.806	0.249	2.616	0.72
Her partner mistreats her while she is pregnant	I don't know him	0.173	0.021	1.448	0.106
	Bad	0.306	0.012	7.652	0.471
	Good	0.383	0.166	0.881	0.024
Knowledge about the standard of antenatal care provided by this medical facility	Very good	Ref			
	Less than 2	2.068	0.843	5.07	0.112
	3-4'	2.511	1.19	5.299	0.016
Number of household members	5 and more	Ref			

4. DISCUSSION

The findings from Rulindo District, Rwanda, indicating that 27.64% of pregnant women initiated their first antenatal care (ANC) visit late, mirror patterns seen in various low-resource settings. This prevalence is lower than figures reported in certain regions of sub-Saharan Africa. For instance, studies conducted in northern Nigeria and parts of Ethiopia have found delayed ANC rates exceeding 40%, largely attributed to socio-cultural norms and geographic inaccessibility (17,18). The relatively better performance in Rulindo might reflect Rwanda's national commitment to maternal health, including community health insurance and increased outreach through community health workers. However, the persistence of delayed ANC among more than a quarter of women highlights that systemic and behavioral barriers still remain.

One notable factor associated with delayed ANC in Rulindo was maternal occupation. Women engaged in farming had significantly higher odds of late ANC initiation. This aligns with findings from Kenya, where occupational constraints and the need to prioritize income-generating activities limit women's ability to seek early ANC (19). Unlike other studies where maternal education was strongly predictive of ANC timing, this study did not find education level to be a significant determinant. This could be attributed to relatively high general awareness levels in Rwanda or effective dissemination of ANC messages through local media and community health structures, which may have narrowed the knowledge gap across education levels.

This study found that partner alcohol consumption was significantly associated with delayed ANC, which supports broader literature on the role of male involvement in maternal health (20). While the partner's educational level was not significantly associated with ANC delay, the protective effect of a non-drinking partner underscores how behavioral support may have a more immediate influence than formal education. This finding suggests that interventions aiming to improve ANC uptake might benefit from targeting male behaviors and promoting spousal communication, rather than focusing solely on educational attainment.

Lastly, individual knowledge and perception about the timing of ANC emerged as the strongest predictors. Women who believed ANC should begin after the first trimester or were unaware of the recommended timing were significantly more likely to delay care. These findings are consistent with those from Uganda and Ghana, where misconceptions about the purpose and timing of ANC were key barriers (5,21). Furthermore, perceptions of service quality and household structure also influenced ANC timing, suggesting that both subjective experiences and social contexts matter. Women in smaller households and those who perceived services as only "good" rather than "very good" were more likely to delay, implying

that perceived value and social support might drive health-seeking behaviors. These insights underline the importance of addressing community-level beliefs and health system responsiveness to improve ANC timeliness.

The limitations of this cross-sectional study include the inability to establish causal relationships between identified factors and late antenatal care initiation due to the temporal nature of the design, where exposure and outcome are measured simultaneously. The study's findings may have limited generalizability beyond Rulindo District, as local healthcare infrastructure, cultural practices, and socioeconomic conditions may differ from other districts in Rwanda. Additionally, the quantitative approach may not capture the complex underlying reasons and personal experiences that influence women's decisions regarding antenatal care timing, potentially missing important economic factors that could inform more comprehensive interventions. Self-reported data on antenatal care initiation timing may also be subject to recall bias, particularly among women who delivered some time ago.

5. CONCLUSION

In conclusion, the study demonstrates that delayed initiation of antenatal care among pregnant women in Rulindo District is influenced more by behavioral, occupational, and perceptual factors than by formal sociodemographic characteristics such as education or insurance status. Women engaged in physically demanding or farmer occupations, those who desired to become pregnant later, and those whose partners exhibited unsupportive behaviors such as alcohol consumption were more likely to delay their first ANC visit. Additionally, negative perceptions of service quality and limited household support were associated with late attendance. These findings underscore the importance of addressing misinformation, strengthening male involvement, and improving service delivery experiences in order to promote timely ANC uptake and improve maternal health outcomes.

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