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Determinants of attendance in antenatal care clinics in rural settings in Mali and Burkina Faso: a cross-sectional study

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Abstract

Background Since 2016, the World Health Organization (WHO) has recommended a minimum of eight antenatal care (ANC) contacts during pregnancy, replacing the previous recommendation of four focused ANC visits. In Mali and Burkina Faso, the four ANC visits are still recommended and their coverage remains low or insufficient. To anticipate possible obstacles to the implementation of the new recommendations, this study aimed to identify the individual determinants of ANC attendance in two study districts, with a representative sample of women recruited from the community.

Methods Data were collected in June 2022 through a three-stage household survey with a representative sample of women who delivered in the previous 12 months in the health districts of Kangaba (Mali) and Boussé (Burkina Faso). Country-specific analyses were performed using self-reported data. Women's sociodemographic and clinical characteristics, as well as attitudes towards ANC attendance, were described to account for clustering. Multivariable logistic regression models using generalized estimating equations were used to identify the determinants of four or more ANC uptakes. A p-value < 0.05 was considered statistically significant in the adjusted model.

Results Overall, 1590 women participated (780 in Mali; 810 in Burkina Faso) in the study. Women in Burkina Faso were older and less educated than women in Mali. The proportions of women with at least four ANC visits were 80% and 54%, and that of ANC in the first trimester was 38.7% and 43.8% in Burkina Faso and Mali respectively. Factors significantly associated with a greater probability of women attending ANC4 + visits were found only in Mali: a history of stillbirth and time spent at ANC. Factors reducing the use of ANC4 + were the lack of transportation/distance in Burkina Faso, travel time of less than 1 h to reach the maternity clinic, women's nonrecognition of the importance of ANC visits, and the perceived high cost of the ANC visit in both countries.

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Conclusion ANC was lower in Mali than in Burkina Faso. Health policies aimed at achieving the WHO recommendation of 8 ANC contacts should prioritize health information and sensitization of pregnant women to improve their knowledge of the importance of attending ANC several times.

Trial registration Retrospectively registered on August 11th, 2022 registration # PACTR202208844472053. Protocol v4.0 dated September 04, 2023.

Keywords Antenatal care, Pregnant women, Maternal and childbirth, Epidemiology, West Africa

Introduction

Pregnancy and childbirth are critical periods for women and their families because of the high risk for maternal and child morbidity and mortality [1–5]. In 2020, approximately 287,000 women died during and following pregnancy and childbirth, of which 95% of them died in low and middle-income countries. However, most of these maternal deaths could have been prevented [6]. While the maternal mortality rate decreased from 339 in 2000 to 223 per 100,000 live births in 2020 [7], it remains unacceptably high for the targeted rate of 70 maternal deaths by 2030 according to the sustainable development goals [8]. In addition, perinatal mortality remains high, at 47 deaths per 1000 births in 2020 [9], highlighting the need for skilled care during delivery and newborns' first days of life.

Inadequate and insufficient use of antenatal care (ANC) with qualified healthcare professionals contributes to the occurrence of these preventable maternal and perinatal deaths [10–12]. Indeed, ANC visits are key opportunities for women to receive care from qualified healthcare staff, enabling the prevention, identification, and treatment of illnesses during pregnancy [13]. Since 2016, the World Health Organization (WHO) has recommended that every woman should have a minimum of eight contacts with a skilled health worker during her pregnancy, with the first contact occurring in the first trimester of the pregnancy [13]. These recommendations replaced the previous guidelines of four focused ANC visits during pregnancy. The term "visit" was replaced by "contact" to take into account the active link between pregnant women and healthcare providers. In addition to the number of contacts, their timeline has been reorganized. Finally, these recommendations also include health system interventions to improve the use and quality of ANC to make pregnancy "a positive experience" for women and adolescents [13]. Sub-Saharan countries are not equal in terms of implementing these recommendations. They have been adopted in Mali since 2019 [14], and in Burkina Faso since 2018 [15].

In 2022, UNICEF reported that only 66% of pregnant women had at least four ANC visits worldwide [16]. In sub-Saharan Africa, fewer than 60% of pregnant women attended at least four ANC visits [16]. This figure is even lower for Mali (24.4% in 2020) and Burkina Faso (38% in 2020) [17, 18]. In addition, only 36% and 39% of pregnant women attended ANC visits during the first trimester of pregnancy in Mali in 2018 [19] and in Burkina Faso in 2020 [18], respectively. Many studies have documented the barriers preventing women from using ANC including economic, sociodemographic, geographic, and contextual barriers [20–25]. However, few studies have been conducted in Mali and Burkina Faso, and in the context of the 2016 WHO recommendations for ANC. In Mali, in 2018, on the basis of demographic and health survey (DHS) data, only 3.5% of women reported having eight contacts during their last pregnancy; these women were more likely to be affiliated with health insurance, to live close to a health center, to have a higher wealth index, and to have husbands whose education level is higher than primary school [26]. In Burkina Faso, studies assessing the determinants of ANC attendance have used at least four ANC visits as the primary endpoint [27, 28]. Identifying the ANC attendance barriers could help in designing appropriate interventions to improve access to and the timeliness of prenatal care.

This study aimed to identify the determinants of women's access to at least four ANC visits (ANC4+) in two health districts in Mali and Burkina Faso in the context of the new 2016 WHO recommendations.

Methods
Study settings

The INTEGRATION project was carried out in the catchment areas of the Kangaba and Boussé health districts in Mali and Burkina Faso, respectively. Mali and Burkina Faso are two sub-Saharan countries with catchment sizes of 1,241,238 km^2 and 274,220 km^2 and an estimated populations of 20,732,476 and 20,487,979 inhabitants, and they are subdivided into 13 and 11 regions, respectively. Burkina Faso's economy relies on agriculture and mining production, particularly gold production. Over 40% of its population lives below the national poverty line [29]. Mali's economy is based primarily on mining and agriculture, with a national poverty rate of 42% [30]. Each of the countries has three climatic zones: Mali (Saharan, Sahelian, and Sudanian), and Burkina Faso (Sahelian, Sudano-Sahelian, and Sudanian). Both countries have a pyramidal health system, comprising: peripheral health centers at the primary level with referral hospitals (medical centers

with surgical units), secondary level (regional hospitals) and tertiary level (university and national hospitals). Like the other health districts, Boussé and Kangaba are part of the primary level of care. In Burkina Faso, the free healthcare for pregnant women and lactating women have been implemented since 2016, and the "national health development plan", and the "Reproductive health policy and standards" define the framework for the implementation of reproductive health. In Mali, the "Strategic plan for maternal, newborn, child, adolescent reproductive health and nutrition" is the foundation of the five-year health policy for prenatal care, and fees are charged for maternal services. The focused ANC policy is currently being used in both countries, while the training of health personnel and the widespread implementation of the 2016 WHO recommendations are taking place gradually. The percentages of women who had completed at least one (1+) and four or more (4+) ANC visits in 2020 in the region covering Kangaba district were 82.4% and 32.3%, respectively, and 49.7% of them had received at least three doses (3+) of IPTp-SP [17]. In the health district of Boussé, 51.4% of pregnant women had attended at least one ANC visit in 2020, of whom 38.3% of whom were in their first trimester of pregnancy. The proportion of pregnant women with four ANC visits was 48.6%, and 72.3% had received three doses of IPTp-SP in the district [18]. Studies are underway in each country to define the model for implementing the new WHO recommendations on ANC, but these studies are being carried out in districts other than Kangaba and Boussé, where the old WHO recommendations still apply.

Data sources, household survey sampling methods and data collection

Data for this analysis were collected through baseline household surveys conducted from June–July 2022 within the INTEGRATION (INcreasing the upTakE of IPTp-SP throuGh Seasonal MalaRiA Chemo-prevenTION channel delivery) project, a cluster randomized implementation trial (RIA2020S-3302) in Mali and Burkina Faso. This trial aimed to increase IPTp-SP coverage by delivering it in communities via the seasonal malaria chemoprevention (SMC) channel—monthly amodiaquine/sulfadoxine-pyrimethamine administration to children 3–59 months during the rainy season, delivered door-to-door by community health workers over four months—along with encouraging pregnant women to attend antenatal care (ANC). In each country, a multi-stage cluster sampling method was used: (1) random selection of clusters (smallest geographic areas of adjacent households, the unit of randomization) using probability proportional to size; (2) random selection of households within clusters; and (3) selection of the woman with the most recent pregnancy (live birth or

stillbirth within the past 12 months, resident, and consenting) within each household. A standardized questionnaire, administered by trained female interviewers (nonresidents and nonhealthcare staff) using REDCap tablets in the woman's chosen language, collected data on sociodemographic characteristics, obstetrical history, ANC visits, reasons for limited ANC, household assets for wealth index calculation, and ANC costs. Maternal health card data were used to verify ANC visits and IPTp-SP doses. The baseline surveys served to assess IPTp and ANC uptake before trial implementation, with interviewers supervised by the study team.

Variables of interest

For this specific analysis, the main outcome variable was the ANC4 + attendance, which was categorized as 0: < 4 ANC visits or 1: ≥ 4 ANC visits. Because more than half of the women in Mali did not have a maternal health card, the main variable outcome (ANC attendance) was defined based on the women's self-reports only.

The potential factors associated with ANC attendance were selected on the basis of the literature: the women's characteristics and birth history were selected based on literature that identifies them as potential barriers to ANC access. Economic variables related to the households are standard variables used to assess the wealth index, as usually used by the Demographic and Health Surveys (DHS) Program [21–23, 31]. They included sociodemographic and economic factors defined at the individual and household levels, such as the women's age (categorized into < 21, 21–25, 26–30, or > 30 years old on the basis on the age quartiles), her marital status (single; including no married, widows and divorced or married), and her ethnicity and religion. Additional factors were the education level of both the woman and the household head (categorized into no schooling, primary, or secondary/university), the number of household members (categorized into < 5, 6–7, 7–8, or > 8, on the basis of the quartiles), and sex (categorized as male or female) and occupation of the household head (categorized into farmer/breeder, employee, worker, or unemployed). The household wealth quintiles (categorized into poorest, poorer, middle, richer, and richest) were calculated via principal component analysis [32] of household assets as follows: households were given scores on the basis of the number and types of consumer goods they owned, ranging from a television to a bicycle or car, and housing characteristics such as the drinking water source, toilet facilities, and flooring materials. District wealth quintiles (from lowest to highest) were obtained by assigning a household score to each household member and ranking each person in the household population by her or his score [33]. The most recent DHS weights for each household asset were used to calculate a wealth index

for each household within our sample in each country. The quintile ranges from the DHS at the national level for each country were then applied to the wealth index of our sample. Regarding contextual factors, we considered the means of transportation to visit the maternity clinic (categorized into walking, bicycle, motorbike, car, or taxi), and the travel time to reach the maternity clinic (< 1 h, or ≥ 1 h). Finally, factors related to the woman's obstetrical history and to ANC itself were considered as potential determinants of ANC uptake: gravidity (categorized into primiparous, two or three pregnancies, and large multiparous), history of stillbirth (yes or no), and gestational age at the first ANC visit (first, second, or third trimester). The reasons given by women for not attending ANC more often were investigated through the following questions: the high cost of the ANC visit (yes or no), presence of female health providers at the facility (yes or no), closest facility open (yes or no), authorization from the husband/family required (yes or no), distance to the health facility perceived by the woman as too far away or absence of transportation (yes or no), the perceived necessity to seek ANC more frequently (yes or no), poor quality of the ANC services (yes or no), and the fact that the woman was unaccustomed to seeking ANC more frequently (yes or no). Women's ANC expenses (categorized into up to US\$ 2, 2.1–4, 4.1–6, or greater than US\$ 6), and the time spent waiting for and receiving ANC services (categorized into less than 1 h–1 h and more) were also considered. The complete list of variables is provided in the supplementary Table 1.

Statistical analysis methods

Statistical analyses were performed via Stata version 15.0. The analyses were conducted for each country separately. All analyses accounted for clustering.

First, we described the characteristics of both women and their households. The number of ANC visits, the proportion of women with four ANC visits (ANC4+), and the distribution of gestational age at the first ANC visit were computed via both maternal health cards and the women's self-reported responses. The concordance between ANC uptake from data collected on the ANC card and self-reported data was assessed. Moreover, women's characteristics according to whether they had an ANC card or not were compared via the Chi-square test and Student's T-test.

Second, we conducted unadjusted analyses to determine which factors were associated with at least four ANC visits via logistic regression models with generalized estimating equations. All the variables that were significantly associated with ANC4+ (p-value < 0.2) in the unadjusted analyses were selected for the adjusted analysis, for which we used a logistic regression model with

generalized estimating equations. A p-value less than 0.05 was considered statistically significant.

Results

Characteristics of the study population

Overall, 1590 women (780 in Mali and 810 in Burkina Faso) gave birth in the last 12 months before the surveys and were included in the study. For the outcome data collection, ANC cards were available for 335/780 women in Mali and 792/810 in Burkina Faso (Fig. 1).

The women's characteristics are summarized in Table 1. In Mali, approximately 60% of the women surveyed were under the age of 25 years, most of them were of the Malinké ethnic group (67.7%), the majority were not educated (56%), they were married (98%), and they were predominantly Muslim (more than 97%). Half of the women (50%) had at least three pregnancies, and 12% had a history of stillbirth. The majority of the household heads were men (98.9%). In Burkina Faso, over 55% of the women surveyed were over the age of 25 years, most of them were of the Mossi ethnic group (95%), the majority were not educated (70%), they were married (99%), and they were predominantly Christian (over 60%). More than half of the women (53%) had at least three pregnancies, and 17% had a history of stillbirth. The majority of household heads were men (96.5%).

Number and timing of ANC visits

Figure 2 shows the distribution of the number of ANC visits attended by pregnant women during their last pregnancy. Approximately 53.5% (95% CI [49.9–57.3]) and 79.9% (95% CI [76.2–83.1]) of women attended four ANC visits in Mali and Burkina Faso, respectively.

Figure 3 presents the distribution of gestational age at the first ANC visit: 38.7% (9% CI [34.5–40.0]) and 43.8% (95% CI [39.3–48.5]) of women who had their first visit in the first trimester in Mali and Burkina Faso, respectively.

Reasons preventing women from seeking antenatal care more frequently

Table 2 presents the reasons preventing women from seeking ANC more frequently in Mali and Burkina Faso.

Among the 780 women surveyed in Mali, 26% reported that ANC visits were too expensive, and 16% did not see the need to have several ANC visits. Additionally in Mali, 71% of women went to ANC visits by foot, walking less than an hour (82.7%); 50% of them spent more than US\$ 6 for an ANC visit, and most of them (63%) spent more than an hour in the facility for ANC, including waiting time and time receiving ANC services.

Among the 810 women surveyed in Burkina Faso, approximately 11% and 21%, respectively, reported that they were unaccustomed to seeking ANC and did not see the need to have several visits. Approximately 78% of
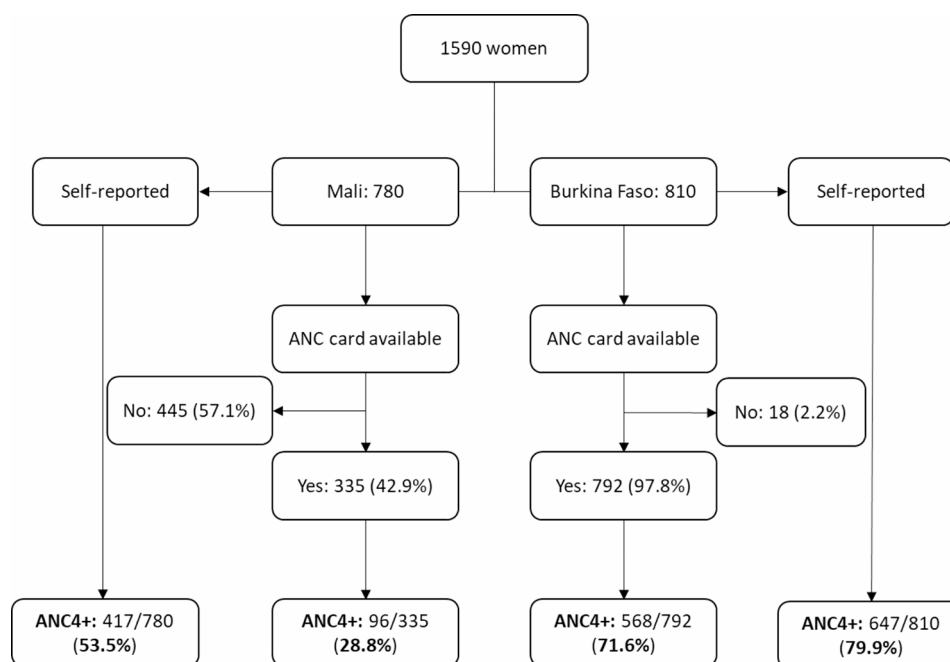
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Fig. 1 Study profile

the women went to ANC visits on a bicycle, for a travel time of less than an hour (71%), and 88% of them spent less than US$ 2 on ANC visits. Most of them (77%) spent more than an hour waiting and receiving ANC services in the facility.

Comparison between self-reported and recorded data on maternal health cards

Supplementary Table 2 shows the concordance between the number of ANC visits during the last pregnancy via self-reported data and data extracted from maternal health cards. Overall, the agreement (percentage of the same responses for a given outcome between the two sources) was 21.8% in Mali and 81% in Burkina Faso. In Mali, while we found relatively similar proportions of women with one or two ANC visits regardless of the data source, a greater proportion of women reported three or four ANC than maternal health cards did (Supplementary Table 3). The same pattern was observed in Burkina Faso but to a lesser extent. Supplementary Table 4 shows that in Mali, women with and without a maternal health card had similar baseline characteristics, except for the history of stillbirth. Women with a history of stillbirth were more likely to have a maternal health card (*p* = 0.04).

Factors associated with ANC4+

Factors associated with ANC4 + in the unadjusted and adjusted analyses in Mali and Burkina Faso are presented in Table 3.

In Mali, in the adjusted analysis, determinants positively associated with ANC4+ were: a history of stillbirth

(OR = 1.3, 95% CI [1.1–1.6]) and time spent waiting and receiving ANC services ≥ 1 h (OR = 1.1, 95% CI [1.0–1.3]). In contrast, the factors negatively associated with ANC4 + were: the cost of the ANC visit perceived as high by the women (OR = 0.6, 95% CI [0.5–0.7]), the fact that women were unaccustomed to seeking ANC more frequently (OR = 0.7, 95% CI [0.5–0.9]), and travel time to visit the maternity clinic ≥ 1 h (OR = 0.6, 95% CI [0.5–0.8]).

In Burkina Faso, in the adjusted analysis, no evidence was found of any factors positively associated with ANC4+. In contrast, factors negatively associated with ANC4 + were the cost of the ANC visit perceived as high by the women (OR = 0.5, CI 95% [0.4–0.7]), the distance to the facility perceived as too far or the lack of transportation means (OR = 0.7, CI 95% [0.5–0.9]), the fact that women were unaccustomed to seeking ANC more often (OR = 0.8, CI 95% [0.7–0.9]) or believed that frequent visits were unnecessary (OR = 0.8, CI 95% [0.7–0.9]), and the travel time to visit the maternity clinic ≥ 1 h (OR = 0.9, CI 95% [0.8–0.9]).

Discussion

This study assessed the individual determinants of antenatal care utilization before the implementation of the 2016 WHO recommendations on antenatal care. The coverage of ANC4 + was greater in Burkina Faso than in Mali, with fewer than half of the women attending their first ANC visit in the first trimester of pregnancy. In these settings, we confirmed known individual and contextual factors associated with ANC attendance such as

Table 1 Characteristics of the study population in Mali and Burkina Faso

Characteristics	Mali *N* = 780 *n* (%)	Burkina Faso *N* = 810 *n* (%)
Sociodemographic		
Age (years)		
Median (Q25– Q75)	24 (20–30)	27 (22–42)
< 21	237 (30.5)	138 (17.04)
21–25	227 (29.21)	217 (26.79)
26–30	178 (22.91)	203 (25.06)
>30	135 (17.37)	252 (31.11)
Ethnicity of the woman		
Bambara	64 (8.21)	-
Malinké	528 (67.69)	-
Fulani	73 (9.36)	-
Sarakolé	18 (2.31)	-
Mossi	-	771 (95.19)
Gurunsi	-	30 (3.7)
Other	97 (12.44)	9 (1.11)
Marital status		
Single	15 (1.92)	8 (0.99)
Married	765 (98.08)	802 (99.01)
Women's education		
No education	439 (56.35)	568 (70.12)
Primary school	161 (20.67)	95 (11.73
Secondary/University	179 (22.98)	147 (18.15)
Religion		
Muslim	762 (97.69)	312 (38.52)
Christian	3 (0.38)	482 (59.51)
Other	15 (1.92)	16 (1.98)
Number of household members		
< 5	235 (30.13)	190 (23.46)
5–6	236 (30.26)	223 (27.53)
7–8	1555 (19.87)	165 (20.37)
>8	154 (19.74)	232 (28.64)
Sex of the household head		
Male	772 (98.97)	782 (96.54)
Female	8 (1.03)	28 (3.46)
Occupation of the household head		
Farmer/Breeder	378 (48.52)	668 (82.47)
Employee	61 (7.83)	13 (1.6)
Worker	322 (41.34)	113 (13.95)
Unemployed	18 (2.31)	16 (1.98)
Education of household head		
No education	397 (51.03)	625 (77.16)
Primary school	123 (15.81)	98 (12.1)
Secondary/University	258 (33.16)	87 (10.74)
Obstetrical history		
Gravidity		
1	122 (15.66)	152 (18.77)
2–3	270 (34.66)	228 (28.15)
>3	387 (49.68)	430 (53.09)
Stillbirth		
No	685 (87.93)	669 (82.59)
Yes	94 (12.07)	141 (17.41)
Economic		

Table 1 (continued)

Characteristics	Mali *N* = 780 *n* (%)	Burkina Faso *N* = 810 *n* (%)
Wealth index		
Poorest	229 (29.36)	291 (35.93)
Poorer	149 (24.23)	170 (20.99)
Middle	189 (20)	169 (20.86)
Rich	156 (20)	88 (10.86)
Richest	57 (7.31)	92 (11.36)
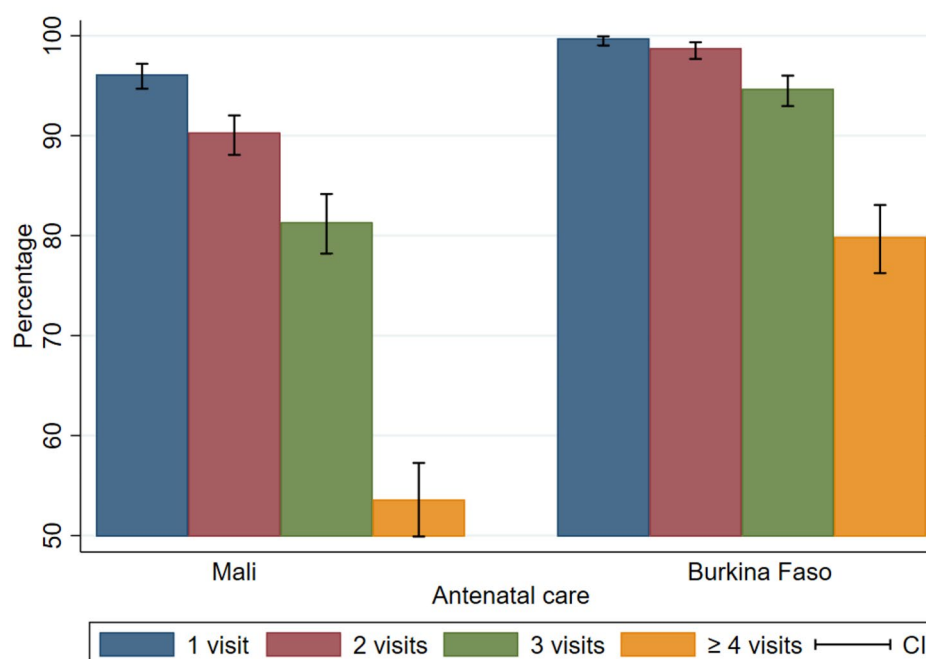
Fig. 2 Distribution of the number of ANC visits during the previous pregnancy, by country

the obstetrical history, the distance or time spent to reach the health facility, the ANC cost, and the women's lack of recognition of the importance of prenatal care.

ANC4 + coverage was 53.6% and 79.9% in Mali and Burkina Faso, respectively. These coverage estimates are higher than those reported in 2020: in Mali, in the Koulikoro region, which includes the Kangaba health district, ANC4 + was 32.3% whereas in Burkina Faso, in the region covering the Boussé health district (Plateau Central), it was 39% [17, 18]. The higher coverage rates in our study may reflect differences in ANC4 + within the Koulikoro and Plateau Central regions. This could also be explained by greater access to and use of care by women during the study period than in 2020, probably due to the COVID-19 pandemic. As the new WHO recommendations have not yet been implemented at scale in Mali and Burkina Faso, they have had no impact on the use of antenatal care in the two study districts. Our results in Burkina Faso are similar to those of 24 health districts included in

the performance-based financing in Burkina Faso where ANC4 + coverage was 80.80% [34]. The new recommendations stipulate that the first contact be made in the first trimester. This allows the determination of the number of fetuses and checking their viability, as well as the initiation of certain preventive measures such as the distribution of mosquito nets [13]. Additionally, it has been shown that early attendance in pregnancy is associated with a higher number of ANC visits throughout the pregnancy [26].

In Mali, we found that women with a history of stillbirth were more likely to seek ANC4+. This finding is in agreement with a study in Nigeria where stillbirth was reported to be a key factor in starting ANC follow-up early [35]. Infections during pregnancy (urinary tract infection, sexually transmitted infection, malaria, etc.) cause half of all stillbirths in developing countries. These infections and other pathologies are detectable during ANC visits, hence the need for more frequent antenatal
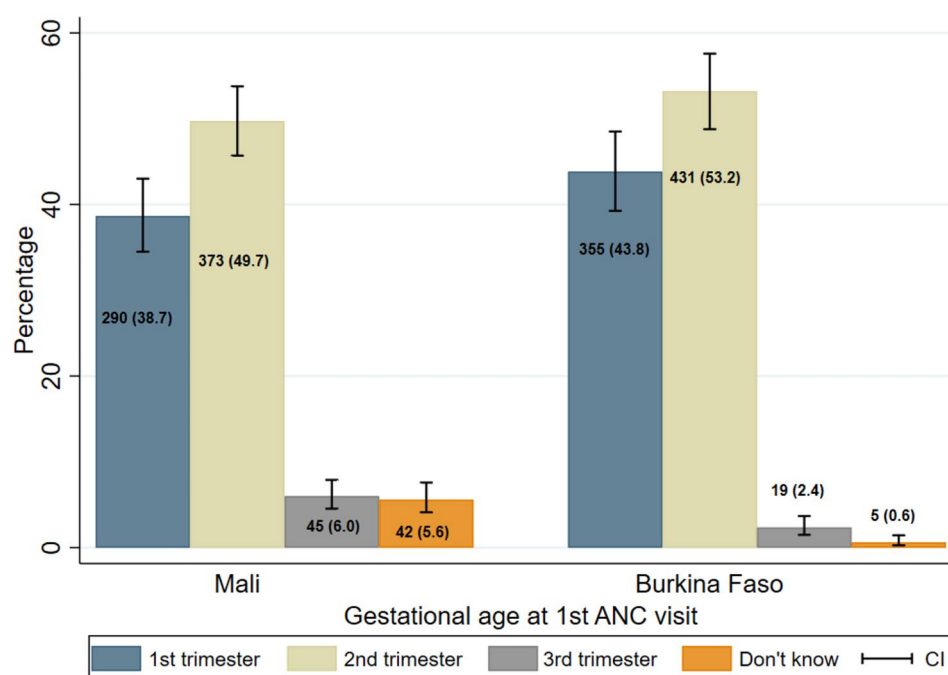
Fig. 3 Distribution of the gestational age at the first ANC visit among women, by country

care [4]. Having a stillbirth in a previous pregnancy is a negative experience for women; to prevent the same situation from occurring again, pregnant women could seek prenatal care more frequently.

Another finding in Mali was the positive association between the number of ANC4 + visits and the time spent waiting and receiving ANC services ≥ 1 h. Although we were unable to distinguish between waiting time and time spent in consultation, the time spent with a qualified healthcare staff could be a factor in encouraging pregnant women to attend several ANC visits as they have time to express their concerns related to their state of health and pregnancy. This fact was reported in Ghana where spending at least 20 min or more during the first ANC contact was associated with eight or more ANC contacts [36]. In contrast, pregnant women may perceive a relatively short consultation time as synonymous with the poor quality of health services provided, as reported in Uganda, Burkina Faso, and Tanzania, where the duration of first visits was < 15 min; and health workers spend even less time in subsequent visits because of noncompliance with all the procedures stipulated in the focused ANC guidelines [37].

The cost of the ANC visits perceived as high by the women was significantly associated with a lower probability of attending ANC4 + visits. This association was found independently of the household wealth index. Attending ANC involves both direct and indirect costs, especially in Mali where ANC visits for pregnant women are not free of charge [38]. In Burkina Faso, where healthcare has been free for pregnant and breastfeeding women

since 2016, the indirect costs for pregnant women can also be perceived as very high. Drug stockouts or when certain tests are unavailable or not offered free of charge in the health center can result in additional ANC-related expenses beyond travel costs [39, 40]. In the event of a drug stockout at the health center, the pregnant woman receives a prescription to pay for the medicines in private pharmacies. Additionally, tests such as the determination of rhesus blood group and obstetric ultrasound are not available in peripheral health centers, leading women to carry out these examinations at their own expense.

Pregnant women's knowledge of ANC recommendations influences whether they seek ANC. In Burkina Faso, we found that women who did not think it was necessary to make frequent visits to the maternity clinic in the absence of pregnancy-related problems were less likely to have made four or more visits. Thus, ensuring that women have better knowledge and understanding of what is expected from them in terms of ANC can have an impact on their attitudes toward ANC. A recent systematic review has reported the role of community health workers in improving knowledge about ANC and pregnancy outcomes [41]. Also, organizing focus groups on pregnancy for pregnant women could improve their understanding and encourage them to attend multiple antenatal visits.

Another factor preventing pregnant women from attending ANC4 + visits was the travel time to visit the maternity clinic in both Mali and Burkina Faso. In sub-Saharan Africa, the distance to the health facilities and

Table 2 Potential factors preventing women from seeking ANC services more frequently in Mali and Burkina Faso

	Mali *n* (%)	Burkina Faso *n* (%)
Reasons not to attend ANC		
ANC costs too much*		
Yes	206 (26.4)	58 (7.2)
No	574 (73.6)	752 (92.8)
No female health provider at the facility		
Yes	4 (0.5)	1 (0.12)
No	776 (99.5)	809 (99.9)
Facility not open		
Yes	1 (0.1)	0
No	779 (99.9)	810 (100)
The husband/family did not allow it		
Yes	50 (6.4)	4 (0.5)
No	730 (93.6)	806 (99.5)
Too far/no transportation		
Yes	22 (2.8)	59 (7.3)
No	758 (97.2)	751 (92.7)
Considered unnecessary		
Yes	127 (16.3)	88 (10.9)
No	653 (83.7)	722 (89.1)
Does not trust facility/Poor quality of service		
Yes	10 (1.3)	1 (0.1)
No	770 (98.7)	809 (99.9)
Unaccustomed to seeking ANC		
Yes	96 (12.3)	174 (21.5)
No	684 (87.7)	636 (78.5)
Travel time to reach the maternity clinic		
< 1 h	640 (82.7)	577 (71.2)
≥ 1 h	134 (17.3)	233 (28.8)
Time spent waiting and receiving ANC services		
< 1 h	276 (36.6)	180 (22.2)
≥ 1 h	477 (63.3)	630 (77.8)
Means of transportation		
Motorbike	112 (15)	38 (4.7)
Walking	535 (71.3)	122 (15.1)
Bicycle	2 (0.3)	629 (77.7)
Taxi	97 (13.5)	21 (2.6)
Expenses for ANC (US$)		
≤ 2	100 (17.1)	714 (88.1)
2.1–4	105 (18)	36 (4.4)
4.1–6	88 (15)	24 (3)
> 6	293 (50)	36 (4.4)

Footnote: Perception of the women interviewed regarding the ANC costs.

the quality of the roads are real problems for the population, particularly for pregnant women, to access healthcare [20, 42]. Pregnant women in Burkina Faso also reported distance, and not only travel time, as a limiting factor for attending ANC4 + visits in Burkina Faso [20]. In the Kangaba and Boussé areas, health centers are relatively far away, with bicycles, motorbikes, or walking as

the means of transportation, and are therefore difficult to access due to poor road conditions [43, 44]. This is even worse during the rainy season. This makes it particularly relevant to use community health workers to deliver counseling and to encourage women in the community to initiate ANC early and attend more ANC at the health center.

We acknowledge several limitations in this study. Because more than half of the women in Mali did not have their maternal health card, our main outcome variable (ANC4+) was defined based on the women's self-reports with a low concordance between self-reports and the maternal health card. The use of self-reported data could have led to a bias in the estimation of the number of ANC visits during the previous pregnancy. In addition to a possible recall bias, women may have been more likely to give positive/expected answers due to the interviewer's presence, therefore overestimating the number of ANC visits and the proportion of women with ANC4 + visits. However, even though the agreement between self-reported answers and data extracted from the ANC cards was very low in Mali, we found that women with or without an ANC card had similar overall characteristics, suggesting that this might not have influenced the associations we found when assessed the determinants of ANC uptake. Finally, in our study, we did not document certain factors that might also have influenced the use of ANC such as the real distance from health facilities, the seasonality, complications during previous pregnancies, the health personal knowledge of the ANC guidelines, and the quality and content of services [23].

Conclusion
This study revealed that in Mali, where the new WHO recommendations have not yet been implemented at scale, the rate of ANC4 + remains low, which calls into question the feasibility of the recommendation of eight contacts implementation. In Burkina Faso, where ANC4 + is relatively high, these recommendations were adopted in 2018. In both countries, factors identified as barriers to ANC uptake were mostly contextual or cultural, such as travel time to ANC, not recognizing the need for ANC, and the perceived high cost of ANC. Health policies aimed at meeting the new WHO recommendations may involve strengthening pregnant women's knowledge of the importance of contact with qualified health personnel. This would increase access to ANC more frequently for pregnant women. Finally, these countries could explore other strategies such as enlisting professionalized community health workers, to increase women's awareness and encourage them to receive antenatal care.

Table 3 Determinants of ANC4+, unadjusted and adjusted analyses stratified by country

Characteristics	Mali N=744						Burkina Faso N=810					
	Unadjusted			Adjusted			Unadjusted			Adjusted		
	OR	CI 95%	p-value	OR	CI 95%	p-value	OR	CI 95%	p-value	OR	CI 95%	p-value
Sociodemographic												
Age of the woman (years)			0.04			0.33			0.13			0.25
<21	1			1			1			1		
21–25	0.7	[0.5–1.1]		0.9	[0.8–1.1]		1.0	[0.6–1.6]		1.0	[0.9–1.1]	
26–30	0.6	[0.3–0.9]		0.8	[0.6–1.1]		0.6	[0.3–1.0]		0.9	[0.8–1.0.0]	
>30	0.5	[0.3–0.8]		0.7	[0.5–1.0]		0.8	[0.4–1.6]		1.0	[0.9–1.1]	
Ethnicity			0.36						0.22			
Bambara	1											
Malinké	0.9	[0.5–1.8]					-	-				
Fulani	0.6	[0.3–1.4]					-	-				
Sarakolé	0.7	[0.2–2.3]					-	-				
Mossi	-	-					1	-				
Gurunsi	-	-					0.5	[0–4]				
Other	0.7	[0.3–1.5]					0.2	[0–1.8]				
Marital status			0.32						0.83			
Married	1						1					
Single	0.7	[0.4–1.3]					0.9	[0.6 – 1.3]				
Women's education			0.07			0.41			0.53			
Secondary/University	1			1			1					
No education	0.7	[0.5–1.0]		1.0	[0.8–1.2]		0.7	[0.4–1.9]				
Primary school	0.6	[0.4–0.9]		0.8	[0.7–1.1]		0.9	[0.4–1.3]				
Religion			0.61						0.03			0.08
Muslim	1						1			1		
Christian	-						0.5	[0.3–0.9]		0.9	[0.8–0.9]	
Other	0.7	[0.2–2.2]					0.3	[0.1–1.0]		0.8	[0.6–1.1]	
Number of household members			0.01			0.44			0.70			
<5	1			1			1					
5–6	0.5	[0.3–0.8]		0.8	[0.6–1.0]		1.0	[0.6–1.7]				
7–8	0.5	[0.3–0.8]		0.8	[0.6–1.0]		0.8	[0.4–1.5]				
>8	0.6	[0.3–0.9]		0.9	[0.7–1.1]		1.0	[0.6–1.8]				
Sex of the household head			0.40						0.69			
Male	1						1					
Female	0.5	[0.1 – 2.4]					1.2	[0.4–3.0]				
Occupation of the household head			0.01			0.10			0.64			
Employee	1			1			1					
Farmer/Breeder	0.4	[0.2–0.8]		0.8	[0.7–1.0]		0.2	[0.4–2.0]				

Table 3 (continued)

Characteristics	Mali N=744						Burkina Faso N=810					
	Unadjusted			Adjusted			Unadjusted			Adjusted		
	OR	CI 95%	p-value	OR	CI 95%	p-value	OR	CI 95%	p-value	OR	CI 95%	p-value
Worker	0.5	[0.3–0.9]		0.8	[0.7–1.0]		0.3	[0–2.2]				
Unemployed	1.2	[0.3–3.9]		1.1	[0.8–1.5]		0.5	[0.1–2.7]				
Education of the household head			<0.01			0.12			0.37			
Secondary/University	1			1			1					
No education	0.5	[0.4–0.8]		0.8	[0.7–1.0]		0.7	[0.4–1.3]				
Primary school	0.7	[0.4–1.2]		0.9	[0.7–1.1]		1.0	[0.5–2.0]				
Obstetrical history												
Gravidity			0.02			0.38			0.33			
1	1			1			1					
2–3	0.6	[1.0–2.5]		0.8	[0.7–1.0]		0.8	[0.4–1.7]				
>3	0.5	[1.1–3.1]		0.9	[0.7–1.1]		0.7	[0.3–1.2]				
Stillbirth			0.01			<0.01			0.76			
No	1			1			1					
Yes	1.7	[1.1–2.9]		1.3	[1.1–1.6]		1.0	[0.6–1.8]				
Economic												
Wealth index			<0.001			0.10			0.12			0.06
Middle	1			1			1			1		
Poorest	0.7	[0.4–1.1]		0.8	[0.7–0.9]		1.0	[0.6–1.5]		0.9	[0.9–1.0]	
Poorer	0.9	[0.6–1.4]		0.9	[0.8–1.1]		0.7	[0.4–1.3]		0.9	[0.8–1.0]	
Rich	1.3	[0.8–2.1]		1.0	[0.8–1.2]		1.6	[0.7–3.8]		1.0	[0.9–1.2]	
Richest	1.5	[0.9–2.4]		0.9	[0.7–1.2]		0.7	[0.4–1.4]		0.9	[0.8–1.0]	
Means of transportation			0.37						0.51			
Motorbike	1						1					
Walking	1.0	[0.7–1.5]					0.6	[0.2–1.7]				
Bicycle	0.7	[0.4–12.8]					0.7	[0.3–1.9]				
Taxi/Car	0.7	[0.4–1.8]					1.8	[0.3–9.0]				
Expenses for ANC (US$)			0.68						0.27			
≤2	1						1					
2.1–4	1.2	[0.8–2.0]					2.1	[0.8–5.7]				
4.1–6	0.9	[0.5–1.6]					1.1	[0.4–2.9]				
>6	1.1	[0.7–1.7]					1.3	[0.6–2.7]				
Reason not to attend ANC												
ANC costs too much			<0.001			<0.001			<0.001			<0.001
No	1			1			1			1		
Yes	0.4	[0.2–0.6]		0.6	[0.5–0.7]		0.1	[0.1–0.2]		0.5	[0.4–0.7]	
No female staff			0.88									

Table 3 (continued)

Characteristics	Mali N=744						Burkina Faso N=810					
	Unadjusted			Adjusted			Unadjusted			Adjusted		
	OR	CI 95%	p-value	OR	CI 95%	p-value	OR	CI 95%	p-value	OR	CI 95%	p-value
No	1											
Yes	0.8	[0.2–3.7]										
Husband/Family did not allow			0.22									
No	1											
Yes	0.7	[0.4–1.2]										
Too far/No transportation			0.02			0.26			<0.001			0.03
No	1			1			1			1		
Yes	0.3	[0.1–0.9]		0.6	[0.3–1.3]		0.2	[0.1–0.5]		0.7	[0.5–0.9]	
Considered unnecessary			0.27						0.02			0.03
No	1						1			1		
Yes	0.7	[0.5–1.2]					0.6	[0.3–0.9]		0.8	[0.7–0.9]	
Don't trust facility/Poor quality of service			0.38									
No	1											
Yes	0.5	[0.1–2.0]										
Unaccustomed to seeking ANC			0.04			0.01			<0.01			<0.01
No	1			1			1			1		
Yes	0.6	[0.4–0.9]		0.7	[0.5–0.9]		0.4	[0.3–0.8]		0.8	[0.7–0.9]	
Travel time to attend ANC visit			<0.01			<0.001			0.01			0.04
<1 h	1			1			1			1		
≥1 h	0.5	[0.3–0.8]		0.6	[0.5–0.8]		0.6	[0.4–0.9]		0.9	[0.8–0.9]	
Time spent at ANC visit			0.13			0.01			0.28			
<1 h	1			1			1					
≥1 h	1.2	[0.9–1.6]		1.1	[1.0–1.3]		0.7	[0.5–1.2]				

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Abbreviations

ANC	Antenatal care
ANC4+	Four or more antenatal care visits
CI	Confidence interval
DHS	Demographic and Health Survey
INTEGRATION	INcreasing the upTakE of IPTp-SP throuGh Seasonal MalaRiA Chemo-prevenTION channel delivery
IPTp-SP	Intermittent prevention treatment with sulfadoxine-pyrimethamine during pregnancy
OR	Odds ratio
SMC	Seasonal malaria chemoprevention
WHO	World Health Organization

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12884-025-07568-2.

Supplementary Material 1: Supplementary Table 1. Variables chosen for analysis in Mali and Burkina Faso.

Supplementary Material 2: Supplementary Table 2. Concordance on the number of ANC visits during the last pregnancy using self-reported data vs. data extracted from ANC cards in Mali and Burkina Faso.

Supplementary Material 3: Supplementary Table 3. Spearman index correlation of ANC visits during the last pregnancy using self-reported data vs. data extracted from ANC cards in Mali and Burkina Faso.

Supplementary Material 4: Supplementary Table 4. Characteristics of women with an ANC card vs without an ANC card in Mali.

Data availability

The database used in this study is available from the University of Mali and access can be obtained after requesting authorization from the principal investigator; kayentao@icermali.org.

Declarations

Ethical approval and consent to participate in the survey

The study protocol was approved by the Institutional Review Boards/Ethics Committees and local health authorities in both countries (No 2022/83/CE/USTTB for Mali, No 2022-03-051/MSHP/MESRI/CERS for Burkina Faso) and of the Liverpool School of Tropical Medicine (22 - 006). Informed consent was obtained from the participants, their parents and their legally authorized representatives in this study. Only the participants' anonymous study ID was captured in the database.

Consent of publication

Not applicable.

Competing interests

The authors declare no competing interests.

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