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Analysis of Factors Associated with the Completion of the First Antenatal Care Visit during the First Trimester of Pregnancy in the Analamanga Region, Madagascar: A Cross-Sectional Study

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Abstract

Introduction: The first antenatal care is of particular importance, as it marks the beginning of the continuum of maternal care. The world health organization recommends that it take place before the twelfth week of pregnancy, that is, during the first trimester. This study aims to identify the factors associated with the completion of the first antenatal care visit during the first trimester of pregnancy in the Analamanga region.

Materials and Methods: This is an analytical cross-sectional study of mothers who gave birth in the two months prior to data collection, which took place from October 21 to December 21, 2024. The adjusted odds ratio (AOR) with its 95% confidence interval was used to identify these factors, with a significance threshold set at $p \leq 0.05$.

Results: 246 mothers were included, with a mean age (standard deviation) of 26.49 (6.95) years. Several factors were associated with the completion of the first antenatal care during the first trimester of pregnancy, such as urban residence (AOR[95% CI]=11.44 [1.19-109.71]), absence of a main occupation (AOR[95% CI] =11.79 [1.70-81.37]), participation in agricultural activity (AOR[95% CI]=9.81 [1.69-56.70]), household with an average budget allocated to health (AOR[95% CI]=29.21 [1.47-578.84]), media and family as sources of information on ANC with respective AOR [95% CI] of 39.86 [3.54-447.92] and 25.22 [2.09-304.50].

Conclusion: Promoting the first antenatal care during the first trimester requires a multi-sectoral, concerted and sustainable approach involving policymakers, healthcare providers and communities.

Keywords: Factors associated; First antenatal care; Higher education level; Madagascar; Urban residence

Abbreviations

ANC: antenatal care.
AOR: adjusted odds ratio.
CI: confidence interval.

Introduction

Maternal health remains a major public health challenge and a key indicator of a country's development. Despite the progress made towards Sustainable Development Goal 3.1, maternal mortality remains high in many low-income countries. In 2020, approximately 287,000 women died from complications related to pregnancy and childbirth, nearly 800 per day, with 95% of these deaths occurring in resource-poor regions, primarily in sub-Saharan Africa and South Asia (WHO, 2023). In 2018, the maternal mortality ratio in Madagascar was 426 per 100,000 live births. Most of these deaths are preventable through early and continuous access to quality healthcare, particularly antenatal care (ANC) (INSTAT & UNICEF, 2019). ANC is one of the most effective interventions for improving maternal health. It allows for the early detection of obstetric risks, the prevention of infections, monitoring, and preparation for a safe delivery (WHO, 2016). The first ANC is of particular importance, as it marks the beginning of the continuum of maternal and neonatal care. The world health organization recommends that it take place before the twelfth week of pregnancy or during the first trimester to ensure early detection of pregnancy-related conditions such as hypertension, anemia, and infections, etc., to initiate preventive measures, such as iron and folic acid supplementation, and to plan for the follow-up care of the pregnancy (Kuhnt & Vollmer, 2017). First ANC during the first trimester is also associated with better adherence to subsequent visits, delivery assisted by skilled personnel, and increased use of postnatal care, which helps reduce the risks of maternal and neonatal morbidity and mortality (Moller et al., 2017). Despite these advantages, coverage of the first ANC during the first trimester of pregnancy remains insufficient worldwide. In 2023, only 58.6% of pregnant women had their first ANC before the fourth month of pregnancy (Tekelab et al., 2019). This global average masks significant disparities: in high-income countries, more than 85% of women begin their prenatal care in the first trimester, compared to less than 40% in low-income countries. In sub-Saharan Africa, rates vary between 35% and 45% (Edessa et al., 2023). The situation remains unfavorable in Madagascar, because only 27.2% of pregnant women had their first prenatal consultation before the fourth month of pregnancy. This percentage is 39.2% in the Analamanga region (INSTAT & UNICEF, 2019).

According to previous studies, several factors influence the early completion of the first ANC. Individual characteristics, such as maternal age, parity, education level, employment, and marital status, play a major role (Solanke et al., 2019). Young women, women who have given birth multiple times, and women with low levels of education often access prenatal care too late, due to a lack of knowledge about the importance of early monitoring or a low perception of risk. The household's socioeconomic status, rural or urban residence, distance to health facilities, and the woman's capacity for autonomous decision-making also influence early access to services (Okedo-Alex et al., 2019). Factors related to the supply of healthcare, such as the availability of healthcare staff, the perceived quality of services, the actual free nature of care, and the relationship between healthcare providers, are also frequently cited as obstacles (Tsawe et al., 2015). Furthermore, unplanned pregnancy and multiparous women have been identified as barriers to achieving the first ANC during the first trimester of pregnancy, while high levels of education and geographical proximity to health centers are factors facilitating access to prenatal care (Tsawe et al., 2015). Understanding the determinants of first ANC during the recommended period is therefore essential for guiding maternal health policies. Thus, this study aims to identify the factors associated with the completion of the first ANC visit during the first trimester of pregnancy in the Analamanga region.

Materials and Methods

Study site

This study was conducted in the Analamanga Region, located in the center of the country and part of the central highlands. It covers 17,448 km^2 and is bordered by five regions: Betsiboka to the north; Itasy and Bongolava to the west; Alaotra Mangoro to the east; and Vakinakaratra to the south. Administratively, the region comprises 134 communes within eight districts, including the districts of

Antananarivo Renivohitra, Antananarivo Atsimondrano, Antananarivo Avaradrano, Manjakandriana, Ambohidratrimo, Andramasina, Anjozorobe, and Ankazobe. Among the twenty-three regions of Madagascar, the Analamanga Region has some of the best indicators for maternal and child health. Several maternal health intervention programs have been implemented in this region, such as the ACCESS program, the Bien Naître program, and m TOMADY. All share a common goal: to improve maternal health through health system strengthening activities, including community outreach, ongoing training for health workers, and the active involvement of community health workers (Benski et al., 2020). To facilitate access to maternal health services, numerous health facilities have been established in the region. Consequently, among the twenty-three health regions of Madagascar, the Analamanga region has some of the best indicators in maternal health (INSTAT & UNICEF, 2019).

Sampling

Analamanga is composed of eight districts. Three of these eight districts were randomly selected. Once these districts were selected, the communes were stratified according to urban and rural areas. Two communes per district were chosen, one urban and one rural. Finally, regarding the Fokontany (villages), two Fokontany per commune were selected, one located within the commune's boundaries due to the concentration of health infrastructure in that area, and the other randomly selected. In total, three districts, six communes, and twelve Fokontany were included. The sites selected for this study are illustrated in the following figure (Figure 1).

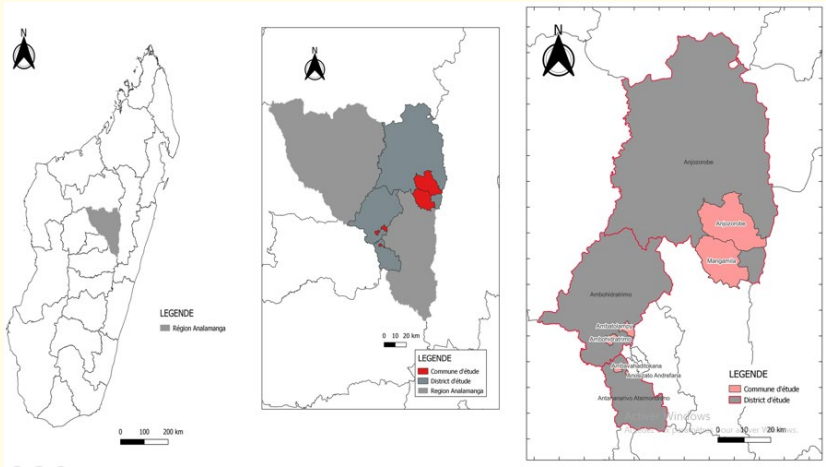

Figure 1: Study sites.

Type of study, population studied and sample size

This is a cross-sectional study, involving mothers who gave birth within the two months preceding data collection. The sample size was calculated using the following formula:

$$n = \text{Ɛ}\alpha^{2}*p*q / d^{2}$$

The confidence level used was 95%, corresponding to a critical value of $\alpha = 1.96$. The proportion of newborns who received at least one postnatal examination in the Analamanga region was $p = 80.6\%$ (INSTAT & UNICEF, 2019). The complementary proportion was $q = 1 - p$. The desired margin of error was $d = 5\%$. Taking these parameters into account, the sample size was 246.

Data collection took place from October 21 to December 21, 2024. Before data collection began, we obtained authorization from the Analamanga Regional Director of Public Health and the district medical inspectors. Mothers residing in the districts but with a mental health condition, including those who were hard of hearing, speech impaired, or had a mental illness, were excluded. Furthermore, each mother included in the study completed and signed a consent form before completing the questionnaire. Data collection was carried out using a pre-established questionnaire administered individually. Responses were recorded on tablets via KoboCollect.

Variables studied and statistical analyses

The variables collected include the sociodemographic profile of mothers, the socioeconomic profile of the household, knowledge of ANC, and variables related to healthcare provision. The sociodemographic profile of mothers includes age, school attendance, education level, occupation, marital status, and religion. The socioeconomic profile of the household includes access to means of communication and a working vehicle, participation in agricultural and livestock activities, the size of the budget allocated to health, the priority given to health expenditures, the individuals making health decisions, and membership in a health insurance scheme. The variables related to ANC concern sources of information about ANC, knowledge of the recommended time to start and number of visits, and ANC providers. Finally, the variables related to healthcare provision focused on the type of nearest facility, the distance between the home and the nearest healthcare facility, the availability of healthcare providers, and the mother's satisfaction with their reception and behavior during prenatal consultations. The collected data were cleaned using Excel 2016 before being analyzed with Stata 14. Multivariate logistic regressions were performed to identify factors associated with attending the first ANC during the first trimester of pregnancy. The adjusted odds ratio (AOR) with its 95% confidence interval was used to identify the relationship between the independent and dependent variables, that is, to identify the determining factors for attending the first ANC during the first trimester of pregnancy. Statistical significance was set at $p < 0.05$. The goodness of fit of the model was assessed using the Hosmer-Lemeshow test (Fagerland & Hosmer, 2012).

Results

A total of 246 mothers were included in the study. The sociodemographic characteristics of the mothers included are presented in Figure 2 below.

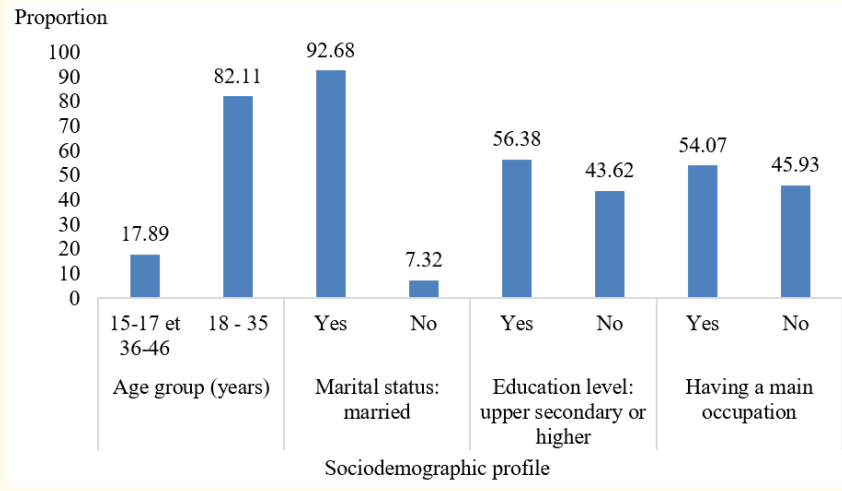

Figure 1: Distribution of mothers according to sociodemographic profile.

This figure illustrates that more than eight out of ten mothers were between 18 and 35 years old. Most of them were married, and more than half had a secondary education or higher. In addition to this information, the average age of the mothers included was 26.49 years, with a standard deviation of 6.95 years.

The distribution of mothers according to district and place of residence, as well as the completion of the first ANC during the first trimester, is presented in the following table 1.

	First ANC during the first trimester		***AOR [95% CI]***	***p***
	Yes n (%)	***No n (%)***		
District				
Ambohidratrimo	40 (42.11)	48 (32,21)	0.91 [0.06-14.05]	0.95
Anjozorobe	25 (26,32)	46 (30.87)	1	
Atsimondrano	30 (31.58)	55 (36.91)	2.85 [0.22-36.02]	0.41
Place of residence				
Urban	33 (34.74)	45 (30,20)	11.44 [1.19-109.71]	0.03
Rural	62 (65.62)	104 (69.80)	1	

Table 1: Distribution of mothers according to district, place of residence and completion of the first ANC during the first trimester.

This table shows that, for the districts, although the proportion of mothers who completed the first ANC within the recommended period was higher in Ambohidratrimo (42.11%) and Atsimondrano (31.58%) compared to Anjozorobe (26.32%), multivariate analysis did not show a statistically significant association. However, the place of residence significantly influenced the timing of the first ANC. Mothers living in urban areas were much more likely to complete their first ANC visit during the first trimester compared to those residing in rural areas (AOR = 11.44; 95% CI: [1.19-109.71]; p = 0.03).

The distribution of mothers according to their sociodemographic profile and the completion of the first ANC in the first trimester is presented in table 2.

	First ANC during the first trimester		***AOR [95% CI]***	***p***
	Yes n (%)	***No n (%)***		
Age group (years)				
15-17 and 36-46	17 (17.89)	26 (17.45)	1.84 [0.17-19.33]	0.61
18-35	78 (82.11)	123 (82.55)	1	
School attendance				
Yes	94 (98,95)	147 (98.66)	N / A	
No	1 (1.05)	2 (1.34)		
If yes, Education level: upper secondary or higher				
Yes	75 (79,79)	62 (42.18)	70.72 [3.96-1270.32]	0.00
No	19 (20,21)	85 (57.82)	1	
Having a main occupation				
No	49 (51.58)	64 (42.95)	11.79 [1.70-81.37]	0.01
Yes	46 (48,42)	85 (57.05)	1	

Marital status: married				
Yes	91 (95.79)	136 (91.28)	N / A	
No	4 (4.21)	13 (8.72)		
Religion belongs to the UCCM*				
Yes	81 (85.26)	120 (80.54)	1.17 [0.16-8.43]	0.87
No	14 (14.74)	29 (19,46)	1	

*Union of Christian Churches of Madagascar.

Table 2: Distribution of mothers according to sociodemographic profile and completion of the first ANC during the first trimester.

According to this table, 82.11% of mothers who had an first ANC during the first trimester were between 18 and 35 years old. The vast majority of mothers who had a visit during this period were attending school (98.95%). Among these, 79.79% had a secondary education level of upper secondary or higher. Regarding employment, 51.58% of mothers who had an early the first ANC visit did not have a declared main occupation. The majority of mothers who had an early the first ANC visit belonged to a religion that was a member of the union of christian churches of Madagascar (85.26%), and their marital status was married (95.79%). Among these variables, a secondary education level of upper secondary or higher and the absence of a main occupation were significantly associated with having the first ANC visit during the first trimester, respectively (AOR = 70.72; 95% CI: [3.96-1270.32]). p = 0.00 and AOR = 11.79; 95% CI: [1.70-81.37]; p = 0.01.

Table 3 presents the association between the socioeconomic profile of the household and the completion of the first ANC during the first trimester.

	First ANC during the first trimester		***AOR [95% CI]***	***p***
	Yes n (%)	***No n (%)***		
Provision of a communication device				
Yes	94 (98,95)	139 (93.29)	0.34 [0.00-653.32]	0.78
No	1 (1.05)	10 (6.71)	1	
Vehicle disposition in service				
Yes	49 (51.58)	71 (47.65)	3.42 [0.57-20.46]	0.17
No	46 (48,42)	78 (52.35)	1	
Agricultural activity practice				
Yes	45 (47.37)	70 (46.98)	9.81 [1.69-56.70]	0.01
No	50 (52.63)	79 (53.02)	1	
Livestock farming practices				
Yes	59 (62.11)	78 (52.35)	5.10 [0.74-35.13]	0.09
No	36 (37.89)	71 (47.65)	1	
Budget allocated to health				
Low	50 (52.63)	78 (52.35)	40.90 [1.84-908.71]	0.01
Medium	37 (38.95)	50 (33.56)	29.21 [1.47-578.84]	0.02
High	8 (8.42)	21 (14.09)	1	
Spending priority over health				
Low	7 (7.37)	17 (11.41)	200.72 [3.09-13002.92]	0.01
Medium	45 (47.37)	68 (45.64)	3.39 [0.46-24.78]	0.22
High	43 (45,26)	64 (42.95)	1	

Health-related decision-making				
The lonely woman	11 (11.58)	32 (21,48)	0.79 [0.10-5.88]	0.82
The lonely man	10 (10.53)	9 (6.04)	3.02 [0.26-34.19]	0.37
Both	67 (70.53)	99 (66.44)	1	
Others	7 (7.37)	9 (6.04	37.02 [1.02-1322.55]	0.04
Membership in a health insurance company				
Yes	54 (56.84)	44 (29.53)	0.30 [0.05-1.56]	0.15
No	41 (43,16)	105 (70.47)	1	

Table 3: Distribution according to household socioeconomic profile and completion of the first ANC during the first quarter.

According to table 3, the vast majority of mothers who attended ANC during the first trimester had a communication device (98.95%), while 51.58% owned a service vehicle. Agricultural activity was practiced by 47.37% of women who had their first ANC visit during the first trimester, while livestock farming was practiced by 62.11%. Agricultural activity was statistically significantly associated with having had the first ANC during the first trimester (AOR = 9.81; 95% CI: 1.69-56.70; p = 0.01). Regarding the health budget, 52.63% of mothers who had early first ANC belonged to low-income households and 38.95% to middle-income households. The adjusted analysis showed a significant association with early first ANC for low (AOR = 40.90; 95% CI: 1.84-908.71; p = 0.01) and medium (AOR = 29.21; 95% CI: 1.47-578.84; p = 0.02) budgets. Similarly, low priority given to health spending was significantly associated with first ANC occurring in the first trimester (AOR = 200.72; 95% CI: 3.09-13002.92; p = 0.01), although this category applied to only 7.37% of mothers. Regarding health decision-making, 70.53% of women made decisions jointly with their partner. The "other" category (decisions made by third parties such as parents or family members), although underrepresented (7.37%), was significantly associated with early first ANC (AOR = 37.02; 95% CI: 1.02-1322.55; p = 0.04). Health insurance coverage was found in 56.8% of women who had early access to care, with no statistically significant association.

Table 4 presents the association between the sources of information on the ANC and the completion of the first ANC in the first trimester.

	First ANC during the first trimester		***AOR [95% CI]***	***p***
	Yes n (%)	***No n (%)***		
Physician				
Yes	39 (41.05)	35 (23.49)	31.44 [2.80-353.01]	0.00
No	56 (58.95)	114 (76.51)	1	
Midwife				
Yes	39 (41.05)	59 (39,60)	2.39 [0.22-26.12]	0.47
No	56 (58.95)	90 (60.40)	1	
Nurse				
Yes	3 (3.16)	0 (0.00)	N / A	
No	92 (96.84)	149 (100.00)		
Community health workers				
Yes	13 (13.68)	19 (12.75)	1.56 [0.16-14.91]	0.69
No	82 (86.32)	130 (87.25)	1	
Media				
Yes	29 (30.53)	19 (12.75)	39.86 [3.54-447.92]	0.00

No	66 (69.47)	130 (87.25)	1	
Matron				
Yes	4 (4.21)	4 (2.68)	8.69 [0.12-585.93]	0.31
No	91 (95.79)	145 (97.32)		
Family				
Yes	74 (77.89)	115 (77.18)	25.22 [2.09-304.50]	0.01
No	21 (22,11)	34 (22.82)	1	
Friend				
Yes	20 (21.05)	53 (35,37)	0.14 [0.02-0.88]	0.03
No	75 (78.95)	96 (64.43)		
Others				
Yes	15 (15.79)	14 (9.40)	4.12 [0.28-58.85]	0.29
No	80 (84.21)	135 (90.60)		

Table 4: Distribution of mothers according to sources of information on ANC and completion of the first ANC during the first trimester.

Table 4 shows that women who received information from a physician were significantly more likely to have completed their first ANC visit (41.05%; OR = 31.44; 95% CI: 2.80-353.01; p = 0.00). The proportion of those informed by a midwife was the same (41.05%), but this association was not significant. A small proportion of mothers completed their first ANC visit within the recommended timeframe (3.16%). Community health workers accounted for 13.68% of those who consulted early, with no statistically significant association. Women exposed to the media were more likely and statistically significantly associated with consulting within the recommended timeframe (30.53%; AOR = 39.86; 95% CI: 3.54-447.92; p = 0.00). The midwife, on the other hand, was cited by only 4.21% of women who had early prenatal care, with no significant association. The family played a significant role as a source of information, involving 77.89% of women who had their first ANC visit during the first trimester, with a significant association (AOR = 25.22; 95% CI: 2.09-304.50; p = 0.01). Having been informed by a friend was less frequent among women who had early first ANC (21.05%), and this source was significantly inversely associated (AOR = 0.14; 95% CI: 0.02-0.88; p = 0.03). Other sources were cited by 15.79% of women who had early prenatal care, with no statistically significant association.

Table 5 presents the association between mothers' knowledge of ANC and the completion of first ANC during the first trimester.

	First ANC during the first trimester		***AOR [95% CI]***	***p***
	Yes n (%)	***No n (%)***		
Month of the start of ANC				
Yes	87 (91.58)	90 (60.40)	5541.56 [60.80-505036.6]	0.00
No	8 (8.42)	59 (39,60)	1	
Number of recommended ANC visits				
Yes	92 (96.84)	135 (90.60)	1.01 [0.03-26.79]	0.99
No	3 (3.16)	14 (9.40)	1	
Agent who will do the ANC				
Physician				
Yes	80 (84.21)	118 (79.19)	0.03 [0.00-0.61]	0.02
No	15 (15.79)	31 (20.81)	1	
Midwife				
Yes	94 (98,95)	148 (99.33)	N / A	

No	1 (1.05)	1 (0.67)		
Nurse				
Yes	25 (26,32)	34 (22.82)	9.37 [1.36-64.25]	0.02
No	70 (73.68)	115 (77.18)		
Community Agent health workers				
Yes	2 (2.11)	0 (0.00)	N / A	
No	93 (97.89)	149 (100.00)		
Matron				
Yes	22 (23,16)	41 (27.52)	0.17 [0.01-1.81]	0.14
No	73 (76,84)	108 (72.48)	1	
Traditional healer				
Yes	2 (2.11)	4 (2.68)	244.44 [1.79-33256.25]	0.02
No	93 (97.89)	145 (97.32)	1	

Table 5: Distribution of mothers according to their knowledge of ANC and completion of the first ANC during the first trimester.

Table 5 shows that the majority of mothers who knew the recommended month for starting ANC had their first ANC visit (91.58%) within that period, and this knowledge was significantly associated with early first ANC (AOR = 5541.56; 95% CI: 60.80-505036.6; p = 0.00). Knowledge of the recommended number of ANC visits was also high among mothers who had their first ANC visit during the first trimester (96.84%), but without a statistically significant association. Regarding knowledge of ANC providers, among those who had their first ANC visit within the recommended period, 84.21% recognized the physician, 98.95% the midwife, 26.32% the nurse, 2.11% the community health worker, 23.16% the traditional birth attendant, and 2.11% the traditional healer. Knowledge of the doctor, nurse and traditional healer as a provider of ANC was significantly associated with early completion of first ANC, respectively with AOR = 0.03 (95% CI: 0.00-0.61; p = 0.02), AOR = 9.37 (95% CI: 1.36-64.25; p = 0.02) and AOR = 244.44 (95% CI: 1.79-33; p = 0.02).

Table 6 presents the analysis of the relationship between the supply of care and the completion of the first ANC during the first trimester.

	First ANC during the first trimester		***AOR [95% CI]***	***p***
	Yes n (%)	***No n (%)***		
Type of nearest healthcare facility				
Medical practice	8 (8.42)	7 (4.70)	0.46 [0.02-7.73]	0.59
Basic health center	78 (82.11)	123 (82.55)	1	
Private clinic	3 (3.16)	2 (1.34)	12743.09 [0.10-1.48e+09]	0.11
Hospital	6 (6.32)	17 (11.41)	0.00 [0.00-0.15]	0.00
Distance between home and nearest healthcare facility ≤ 1 km				
Yes	65 (68.42)	97 (64.10)	0.05 [0.003-0.75]	0.03
No	30 (31.58)	52 (34.90)	1	
Health worker always available				
Yes	91 (95.79)	143 (95.97)	106.92 [1.82-6249.84]	0.02

No	4 (4.21)	6 (4.03)	1	
Knowledge of the day dedicated to prenatal care in the healthcare facility				
No	6 (6.32)	6 (4.03)	0.69 [0.00-58.40]	0.87
Yes	68 (71.58)	121 (81.21)	1	
I don't know	21 (22,11)	22 (14.77)	3.11 [0.49-19.49]	0.22
Satisfaction with the behavior of healthcare workers				
Not satisfied	5 (5.26)	8 (5.37)	0.02 [0.00-4.29]	0.16
Satisfied	60 (63.16)	104 (69.80)	1.02 [0.10-10.21]	0.98
Very satisfied	30 (31.58)	37 (24.83)	1	
Satisfaction with the reception				
Not satisfied	3 (3.16)	4 (2.68)	731.40 [0.25-2128170.00]	0.10
Satisfied	62 (65.26)	94 (63.09)	5.58 [0.61-50.43]	0.12
Very satisfied	30 (31.58)	51 (34.23)	1^2	

Table 6: Distribution according to healthcare provision and completion of the the first ANC during the first trimester.

According to table 6, regarding the nearest healthcare facility, 82.11% of mothers who had early first ANC resided near a basic health center, 8.42% near a medical practice, 3.16% near a private clinic, and 6.32% near a hospital. Proximity to a hospital was significantly and inversely associated with having first ANC during the first trimester (AOR = 0.00; 95% CI: 0.00-0.15; p = 0.00). A distance of ≤ 1 km between home and healthcare facility was observed in 68.42% of women who had early access to healthcare and was inversely associated with early first ANC (AOR = 0.05; 95% CI: 0.003-0.75; p = 0.03). The continuous availability of a health worker at the facility was reported by 95.79% of women who had their first ANC visit early and was statistically significantly associated with having the first ANC visit within the recommended timeframe (AOR = 106.92; 95% CI: 1.82-6249.84; p = 0.02). Awareness of a specific day dedicated to ANC visits at a health facility was mentioned by 71.58% of women. The majority of mothers were satisfied with the behavior and reception of the health workers, with 63.16% and 65.26% respectively expressing satisfaction. No statistically significant association was observed for these two variables.

Discussion

This study highlights several factors associated with the completion of the first ANC visit during the first trimester of pregnancy, while also emphasizing the specific contextual characteristics of the Analamanga region. The age analysis shows a mean age of 26.49 years, with 82.11% of mothers aged 18 to 35 years, indicating a predominantly reproductive-age population. This age group is frequently observed in demographic and health surveys in sub-Saharan Africa, where the cohorts studied often focus on women of childbearing or reproductive age (Abdo et al., 2023).

Analysis by district and place of residence illustrates that the lack of a statistically significant association between district and early initiation of first ANC, despite higher proportions in Ambohidratrimo and Atsimondrano, could be explained by sample distribution and intra-district heterogeneity. Indeed, differences in services, accessibility, and local interventions may exist without resulting in significant associations once adjusted, as observed in other African studies (Okedo-Alex et al., 2019). Conversely, urban residence is significantly associated with having the first ANC during the first trimester, which is consistent with numerous studies showing that the likelihood of initiating prenatal care early is higher in urban areas. This association is attributed to better access to healthcare facilities, greater exposure to information campaigns, and often higher socioeconomic capital in urban areas compared to rural areas (Ambaye et al., 2023; Daniels-Donkor et al., 2024). Systematic reviews confirm urban residence as a predictive factor for early onset

of first ANC in Africa (Abdo et al., 2023).

Analysis of the sociodemographic profile identifies two main factors: education level and absence of a main occupation. A secondary education level of upper secondary or higher is significantly associated with early completion of the first ANC visit, as education improves knowledge of recommendations, the ability to recognize risks, the use of services, and autonomy in decision-making (Benski et al., 2020). These results are consistent with previous studies showing the effect of education level on the early completion of the first ANC visit (Solanke et al., 2019; Wulandari et al., 2021). The link between the absence of a main occupation and early first ANC is less intuitive, but could be explained by two mechanisms. First, women without a primary occupation have more time to seek care early. Second, the absence of employment can coexist with better support from the household or family, particularly from the partner, which facilitates access to prenatal services (Longchar et al., 2025). Regarding marital status, the high proportion of married women among those consulting during the recommended period reflects the local social norm and the frequent correlation between marriage, partner support, and healthcare utilization, even though marital status did not appear to be a significant factor in this study. However, other studies demonstrate the role of marital status in the early initiation of ANC (Daniels-Donkor et al., 2024).

Analysis of the household's socioeconomic profile shows that ownership of a communication device is almost universal among mothers who completed their first ANC visit in the first trimester, indicating the growing importance of mobile and information technologies for promoting ANC, particularly in Madagascar, through mHealth interventions (Benski et al., 2020). The practice of agricultural activities is also associated with achieving first ANC during the first trimester. In some contexts, households engaged in agriculture may live closer to community structures, benefit from local awareness programs, or maintain relationships with health workers, which can facilitate early access to care (Benski et al., 2020). The results show that it is possible to achieve early first ANC, even in low-income or health-oriented households. These observations confirm the complexity of the socioeconomic determinants of antenatal care utilization. In resource-limited settings, household budget priorities do not necessarily influence service use, particularly when public policies providing free maternal care and community-based interventions target pregnant women. Studies conducted in sub-Saharan Africa have shown that free ANC and community mobilization significantly increase the number of economically disadvantaged women attending early first ANC (Adhikari, 2016; Tessema et al., 2021). Individual perception of the risk of obstetric complications and the desire to avoid high future expenses are also motivations for consulting during the recommended period, i.e., during the first trimester of pregnancy (Nakato et al., 2025; Nsibu et al., 2016). These factors, combined with social norms that value pregnancy and family or community support, explain why even low-income or health-conscious households can adopt behaviors that favor early ANC. Health decision-making is predominantly shared with the partner, but the "other" category, including decisions made by third parties such as parents or in-laws, is significantly associated with early first ANC. This underscores the influence of the family and community environment on early access to care (Iliyasu et al., 2010; Nsibu et al., 2016). Studies conducted in Nigeria and Democratic Republic of Congo have shown that support from the extended family can encourage women to attend their first ANC within the recommended timeframe, by providing logistical support, advice, or material assistance (Iliyasu et al., 2010; Nsibu et al., 2016). Health decision-making is predominantly shared with the partner, but the "other" category, which includes decisions made by third parties such as parents or in-laws, is significantly associated with early first ANC. This underscores the influence of the family and community on early access to care. Studies conducted in sub-Saharan Africa have shown that support from the extended family can encourage women to attend their first ANC on time by providing logistical support, advice, or material assistance (Nakato et al., 2025; Okedo-Alex et al., 2019).

Knowledge of the recommended month to begin ANC is significantly associated with its early initiation, thus confirming the importance of raising women's awareness of the ANC schedule (Patel & Chauhan, 2020; Tekelab et al., 2019a, 2019b). Similarly, knowledge of qualified healthcare providers (physician, nurse) as competent to provide ANC is associated with early consultation, while recourse to traditional healers, although statistically associated, can delay first ANC. Studies conducted in sub-Saharan Africa confirm that knowledge of and trust in qualified personnel are major factors in initiating ANC within the recommended timeframe (Eliufoo et al., 2024; Kr et al., 2025; Letsie & Lenka, 2021).

Finally, the characteristics of healthcare provision also influence the completion of the first ANC visit during the first trimester. Distance from the health center, the type of facility, and the continuous availability of a healthcare worker are associated with early completion of the forst ANC visit. Paradoxically, excessive proximity can delay the visit, while basic health center are preferred for routine ANC, with hospitals often perceived as facilities reserved for complicated cases (Borgès Da Silva et al., 2011; Ministry of Public Health, 2017; Torre, 2009). The continued availability of staff strengthens early access, thus highlighting the importance of continuity and accessibility of care (Ambaye et al., 2023; Andriantsimietry et al., 2015).

Conclusion

This study shows that the completion of the first ANC visit during the first trimester of pregnancy is influenced by individual factors such as sociodemographic factors and knowledge about ANC, household socioeconomic status, family circumstances, and healthcare provision. Mothers living in urban areas, with a high level of education, without a main occupation, engaged in agriculture, with a low or medium healthcare budget, and with family support in decision-making are more likely to access care early. Knowledge of the recommended time to begin ANC and recognition of qualified providers (physician, nurses) also increase the likelihood of fist ANC being completed during the first trimester. On the healthcare provision side, the continuous availability of healthcare personnel and proximity to a primary healthcare center are crucial. These results confirm the need for an integrated approach combining community outreach, improved accessibility, and enhanced quality of services to increase early ANC coverage in the region. Based on these results, several actions are suggested: strengthening community awareness targeting women of reproductive age and their families through the media and community agents; involving qualified providers and strengthening their capacities; improving the availability and continuity of services in health centers; promoting women's education and empowering women to foster informed decision-making; integrating families into the promotion of maternal health; optimizing free policies and economic support to reduce financial barriers; and finally, establishing a regular monitoring and evaluation system for indicators related to early first ANC to guide local strategies.

Conflict of interest

The authors declare that they have no conflict of interest in relation to this study.

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