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Barriers to malaria prevention services in pregnancy: a multi-methods study in rural western Uganda

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Abstract

Background Malaria in pregnancy (MiP) remains a substantial public health problem, accounting for a large proportion of adverse outcomes for both mothers and developing child in endemic areas. Although interventions such as intermittent preventive treatment in pregnancy (IPTp) have been shown to be effective, uptake remains suboptimal. This study aimed to identify factors associated with MiP among pregnant women at their initial antenatal visit and to explore perceptions of MiP among both midwives and pregnant women in the community to identify barriers to the utilization of available prevention services.

Methods Pregnant women attending their first antenatal clinic visit at one of four lower-level health facilities were screened for *Plasmodium falciparum* malaria using a rapid diagnostic test. Demographic characteristics and clinical measures were documented on case report forms to assess associations with the malaria test result. Quantitative findings informed focus group discussions with pregnant women and individual semi-structured interviews with midwives at each facility.

Results From February 2021 to September 2022, 1,644 pregnant women underwent testing for malaria. A total of 225 (13.5%) had a positive rapid diagnostic test (RDT) result. Primigravid status and younger maternal age were associated with malaria positivity. In the qualitative arm, stakeholders identified the following risk factors and barriers regarding MiP: (i) delayed testing for pregnancy and MiP, (ii) fear or hesitancy of chemoprevention, (iii) financial constraints, (iv) transportation barriers, (v) antenatal clinic operations, (vi) low bed net use, (vii) knowledge gaps, (viii) and attitudes of spouses.

Conclusion Young, primigravid women remain at the highest risk of MiP in rural western Uganda. Although consistent with findings from other regions, the impact of geographic barriers that may delay pregnancy testing and initiation of antenatal care merit further study. Approaches to decentralize services further into the community may be particularly beneficial.

Keywords Malaria in pregnancy, Plasmodium, Malaria, Uganda, Multi-methods

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Introduction

Despite established, evidence-based prevention guidelines, malaria in pregnancy (MiP) remains a significant public health problem. In 2020, for example, more than 120 million pregnancies occurred in malaria-endemic regions of the world, resulting in approximately 70 million live births [1]. Of these, approximately 25 million women were infected with *Plasmodium falciparum* or *Plasmodium vivax* during pregnancy [2]. Across sub-Saharan Africa (SSA), Southeast Asia, and parts of South America, MiP continues to be a leading cause of adverse outcomes for both mother and developing child [3]. In endemic regions of SSA, MiP accounts for approximately 70% of intrauterine growth restriction (IUGR), 36% of preterm deliveries, 20% of stillbirths, and 11% of neonatal deaths attributed to low birthweight (LBW) infants [4–6].

The World Health Organization (WHO) recommends that pregnant women living in regions of moderate and high malaria transmission, which includes most of SSA, receive at least three doses of intermittent preventive treatment in pregnancy (IPTp) using sulfadoxine pyrimethamine (SP) at one-month intervals beginning at the second trimester, generally around 14 weeks gestation [7]. However, in 2019, prior to the onset of the global COVID-19 pandemic, only 35% of pregnant women in SSA received three doses of IPTp during pregnancy [8]. The impact of the pandemic on IPTp uptake is not yet fully understood but is unlikely to have improved substantially during this period [9].

Like much of SSA, low uptake of IPTp has been a public health concern in Uganda, where MiP remains the leading cause of maternal anemia and LBW infants [10]. According to the 2016 Uganda Demographic and Health Survey, only 46% of women reported taking at least two IPTp doses, while only 17% reported taking at least three doses during pregnancy [11]. Although antenatal clinic (ANC) attendance rates should not be used as a proxy for IPTp uptake, studies have shown that uptake of IPTp-SP is associated with ANC attendance [7]. The number of ANC visits attended, however, may be a surrogate measure of geographic distance or travel burden to the clinic. If true, IPTp uptake may be particularly low in the areas of western Uganda where the rugged terrain of the Rwenzori Mountains further limits access to health services.

The purpose of this study was twofold. First, we sought to identify demographic factors associated with and a positive malaria rapid diagnostic test (RDT) among pregnant women seeking antenatal care at four primary health centers in the Kasese District. Second, given the high rates of MiP identified, we wanted to understand what factors may be contributing to the high rates of MiP in the region. To achieve this, we conducted interviews with key stakeholders in the community as part of

a contemporaneous prevention of mother-to-child transmission (PMTCT) of hepatitis B project [12].

Methods

Study setting

The study was conducted in the Kasese District, a malaria-endemic region of western Uganda notable for a rugged geography characterized by steep hillsides up to 2500 m in elevation due to its proximity to the Rwenzori mountains. The terrain and limited road network make vehicular transportation difficult. Most individuals travel by foot or motorcycle taxi, both of which are affected during the rainy seasons [13]. The climate permits year-round malaria transmission with seasonal peaks in January and July. *P. falciparum* accounts for the majority of malaria infections (>95%) in the district [14]. The most recent malaria indicator survey undertaken in the Tooro sub-national region, which includes Kasese District (2018–19), reported *P. falciparum* parasitemia rates (PfPR) 7.3% [15]. However, in a recent survey in the study areas, the PfPR among children 2 to 8 years of age was upwards of 30% in many of the lower elevation villages near the rivers [16].

Study design

We employed a multi-methods study design comprised of (i) a quantitative assessment of *P. falciparum* parasitemia as measured by malaria RDT among pregnant women at the time of first antenatal clinic attendance followed by (ii) interviews to explore factors that may be contributing to the high rates of MiP in the district.

To estimate the prevalence of *P. falciparum* parasitemia, we leveraged an ongoing hepatitis B PMTCT program that collected samples from February 2021 to September 2022, as malaria testing was performed concurrently with the PMTCT program. This study was nested within a pilot feasibility study implementing universal hepatitis B (HBV) screening and comprehensive care into routine antenatal services to prevent mother-to-child transmission. Women presenting to their first ANC visit were tested with a RDT for HBV and if positive, underwent additional testing to determine if antiviral prophylaxis was needed in the final trimester. The methods of which have been previously described [12]. In brief, clinic staff at four primary health centers in the Kasese District enrolled pregnant women presenting for their first antenatal visit or those in routine follow-up, but not previously screened for HBV. At the four primary health centers, palpation was conducted by midwives to determine the fundal height of a fetus, which, in combination with the date of a woman's last menstrual cycle, was used to provide an estimated gestational age. The four primary health centers in this study lacked ultrasound equipment, which is used to more accurately

determine gestational age based on the average size of an embryo or fetus at each developmental age.

Approximately 100 μ L capillary blood was drawn for HbsAg, HIV, and syphilis testing via a rapid diagnostic test per Ugandan guidelines [11]. While not part of routine screening, we added testing for malaria using a histidine rich protein 2 (HRP2) based RDT (SD Biosensor Standard Q Malaria P.f Ag, Gyeonggi-do, Republic of Korea). Results of testing were available within 20 min, after which time the ANC staff provided the results and appropriate post-test counseling to the patient. Ugandan guidelines do not recommend treatment of MiP based on asymptomatic malaria in pregnancy (i.e., post-test, but without symptoms). Instead, women receive IPTp and are advised to return if symptoms develop [17]. All data were also recorded directly into a tablet device with internet connectivity and uploaded to a central database [18].

To elucidate factors contributing to the high rates of malaria among pregnant women in the community, we conducted face-to-face semi-structured interviews (SSI) with midwives and hosted focus group discussions (FGD) with pregnant women. Participants in the FGDs were recruited from women in the waiting area of the ANC clinics at each of the health centers. Eligible women were approached by the interviewer, a member of the research team fluent in local dialect (e.g., Lhukonzo) who provided a brief introduction about the study. Interviews were conducted on the same day as their ANC visit, in a private room where responses could not be overheard by non-participants in the FGDs. Interviews were conducted in Lhukonzo and then translated by the interviewer into English for subsequent analysis. There were four FGDs each with 12 pregnant women. The sample size for the FGDs was established through pilot testing and the number of FGDs was determined based on the total number of study sites, with one FGD per ANC. The average FGD lasted 62:35 (mm:ss).

There were 12 individual SSIs with midwives. This sample size was determined by interviewing all available midwives at each of the four study sites. For the SSIs, midwives at each of the health centers were approached and introduced to the study by the interviewer. If the midwife consented to participate, she was interviewed at a private location at the health center. The average SSI lasted 37.19 (mm:ss). Due to the high English comprehension and speaking level among the midwives, the interviews were all conducted in English.

Interview questions were intended to solicit perceptions and experiences of pregnant women and health care providers in the community regarding the following:

- What are the perceptions of MiP, e.g., risk factors, consequences, severity, etc., among key stakeholders?

- What barriers, e.g., economic, environmental, social, etc., may inhibit pregnant women from receiving preventive care for MiP in the remote region?

Each interview guide had the same open-ended structure to allow for flexibility (S3 Appendix and S4 Appendix). To ensure the confidentiality of each participant, no personal identifiers were used. Instead, each participant was assigned a unique code number. For the FGDs, each woman was assigned a number from one to four to indicate her discussion group. Within each group, participants were further assigned a letter to distinguish individual responses. For example, FGD-3A refers to a pregnant woman in the third focus group, while FGD-3D indicates a different participant from the same group. The interviews were conducted from August 2022 to September 2022.

Statistical and qualitative analyses

All analyses were conducted in R version 4.0.3 [19]. For the continuous response variables (gestational age and maternal age), differences in these variables between women with a positive mRDT (mRDT+) and women with a negative mRDT (mRDT-) were tested using a Welch Two Sample t-test. A chi-squared test was used to assess associations between the outcome of interest—mRDT result—and categorical variables (maternal gravidity).

FGD transcriptions were developed manually, while the SSIs were transcribed using the transcription software Otter.ai [20]. The qualitative data was analyzed using thematic analysis with the qualitative data analysis software ATLAS.ti [21]. The following overarching theme was developed inductively after all interview transcriptions were completed: risk factors and barriers for the prevention and treatment of MiP.

Ethics statement

The study was approved by the University of North Carolina at Chapel Hill Institutional Review Board (UNC 20–2042) and the Mbarara University of Science and Technology Research Ethics Committee (47/03–20). Written informed consent was provided by all participants and the study was conducted in accordance with the Declaration of Helsinki.

Results

Parasite prevalence and risk factors

From February 2021 to September 2022, 1,644 pregnant women were enrolled from the antenatal clinics. The median age of women was 25.0 years (interquartile range [IQR] 18.0, 53.0) with a median gestational age of 22.0 (IQR 8.00, 29.0) weeks at initial visit (Table 1). Of those with an evaluable mRDT result, 225 of 1661 (13.5%) were

Table 1 Demographic factors stratified by mRDT result

	mRDT negative women (N=1416)	mRDT positive women (N=224)	Overall (N=1644)	P-Value	95% Confidence Interval
Gestational Age (weeks)				0.033	0.064–1.47
Mean (SD)	21.7 (4.94)	21.0 (4.96)	21.6 (4.96)		
Median [Min, Max]	22.0 [8.00, 39.0]	21.0 [8.00, 30.0]	22.0 [8.00, 29.0]		
Missing	3 (0.2%)	0 (0%)	0 (0%)		
Maternal Age ^a (years)				<.001	1.55–3.18
Mean (SD)	26.1 (6.38)	23.8 (5.66)	25.8 (6.34)		
Median [Min, Max]	25.0 [18.0, 53.0]	22.0 [18.0, 42.0]	25.0 [18.0, 53.0]		
Missing	1 (0.1%)	0 (0%)	1 (0.1%)		
Maternal Gravidity				0.0038	
Primigravid	325 (23.0%)	72 (32.1%)	398 (24.2%)		
Multi-gravid	1090 (77.0%)	152 (67.9%)	1245 (75.7%)		
Missing	1 (0.1%)	0 (0%)	1 (0.1%)		

^aOne value masked due to identified error in data entry

positive. When stratified by mRDT result, both younger maternal age and primigravid status were associated with an increased risk of *P. falciparum* parasitemia (Table 1). Notably, the prevalence of positive RDT among primigravid women was 18.1% (72/392) compared to 12.2% (153/1252) prevalence of positive RDT among multi-gravid women ($p=.004$). The median maternal age of RDT positive women was approximately 3 years less than RDT negative women (22.0 vs 25.0, $p = <.001$) (Table 1).

Given the observed collinearity between gravidity and maternal age, we examined the potential modifying effect of gravidity status and maternal age on malaria positivity. When examined for percent positivity among each age group (Fig. 1), no apparent association between malaria positivity and maternal age exists among primigravid and multigravid women. However, young (e.g., 18 years), primigravid women accounted for the largest proportion of women with a positive mRDT result, even compared to age matched multi-gravid women (51% vs 4%) (Fig. 2).

Barriers to MiP services

During the FGDs, respondents demonstrated high levels of awareness about the potential risk factors for MiP (Table 2). The FGDs and SSIs highlighted continued barriers to accessing critical services in the care cascade of MiP — including pregnancy testing, ANC attendance, and obtaining IPTp — with transportation and drug stock-outs being some of the most frequently reported issues.

Barriers to ANC attendance and uptake of preventive services for MiP

Financial limitations Financial barriers that limit pregnant women from acquiring antenatal resources, such as maternity dresses, baby wraps, and bedding were frequently reported. The shame and guilt associated with attending the clinic without these resources was viewed as a deterrent for many pregnant women, as described by two participants:

Sometimes if I don't have the necessary materials needed like the African prints [kitenge] or the maternity dresses, I don't find any reason as to why I should come to the health center...They [midwives] attend to you but as a pregnant mother, you become shy or feel guilty especially if you find that the other

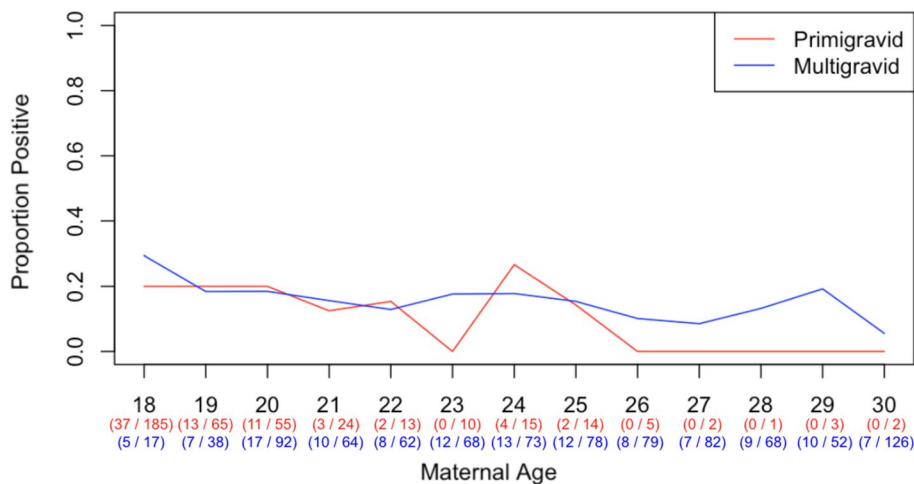


Fig. 1 Malaria test positivity rate (i.e., number positive/number tested) among pregnant women at initial antenatal clinic visit stratified by gravid status

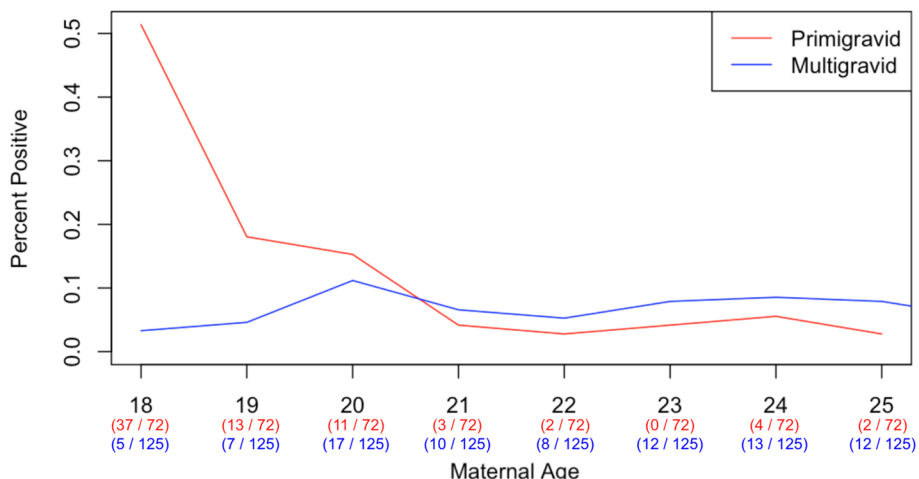


Fig. 2 Age distribution of pregnant women with a positive malaria rapid diagnostic test stratified by gravid status

Table 2 Summary of findings from focus group discussions and semi-structured interviews

<p>Delayed Testing for Pregnancy and MiP</p> <ul style="list-style-type: none"> - Delayed awareness of pregnancy status and late initial ANC visits during pregnancy were reported, which reduces the opportunity for optimal uptake of malaria chemoprevention 	<p>Fear or Hesitancy of Chemoprevention</p> <ul style="list-style-type: none"> - Fear or hesitancy of SP due to its potential adverse side effects and the size and smell of the drug, as well as rumors regarding the drug's safety are widespread
<p>Financial Constraints</p> <ul style="list-style-type: none"> - Lack of access to antenatal resources (e.g., maternity dresses, lesu, baby receivers, and bedding) creates shame or guilt among pregnant women, which limits ANC attendance 	<p>Transportation Barriers</p> <ul style="list-style-type: none"> - Limited access to boda bodas due to the rough terrain and limited financial resources limits access to ANCs - Exertion from walking long distances and general body weakness or nausea causes some pregnant women to avoid attending the ANC altogether
<p>Antenatal Clinic Operations</p> <ul style="list-style-type: none"> - Stock outages of SP were frequently reported - Inconsistent working hours and hostile attitudes of midwives were reported to discourage ANC attendance 	<p>Low Bed Net Use</p> <ul style="list-style-type: none"> - Lack of access to bed nets due to stock outages were reported - Lack of bed net use was reported due to physical discomfort from the nets, attitudes of husbands, and difficulty properly hanging the nets
<p>Knowledge Gaps</p> <ul style="list-style-type: none"> - Knowledge barriers surrounding the benefits of antenatal care were reported to limit early ANC attendance in pregnancy 	<p>Attitudes of Spouses</p> <ul style="list-style-type: none"> - Husbands' attitudes and perceptions of antenatal care play an important role in ANC attendance and bed net use

mothers have come with what you don't have (pregnant woman, FGD-5B).

They [midwives] may even ask for a lesu or even something they can use for padding...to stop the bleeding and most times you find that we don't have these things with us because we cannot afford them. So, it is a big problem, and it makes us want to stay

home and suffer from there instead of getting embarrassed at the health center (pregnant woman, FGD-4A).

Transportation barriers The two methods of transportation utilized by pregnant women attending the ANC were walking or motorcycle taxis, called *boda bodas*. The inability to access motorized transportation was reportedly caused by high fares. Due to the rugged highland terrain of the Rwenzori Mountains, many pregnant women reported no alternative method of transportation — “my place is non-motorable, if I don't walk, there is no other way of reaching the health facility” (pregnant woman, FGD-8D).

The exertion required to walk long distances combined with associated symptoms of fatigue and nausea was enough for some pregnant women to avoid attending the ANC altogether — “when you calculate the distance, and yet you are feeling weak, that alone limits us from attending antenatal because you are far away from the health center” (pregnant woman, FGD-3A). Walking long distances was also suggested by several women to exacerbate any existing illness(es) and to contribute to malaria exposures. Similarly, according to the midwives interviewed, the physical strain of walking and the economic burden of paying for transportation are enough for many pregnant women to limit their number of ANC visits, for instance:

Some come from long distances, they come from the mountains... she [pregnant women] says 'no for me, I'll come at 8 months, 6 months' because they wanted to shorten the frequency of going to the health facility (midwife, SSI-4).

Most of them [pregnant women] talk of distance, the distance is too far... so they come twice [to antenatal] (midwife, SSI-3).

Barriers to early identification of pregnancy and MiP

Delayed awareness of one's pregnancy status and late initial ANC visit during pregnancy were other reported risk factors for malaria infection. According to the interviews, the majority of pregnant women in the community arrive at the health center unaware of their pregnancy status and subsequently test at the clinic, where point-of-care tests are provided free of charge. A much lower proportion of mothers "test from villages... there are some VHTs [Village Health Teams] with the strips, so they go there and test... and some of them buy strips from the drug shops" (midwife, SSI-3). One pregnant woman (FGD-2A) reported that some women do not get any of the signs commonly associated with early pregnancy, so they do not know their pregnancy status until nearly four months and "that is where you find one getting sick of malaria and not fully treating themselves because they are not aware they are pregnant." The need for ANC visits early in pregnancy was also reported by another participant (FGD-10B) who stated that pregnant women are encouraged by health workers to visit during their third month of pregnancy to test for malaria and receive the full dose of chemoprevention. Another pregnant woman (FGD-12C) similarly reported that MiP is exacerbated by late antenatal care, which reduces a woman's opportunity for optimal uptake of malaria chemoprevention beginning during the third month of pregnancy.

Clinic operations The following factors related to clinic operations were mentioned as barriers: reliable supplies of key drugs – including SP – and diagnostics, as well as adversarial encounters with clinic staff. Of these barriers, stock outages were reported most frequently. One woman reported that due to stock outages she often does not attend ANCs, stating:

The main reason why I don't always come to this health center is because whenever I come for my antenatal visits, I am always told that the medicine for pregnant women is not available. They instead write the medicine for me and I am forced to go and buy from the clinic, so I do not see the reason why I should come (pregnant woman, FGD-10B).

The ANCs also provide preventive care in the form of IPTp-SP, long-lasting insecticidal net (LLIN) distribution, and "Mama Kits," which contain basic delivery supplies, such as gloves, razor blades, soap, sanitary pads, etc. These kits are only supplied at level three health centers (HCIIIs), which is where deliveries are conducted. Of the four health centers in this study, only two were HCIIIs, while the other two were level two health centers (HCII). However, preventive care in the form of LLINs and IPTp-SP were reportedly limited due to stock outages, as the following midwives explained:

The government is providing them [pregnant women] the mosquito nets and Mama Kits, but they are not enough (midwife, SSI-1).

The way we distribute mosquito nets, we run out of stocks. So, when we get some, we give when they are there, but when they are not there, we don't give, and so we think those months we don't give, most of them [the pregnant women] get malaria (midwife, SSI-3).

We get stock outs, like, if Fansidar is out of stock... or hematinic, the folic, the ferrous... you might find that they are out of stock from the health facility, so they [the pregnant women] go home without these services (midwife, SSI-11).

In addition to stock outages, two participants reported issues related to inconsistent working hours and hostile attitudes. For instance, one pregnant woman (FGD-9B) reported that "sometimes they send us health workers [midwives] who are arrogant such that they discourage you from explaining your health issues." This same participant (FGD-9B) also stated that she doesn't always come to the health center because of failure of the midwives to report on time and another (FGD-1C) reported that she struggles to find midwives present full-time, particularly after 1:00 p.m., so she is forced to attend a HC III further away for ANC services. Several midwives reported that pregnant women had told them that they delayed antenatal care because of prior experiences with a "rude" or "arrogant" midwife. One midwife also reported that during Mondays and Wednesdays, when the clinic is often busiest, there are only "one or two on the shift, so they [pregnant women] will have to wait for long hours to be worked upon... and these mothers will get discouraged and if it happens twice...she will get discouraged and may decide to stay at home" (midwife, SSI-1).

Knowledge gaps and fear Over half of the midwives interviewed reported knowledge gaps surrounding the benefits as a factor limiting early ANC attendance. Health education services are provided to mothers once they reach the clinic, but according to some midwives, reaching mothers in the community remains a challenge. For instance:

The biggest barrier... some [pregnant women] have a knowledge gap about the services, like they... don't take it seriously that antenatal is something important (midwife, SSI-11).

And even others, they don't know that they are supposed to. There is a knowledge gap that they're supposed to attend antenatal... (midwife, SSI-4).

Few midwives provided examples of outreach efforts, particularly with community health workers, known

locally as village health teams (VHT), to educate mothers early in their pregnancy about the importance of antenatal care. The midwives have even “encouraged VHTs... [to] give health talks, like on occasions... [such as] burials, in weddings, in churches” to the community about the importance of antenatal care (midwife, SSI-11). In addition, visiting ANCs is not a private event, so if a woman wishes her pregnancy to remain private from her family or the community, she will avoid visiting the clinic for fear of disclosing her pregnancy status. As mentioned by one midwife, this is especially the case for younger women and adolescent girls.

Utilization of preventative interventions

Long-Lasting Insecticidal Nets (LLINs) Based on the reports from the interviews, low LLIN use can be divided into two categories: 1) lack of access and 2) underutilization, despite access. Low ownership was the most frequently reported barrier, along with attitudes (e.g., “lack of care for one’s health” and “laziness”), and physical discomforts (e.g., heat). Other less commonly reported challenges were difficulties with properly hanging the nets, damage and loss, and fear of the nets catching on fire from candles.

A lack of access to LLINs was reportedly due to low government supply. One pregnant woman (FGD-3C) reported that “most women last received bed nets during the 2020 Universal Net Campaign”, however, in a separate interview, another pregnant woman (FGD-6D) stated that during the Universal Net Campaign, only individuals with a national identity card, provided to citizens of Uganda 18 years and older, were able to receive a net. This point was corroborated by another pregnant women (FGD-4D) who said, “when I started antenatal care visits for my first time, I was given a net, and they used to give us nets based on the national IDs. Anyone who did not have it, couldn’t receive a net unless she brought that of the husband.” A pregnant woman in a separate interview group (FGD-3C) also stated that health workers (midwives) only provided nets to women who actively had malaria and another participant (FGD-4D) reported that health workers only provided nets to “lactating mothers with babies between one to two years.”

However, there were inconsistencies between the reports from the FGDs and SSIs regarding LLIN distribution. The reports from the midwives during the SSIs varied — one midwife believed that all pregnant women ought to be provided a net upon their initial ANC visit, while another thought that pregnant women should receive a LLIN during their third trimester. One midwife also stated that nets should be provided to women who were not provided a net during their prior ANC visit or to “those who come from other facilities where they don’t have nets” (midwife, SSI-8).

Attitudes of spouses on bed net use During the FGDs, husbands were frequently reported as barriers to LLIN use. For instance:

I fail to sleep under the mosquito net because my husband says the mosquito net makes him uncomfortable or it makes him fail to get sleep at night (pregnant woman, FGD-11B).

My husband has a tendency of not sleeping under the mosquito net and even when I try to complain about it, he insists that it makes him sweat at night (pregnant woman, FGD-8A).

Midwives reported that husbands’ attitudes and perceptions of antenatal care also play an important role in pregnant women’s care. One midwife stated that “the husbands have a low attitude” surrounding antenatal (midwife, SSI-11), while other women have “husbands who are strict... someone will tell you... the reason why I have started antenatal late my husband said I should not be coming. I should not come early... to antenatal” (midwife, SSI-10).

A few midwives reported the importance of men attending initial ANC visits with their partners and that mothers “delay because they want their husbands to bring them [to the clinic]” (midwife, SSI-12). The thought is, if the husbands understand the types of services provided at antenatal and their importance, they will encourage or remind their partners to receive antenatal care early and often and even encourage SP use. For instance, “...if we keep encouraging them [pregnant women] to come with their husbands... when the husband comes, he will continue to encourage the mother to take the tablet [SP]” (midwife, SSI-6).

Chemoprevention

Perceptions of IPTp-SP The topic of chemoprevention, particularly the use of IPTp-SP, was the longest topic of discussion throughout the FGDs. In general, more participants provided responses surrounding the barriers to taking SP than the benefits. Among participants who responded positively about the use of SP, there was a consensus about its role in providing protection against malaria. For instance:

Whenever I start these [SP] pills early while pregnant, it helps me a lot and I don’t get sick frequently. I have given birth to five children and have never gotten malaria while pregnant (pregnant woman, FGD-2C) (note: participant 2C reported taking SP throughout all five of her pregnancies).

I used to get malaria a lot but ever since I started receiving this medicine [SP pills], I no longer get sick of malaria (pregnant woman, FGD-11C).

Many of these same participants also mentioned the benefits of SP use for the health of the fetus. A pregnant woman (FGD-12D) even claimed that SP gave her the impression she was healthier, stating that "...when I am given Fansidar, I feel better. If I have been feeling weak, I start feeling fine and my mind tells me that I am feeling better because of the SP pills given to me." In the community, the average price for SP pills at a local drug shop is around 2,000 UGX for three tablets (note: this cost was reported by participant FGD-10B). However, when there are no stock outages, the four primary health centers provide pregnant women SP free of charge upon each ANC visit roughly one month apart starting at 13-weeks gestation.

Barriers to IPTp-SP and Directly Observed Therapy (DOT) Despite the benefits of SP use reported in the previous section, responses from all four FGDs suggest that uptake of IPTp-SP remains sub-optimal. The drug's side effects (e.g., dizziness, weakness, and vomiting) were the most common barrier reported, while the large size and unpleasant odor of the pill were also noted. For example:

One issue I have about Fansidar is that you cannot take it before having your meals. If I do... then I will start feeling weak, so it's best to take it after eating (pregnant woman, FGD-1A).
I feel dizzy after taking the medicine. I think it's because I take them on an empty stomach (pregnant woman, FGD-4B).

These adverse side effects have caused concern within the community regarding the drug, resulting in fear or hesitancy with its uptake. According to one woman, rumors surrounding its safety are widespread in the community, for instance, that the drug causes delays in labor, abnormal deliveries, and cesarean sections. As a result, some pregnant women do "not swallow the medicine [SP]" rather "they simply keep the medicine or even throw it away because of these rumors" (pregnant woman, FGD-2A). From the interviews, there also appear to be inconsistencies with SP administration. Some pregnant women reported being forced to take the pill in front of the presiding midwife via directly observed therapy (DOT), while others reported being able to take the pills home with them, for instance:

...they [midwives] instruct us to take them [SP pills] from the facility as they directly observe us (pregnant woman, FGD-3C).
...these days, they [midwives] started refusing [to pack the pills to go]...instead, give you water to take the tablets as they observe (pregnant woman, FGD-2C).

Some participants insisted that instead of DOT, the health care workers "should allow us [pregnant women] to take them [SP pills] while in our homes" (pregnant woman, FGD-9C). For instance:

...when we are at the health centers, the nurses deliberately tell us to take this medicine with water, yet they are not sure of whether one has eaten something or not. You may not even have money to buy a yellow banana at that time and if someone ends up vomiting it [SP pill] out, they [midwives] will still scold them and say that they have wasted the drug, yet they don't inquire if one is comfortable with taking it at the health center or at home (pregnant woman, FGD-3B).
Sometimes these nurses give us the medicine, they tell us to take the medicine while at the facility and they do this without even being sure whether a mother has eaten food or not. So, I was suggesting that they always pack these drugs for us so that when one gets home, they can first eat some food and then take the medicine (pregnant woman, FGD-1A).

However, other participants believed that instead of packing the drugs to take at home, pregnant women should simply eat or drink something before attending the ANC to minimize the adverse side effects of the drug. For instance:

...when we [pregnant women] are going for antenatal care at the health facility, we should all go after having a meal, so when we get there, we are able to take the pills with ease (pregnant woman, FGD-3C).
...we [pregnant women] should always ensure that by the time we are taking it [SP pills] we have enough fluids to take, so that we do not face any other challenges" (pregnant woman, FGD-4A).
...when you go for antenatal care services, you should first eat to be able to take the pills as you reach the health center (pregnant woman, FGD-2C).

Others recognize that without DOT, many pregnant women would neglect to take the pills out of fear. For example, one pregnant woman (FGD-8A) stated that,

...since I fear taking medicine, I may end up throwing it away on my way home. So, for me I think the practice of nurses telling us to take Fansidar from the health facility is a good practice and it is up to us to either go to the facility while we have eaten or not eaten because we are always aware that we are going to be given Fansidar when we reach the health center.

Another pregnant woman (FGD-7B) similarly stated that “some pregnant mothers are given this medicine [SP pills] to go take it from home and they resort to keeping the medicine instead of taking it. So that’s why the nurses prefer people taking the SP pills from the health center where they can watch them.”

Many of the same complaints about the SP pills reported by pregnant women during the FGDs were reiterated during the SSIs with midwives. Nausea associated with taking the pills on an empty stomach, for instance:

The way they are administered [SP pills], it’s oral treatment and most oral treatments irritate the GI or gastrointestinal tract ... a few others come when they have not eaten breakfast, and they are hungry and here you are giving tablets on an empty stomach... and you find others have vomited even when we have given the treatment as directly observed.... It would be well you give the treatment with some little accompaniment, even if it is a yellow banana to avoid some of these irritations and it would help to advise these mothers to take treatment as directly observed (midwife, SSI-1).

Some fear those drugs because when they take those drugs, they vomit. Some fear them and it’s a barrier (midwife, SSI-4).

From the SSIs, it appears that there are inconsistencies with patterns of DOT. Some midwives reported that if a pregnant woman vomits the medication within the first 15 minutes, they will normally pack the drugs for her to take from home. Other midwives reported refusing to pack the drugs for women to take at home, which, according to one midwife, has created conflicts between patients and the health care workers.

Suggestions to increase IPTp-SP uptake A few participants offered recommendations to minimize potential barriers of IPTp-SP. One pregnant woman (FGD-6A) recommended educating husbands on the adverse side effects of SP, so that “they will be able to encourage us to take enough fluids so as to avoid any challenges.” Another pregnant woman (FGD-11A) recommended a similar educational approach, except among health care workers; “...when the nurses are prescribing the drugs to us, they should take time to explain to us more about the drugs and even the side effects of the drug and they can go ahead and explain to us on how we should drink a lot after taking the medicine so that we don’t face challenges while taking it.”

To combat the issue of taking SP on an empty stomach, one pregnant woman (FGD-9B) recommended providing water and yellow bananas at the health center “so that those who prefer taking their medicine with water can be

favored and those who prefer taking their medicine with yellow bananas can also be favored.” Regarding the drug itself, some participants suggested changing the drug, for example, two pregnant women in the fourth discussion group (FGD-5D and FGD-4D) recommended altering the drug to be in the form of an injection, like that of the tetanus vaccine. Another participant in this focus group (FGD-11D) also recommended reducing the size of the pill and coating it with a sweet taste to make the drug more tolerable. However, some of these suggestions were not shared by participants in other focus groups, for instance:

I think reducing the size of the drug is not the best option because it will remain Fansidar. They [midwives] will give you the same medicine, you go home and take it and still get nausea... (pregnant woman, FGD-10B).

...for me I don’t think there is any other drug they can change for us. Even if they give us Coartem, we shall still complain that it also smells bad, so I think we should just continue taking Fansidar (pregnant woman, FGD-2B).

...there is no way they can change this medicine [SP] (pregnant woman, FGD-11C).

During the SSIs, many of the midwives reported providing health education services to the mothers who refuse to take the SP pills. For instance, they provide information about the benefits of the drug, the dangers of MiP, and advise them to eat breakfast or carry extra cash when coming for ANC, so that “if she feels like she’s getting dizzy or vomiting she can go and buy a pancake [from the trade center]” (midwife, SSI-4). If a midwife sent medication home, a number of recommendations were provided to encourage compliance. They encouraged women to attend ANC visits with their husbands, have treatment partners at home, and provide contact information so that the midwives could call or send text reminders (note: treatment partners are individuals who remind patients to take their medicine e.g., spouse, elder child, parent, etc.). As mentioned by one midwife, there is also a resource called Family Connect, which deploys trained VHTs in the community to register and visit pregnant women, which could be utilized to remind pregnant mothers to take SP.

Discussion

This study—one of the first conducted in rural western Uganda—quantitatively and qualitatively examined the prevalence, risk factors for, and the barriers to uptake of malaria prevention in pregnancy. Overall, we identified *P. falciparum* parasitemia in more than 1-in-9 women (13.5%) making their first antenatal visit – a proportion

that likely underestimates the true prevalence given the low sensitivity of RDTs compared to PCR [22, 23]. At the same time, our qualitative analysis identified issues related to access to and the uptake of MiP services in this relatively remote and under-resourced region. We believe that many of these challenges can be addressed through targeted education campaigns, but in other areas, more substantial investment and novel approaches are likely required.

Our quantitative findings demonstrate that primigravid women and women of lower maternal age (i.e., age ≤ 24 years) were significantly more likely to have a positive mRDT at initial ANC visit as compared to multigravid women and women of higher maternal age. A 2019 study in Uganda found primigravid women at initial enrollment to have an 84% higher risk of microscopic parasitemia and approximately three times the risk of placental malaria compared to multigravid women [24]. It is speculated that this phenomenon is caused by the development of protective antibodies for malaria throughout successive pregnancies [25]. These results highlight the urgency for younger and primigravid women in the community to initiate antenatal care as early as possible and maintain continuity with monthly visits throughout pregnancy. To ensure that pregnant women can access antenatal care early in their pregnancy, outreach efforts with VHTs targeted towards young women of reproductive age as well as outreach efforts to sensitize husbands in the community to the importance of ANC attendance and bed net use are needed. Another potential intervention is to make pregnancy tests and SP available within the village (i.e., via VHTs) to minimize access to ANCs as a barrier for the prevention of MiP.

The FGDs and SSIs highlighted continued barriers in accessing MiP prevention and treatment services with transportation and drug stock-outs being some of the most frequently reported issues. Regarding existing interventions, access to LLINs and side effects of SP were common themes. Potential solutions that emerged regarding side effects were offering a snack with SP administration at each clinic. To address knowledge gaps, one suggestion was to provide health education services via outreach programs with VHTs to address many of the fears surrounding SP use as well as possible solutions to mitigate its adverse side effects with women in the community. This question was raised by a randomized trial in Burkina Faso, which found delivery of IPTp at the community level to be effective at increasing doses of IPTp administered without affecting ANC coverage [26]. Another study qualitatively examined the impacts of a community-based IPTp (c-IPTp) program in high malaria burden districts of Burkina Faso, finding c-IPTp feasible to facility and community healthcare workers [27].

Our findings are consistent with those of a 2023 systematic literature review on SP perceptions among pregnant women in SSA. For instance, the study reported that complaints of SP's unpleasant side effects suggest "that women are not adequately informed about SP during their ANC visits" and that to reduce fear or stigma surrounding the drug, pregnant women "should receive information on the safety and side effects of pregnancy drugs at the ANCs" but that "this education has to go beyond the clinics to the communities, especially in rural areas, to reach all community members and the women who do not visit hospitals during pregnancy" [28].

Our study has several strengths including a large sample size for the quantitative ($n=1644$) and qualitative ($n=60$) components, which enhances the validity of our findings and allows for greater diversity of perspectives to be captured. However, it also has important limitations. First, the study was conducted in a relatively remote region of the Kasese District among pregnant women who were able to attend ANC visits. Thus, the experiences of women in other settings or perhaps more importantly those who were not able to attend ANC, are not captured (i.e., selection bias). For the qualitative results, the FGDs were conducted in the local Lhukonzo language, to minimize potential language barriers. However, errors in transcription between Lhukonzo and English may have arisen due to the differences between the two languages. To minimize this error, the study questions were piloted, translated, and transcribed by a native Lhukonzo speaker.

The interviews were conducted with pregnant women who were already present at the health center, so their experiences and perceptions may not represent those of women in the community unable to attend ANCs altogether. For the quantitative results – as noted above – mRDTs have relatively low sensitivity for the detection of asymptomatic parasitemia, especially at low parasite densities [29]. Due to the insensitive nature of RDTs, the true prevalence of malaria in the community is likely much higher than the values reported in this study. Another limitation pertained to maternal gravidity, which is defined as the number of times a woman has been pregnant in their lifetime, regardless of gestational age. This introduced a limitation because the number of living children a woman has is not equivalent to gravidity, but because this information could not be derived from the available data, the reported number of living children was used as an estimate for a woman's gravidity.

Conclusions

In this study, where late presentation to initial ANC visit during pregnancy was reported, we found a greater risk of malaria infection among women of lower maternal age and among primigravid women. Numerous risk

factors and barriers to uptake of malaria prevention in pregnancy were also reported through interviews with key stakeholders including: (i) delayed testing for pregnancy and MiP, (ii) fear or hesitancy of chemoprevention, (iii) financial constraints, (iv) transportation barriers, (v) antenatal clinic operations, (vi) low bed net use, (vii) knowledge gaps, (viii) and attitudes of spouses. Together, these findings suggest that there are many missed opportunities for the prevention of MiP. Potential community-based, education interventions that merit further study include health education outreach programs with VHTs and women of reproductive age to address the fears surrounding SP use as well as outreach efforts to sensitize husbands in the community to the importance of ANC attendance and bed net use. Novel interventions include the provision of pregnancy tests and SP pills through village-based VHTs to minimize access to ANCs as a barrier for the prevention of MiP.

Abbreviations

ANC	Antenatal clinic
c-IPTp	Community-based intermittent preventive treatment in pregnancy
DOT	Directly observed therapy
FGD	Focus group discussion
HC	Health center, e.g., HCI, HCII, HCIII, HCIV
IPTp	Intermittent preventive treatment in pregnancy
IUGR	Intrauterine growth restriction
LBW	Low birth weight
LLIN	Long-lasting insecticidal net
MiP	Malaria in pregnancy
mRDT	Malaria rapid diagnostic test
PMTCT	Prevention of mother-to-child transmission
PfPR	<i>Plasmodium falciparum</i> Parasitemia rates
RDT	Rapid diagnostic test
SP	Sulfadoxine pyrimethamine
SSA	Sub-Saharan Africa
SSI	Semi-structured interview
UGX	Ugandan shilling
VHT	Village health team
WHO	World Health Organization

Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s12889-025-24314-7>.

Supplementary Material 1: S3 Appendix. Interview Guide for Semi-Structured Interviews.

Supplementary Material 2: S4 Appendix. Interview Guide for Focus Group Discussions

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Publication

Not applicable.

Authors' contributions

R.C.H. was responsible for the conceptualization of the study, formal qualitative and quantitative analysis—including all coding, funding

acquisition, writing of the main manuscript text, and curation of all figures and tables. H.N. was responsible for the collection of the data for the contemporaneous PMTCT of hepatitis B project that was used for the quantitative analysis. G.N. was responsible for conducting and transcribing the FGDs and SSIs and translating the FGDs into English. E.B., S.B., M.N., E.M., and R.M.B., were responsible for the project administration, supervision, and resource acquisition. R.M.B. also assisted with funding acquisition, quantitative analysis, and reviewing and editing of the manuscript.

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Data availability

No datasets were generated or analysed during the current study.

Declarations

Ethics approval and consent to participate

The study was approved by the University of North Carolina at Chapel Hill Institutional Review Board (UNC 20–2042), the Mbarara University of Science and Technology Research Ethics Committee (47/03–20) and the Uganda National Council of Science and Technology. Written informed consent was provided by all participants and the study was conducted in accordance with the Declaration of Helsinki.

Competing interests

The authors declare no competing interests.

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