INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH AND INNOVATIVE STUDIES
ISSN: 2820-7157
www.ijsrisjournal.com

April 2026 Volume 5 Number 2 68-80

Received Date: 22 February 2026 Accepted Date: 14 March 2026 Published Date: 2 April 2026

# Medical and historical factors influencing susceptibility to malaria among pregnant women in the Malende Health District, DR Congo

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**Abstract**

Malaria is a major health problem, particularly for pregnant women, due to the serious complications it causes, such as anaemia, preterm birth and low birth weight. This study aims to identify the medical and historical factors influencing susceptibility to malaria among pregnant women in the Malende Health Zone in the Democratic Republic of the Congo.

**Methods:** This descriptive and correlational study involved 72 pregnant women attending the Malende Health Centre between November 2023 and March 2024. Data were collected through interviews using a structured guide. Statistical analysis was performed using SPSS, employing the chi-square test to assess relationships between variables.

**Results**: The results show that 44.4% of pregnant women tested positive for malaria. Multiparity, lack of preventive treatment and irregular use of insecticide-treated bed nets are significant factors associated with high malaria prevalence. Furthermore, low educational attainment and inadequate antenatal care were identified as increased risks.

**Conclusion:** Malaria remains a serious threat to the health of pregnant women in this region. Measures such as improving access to preventive treatment and promoting the use of insecticide-treated bed nets are essential to reduce the prevalence of malaria.

**Keywords:** Malaria, pregnant women, prevention, insecticide-treated bed nets, antenatal care, Democratic Republic of the Congo.

## Introduction

Malaria is one of the most widespread infectious diseases in the world, affecting populations in tropical and subtropical regions in particular. Pregnant women represent a high-risk

group, as malaria can lead to serious complications for both the mother and the foetus. In these regions, pregnancy is accompanied by physiological immunosuppression, making pregnant women more vulnerable to malaria infections. This increased vulnerability results in heightened risks of miscarriage, preterm birth, severe anaemia, and even maternal and neonatal death. (Yaya & Ze, 2013)

Several factors can contribute to the occurrence of malaria in pregnant women. These include environmental factors such as proximity to marshy areas or the rainy season, socio-economic factors such as low income and education levels, as well as barriers to accessing adequate healthcare. Furthermore, cultural behaviours and practices can also play a decisive role, such as the inconsistent use of insecticide-treated bed nets, or low attendance at antenatal clinics. (Darriet, 2017)

In recent years, progress in the fight against malaria has stagnated. Not only does malaria continue to pose a direct threat to health and claim lives, but it also perpetuates the vicious cycle of inequality. The most vulnerable people, including pregnant women, infants, children under five, refugees, migrants, internally displaced persons and indigenous populations, continue to be disproportionately affected. (WHO, 2024)

Indeed, malaria in pregnant women is a major public health problem in Africa. It has serious consequences for the mother, the foetus and the newborn. It is responsible for high rates of maternal and child morbidity and mortality. Pregnancy reduces a woman's immunity to malaria, increasing the risk of infection, severe illness and death. Gender inequalities, discrimination and harmful gender norms increase their risk of contracting the disease. If left untreated, malaria during pregnancy can lead to severe anaemia, maternal death, stillbirth, preterm birth and low birth weight. (WHO, 2024)

For example, climate disruption leads to an increase in malaria cases due to longer and more intense rainy seasons. This can be explained by the fact that when it rains, pools of water remain in the environment for a long time. These pools of water serve as breeding grounds for mosquitoes that bite humans, and particularly pregnant women. Similarly, the proliferation of unmaintained fish ponds leads to an increase in malaria vectors in the region, particularly among women and children. Likewise, poor environmental hygiene and the lack of sewage systems also contribute to the rise in malaria cases. Stone quarrying in various areas of this Health Zone is one of the sources of malaria; sometimes, after stones have been extracted, holes are left behind. Thus, after rain, these holes become a favourable breeding ground for mosquitoes. (Magne, 2012)

It is estimated that approximately 300–500 million cases of malaria each year result in 1–2 million deaths; around 11.6 million of the 33.8 million pregnant women, or 34%, are affected by malaria. Across the continent, East Africa has the highest rate of exposure to malaria during pregnancy at 40%, followed by Central Africa at 39% and Eastern and Southern Africa at 22%. (WHO, 2023)

In France, out of 60 pregnancies, 5 were excluded due to elective abortions; 55 were studied, of which 11 were first-time pregnancies and 44 were subsequent pregnancies. The pregnancies were singleton (n=51) or twin (n=4). The mean age was 30.4 years (range 19–45 years). Of the 55 cases, 9 had a miscarriage (8 singleton and 1 twin pregnancy) and 1 had a stillbirth at 21 weeks' gestation, all immediately following the malaria episode. 45 women gave birth (29 vaginal deliveries and 16 caesarean sections) to 48 newborns (42 singletons and 6 twins). Of these, 30 were healthy full-term newborns, 10 had low birth weight (LBW) and 8 were preterm. Overall, 26 of the 55 pregnancies (47.3%) and 29 of the 59 children (49.2%) had adverse outcomes. Compared with singleton pregnancies, twin pregnancies were associated with adverse outcomes (p=0.0438). (Imbert et al., 2024)

Across the African continent, the report notes that West Africa has the highest rate of exposure to malaria during pregnancy (40%), followed by Central Africa (39%) and East and Southern Africa (22%). (Africa Renewal, 2022)

In sub-Saharan Africa, more than 50 million women become pregnant each year and are at risk of exposure to Plasmodium falciparum, the parasite that causes the deadliest form of malaria in the world. If left untreated, malaria during pregnancy can lead to maternal death, anaemia or low birth weight – a major cause of infant mortality. IPTp with quality-assured sulfadoxine-pyrimethamine (SP) during pregnancy can prevent these problems and other adverse outcomes. Although the WHO and its global health partners have long aimed to prevent malaria in pregnant women, coverage of IPTp-SP during pregnancy remains low. Only 22% of eligible pregnant women had received at least three doses of preventive treatment across 33 African countries. The long distances many pregnant women must travel to reach antenatal care clinics and the cost of transport also hinder access to IPTp-SP. Women who do reach health facilities sometimes face difficulties in accessing IPTp-SP due to SP stock-outs or because health workers are not sufficiently informed. (WHO, 2019)

In Africa, malaria in pregnant women is a major public health problem. It has serious consequences for the mother, the foetus and the newborn. It is responsible for high rates of

maternal and infant morbidity. In Niger, this disease is common, with an average parasite density of 177 P/µl (SD: 121; [40–800]). All infections were caused by P. falciparum. Just over seventy-three per cent (73.6%). Only 26.4% (24/91) had uncomplicated malaria; 9.6% (6/91) suffered a miscarriage; 38.4% of newborns had low birth weight and 26.51% (66/249) developed congenital malaria. The case-fatality rate was 1.1% (1/91). Intermittent preventive treatment (IPT) provides significant protection against gestational malaria (p=0.01). (Oumarou et al., 2020)

In Burkina Faso, the overall prevalence of the *P. falciparum* HRPII antigen was 18.6% with a 95% CI of [16.1–21.5]. This study found that the risk of malaria infection was significantly higher among pregnant women who: had not attended school, lived in the city's outlying neighbourhoods known as 'unplanned areas' and in surrounding villages, and did not use mosquito nets. For various reasons, the administration of sulfadoxine/pyrimethamine was not supervised, and fewer than 50% of women slept regularly under a mosquito net. (Ouédraogo et al., 2011)

A total of 10,076 women aged 15–49 took part in the survey. Of these, 1,535 pregnant women were selected for analysis, of whom 389 tested positives in the rapid diagnostic test (RDT). The majority of these women (52.5%) were aged 20–29, and 49.36% were in their second trimester of pregnancy. Almost all women of childbearing age surveyed lived in rural areas (92.75%). All wealth quintiles were represented in our study population. Most women had no formal education (96.4%). The prevalence of asymptomatic malaria among pregnant women in Burkina Faso was 25.34%. Pregnant women in their second trimester were more likely to be asymptomatic carriers of malaria than those in their first trimester (OR: 1.51; 95% CI: 1.12–2.05), and the Northern zone had the lowest prevalence at 17.31% (OR: 0.52; 95% CI: 0.35–0.76) (Zoungrana, 2018)

In Mali, the prevalence of malaria in pregnancy is estimated at 61.1%. The youngest pregnant women and multiparous women were most at risk of malaria infection. Regular use of good-quality ITNs and taking SP during pregnancy have a protective effect against the onset of malaria. The consequences of malaria during pregnancy are a cause for concern due to the incidence of anaemia, low birth weight, preterm birth and miscarriage (DAO, 2022) .

A study conducted in Mali found that the average age of the women was 24.6 ± 6.06, with primiparous and multiparous women being the most common. The majority were in the third trimester of pregnancy; the average number of antenatal care (ANC) visits was 1.9, with fewer than 3 ANC visits among 75.8% of women; 96% had received Sulfadoxine-Pyrimethamine (SP) via DOTS; only 14.7% had received fewer than 3 doses; 67.8% had not received MII. Age and gestational age were significantly associated with late antenatal care. Gestational age, DOTS, SP intake and MII receipt were significantly associated with malaria. Conclusion: Delays in antenatal care hinder the achievement of malaria indicator targets. (Soumounou, 2021a)

The prevalence of malaria was 27.2 out of 257 suspected cases, with a mean age of 24.6±6.06. Multiparous women and those aged 25 and over were at greater risk of attending antenatal care appointments late, with OR=1.65 [1.19–2.24] and OR=1.96 [1.36–2.81] respectively. Primiparous women were at greater risk of contracting malaria, OR=2.41 [1.36–4.26]. (Diarra et al., 2022)

In Benin, the prevalence of low TPI coverage was 48%, unevenly distributed across the municipalities: 56% in the municipality of Pobè, 27% in the municipality of Adja-Ouèrè and 49% in the municipality of Kétou. The bivariate analysis revealed that only three variables showed an association with low antenatal care coverage: fewer than four antenatal care visits (OR 18.24; CI [9.23–36.03]), having had at least one antenatal care visit in the private sector (OR 20.63; CI [2.71 – 156.91]) and having had the first antenatal care visit after three months of pregnancy (OR 3.45; CI [2.12 – 5.59]) (Tiendrebéogo et al., 2015)

In Benin, the prevalence of malaria among pregnant women was 32.62% (95% CI = [27.94; 37.66]). The mean parasite density was 2,056 parasites µl−1 and ranged from 102 to 33,627. Factors associated with the prevalence of malaria among pregnant women were age under 20, first pregnancy, first childbirth (p=0.0001), marital status (p=0.0199), low educational attainment (p=0.0004), being a housewife (p<0.0001), lack of empowerment (p=0.0001), absence of IEC sessions for pregnant women (p=0.0008), unsupervised use of SP (0.0294), correct use of mosquito nets (p=0.0001), quality of the mosquito net (p=0.0001), use of insecticide (p=0.0211), installation of screens on doors and windows (p=0.0032), adherence to the number of antenatal care (ANC) visits (p=0.0048), adherence to the number of SP doses (p<0.0001), the habit of watching television late at night (p=0.0384), and protection of water pits (p=0.0001). (Obossou et al., 2023)

In Cameroon, the results of a study show that the degree of endemicity in the region, the educational level of the pregnant woman, the household's standard of living, the pregnant woman's occupation, her status within the household, household size, her age and her place of residence are significantly associated with the non-use of mosquito nets.

Pregnant women who do not use mosquito nets generally fit the following profile: they live in rural areas of the Far North and North regions of Cameroon, are married and Muslim, have no education, come from poor households, are daughters or relatives of the head of the household, and work in agriculture. In terms of explanatory factors, the factors explaining the non-use of mosquito nets by pregnant women in Cameroon are, in order of importance: household size, the age of the pregnant woman and her occupation. (BAKEDECK, 2011)

In the DRC, a study showed that among households reporting ownership of long-lasting insecticide-treated nets (LLINs), 13.1% (n=54) of respondents reported using them for children under 5 years of age and 80.2% for everyone. In 22.0% of cases, respondents cited lack of money as the reason for not owning LLINs. 79.8% of respondents reported having used the ITN to protect themselves against malaria and 66.3% to protect themselves against mosquito bites. 77.9% of households had left the ITN in the shade for 24 hours before using it for the first time. 15.3% of respondents (n=63) reported having received advice on the use of mosquito nets from the media. Medical staff were the most important source of information on how to use the MILD for 51.2% of households. (Philippe et al., 2016)

Indeed, the proportion of women who had attended at least one antenatal visit was higher in rural areas than in urban areas (67.4% versus 32.6%), with most living in Bandundu Province (16.9%) and Equateur Province (13.5%). Very low proportions are observed in Maniema and Bas-Congo (3.4% and 4.8% respectively). More than 30% of women who have attended at least one antenatal visit belong to the Revivalist, Protestant and/or Kimbanguist churches respectively. The majority of them are educated (over 80%), compared with those with no education, who account for only 16.9%. These women also predominantly come from poor households (42.2%); are aged under 25; in a relationship (86.1%), having married between the ages of 18 and 24 (42.7%) and having had their first child between those ages (60.4%. (BOPE & MANTEMPA, 2015)

Among these women, almost all (97.3%) received antenatal care from qualified staff, and nearly 3 in 5 women did not receive any dose of SP during their antenatal visits. As with place of residence, disparities in women's access to IPT-SP during pregnancy via antenatal care also vary by province of residence (Table 3). Indeed, of all the provinces, Kasai Oriental, Katanga, Equateur and Bandundu have more than 10% of women who did not receive any dose of IPT-SP during antenatal care (15.9%, 11.7%, 14.2% and 15.3% respectively). As for receiving at least one dose of IPT-SP, more than 10% of women who had access to this treatment reside in the provinces of South Kivu, Equateur, Bandundu and North Kivu (15.5%, 14.3%, 15.9% and 13.7% respectively). Furthermore, the provinces of Equateur, Bandundu and Orientale are the only ones where more than 10% of women received at least two doses of TPI-SP during antenatal visits (10.5%; 23.3% and 12.8%) and, finally, only Bandundu province accounts for 27% of women who received at least three doses of this treatment during pregnancy. (BOPE & MANTEMPA, 2015)

In South Kivu, forty cases of malaria were diagnosed in the obstetrics and gynaecology department of the Walungu General Referral Hospital out of a total of 8,351 women hospitalised over the 24-month period, representing an incidence of 0.5%. The prevalence of malaria in pregnancy is high among women from outside the region, at 80%. 67.5% of cases of malaria in pregnancy occurred in mothers aged between 18 and 35 years. 52.5% of cases of malaria in pregnancy occurred in full-term pregnancies. Primiparous women are the most affected by malaria during pregnancy, accounting for 57.5%. 67.5% of pregnant women did not attend antenatal consultations; a large proportion of pregnant women presented with fever, with an incidence of 90%. 55% of newborns weighed less than 2,500g. Foetal mortality stands at 10%; quinine is the most commonly used medication (67.7%); threatened labour accounts for 37.5%; threatened miscarriage for 27.5%; preterm labour for 7.5%; ongoing miscarriage for 15%; and post-term pregnancy for 5%. (

In North Kivu province, malaria has claimed 900 lives, mainly among children under five and pregnant women. To reduce malaria, raising awareness about the correct use of insecticide-treated bed nets, environmental sanitation, and prevention measures for pregnant women remain the challenges to be addressed in the fight against this disease, which continues to fill hospital beds. (Kasereka, 2017)

In the town of Butembo, the prevalence of low birth weight was 11.8%. Being a first-time mother increased the risk of low birth weight by 4.2 times, multiple pregnancy by 2.1 times, male foetal sex by 2.8 times, prematurity by 5.5 times, maternal malnutrition by 1.4 times, malaria during pregnancy by 1.5 times and hypertensive disorders by 1.7 times. Malaria remains one of the risk factors for low birth weight. (Saasita Kahindo Apollinaire et al., 2022)

The aim of this study was to determine the medical and historical factors influencing susceptibility to malaria among pregnant women in the Malende Health Zone in the Democratic Republic of the Congo, a region heavily affected by this disease.

## 1. Materials and methods

### Study setting

The health district in which our research was conducted is known as the Malende Health Zone, with its headquarters at the Malende Health Centre.

It is situated in the DRC, North Kivu Province, City of Butembo, Kimemi Commune, Malende District, 8 km west of the city centre (Butembo Historical Monument) and 2 km from the Komba roadblock. The Malende Health Centre is situated in the Butembo Health Zone, which has a total population of 10,515 inhabitants comprising 1,443 households

### Type of study:

This is a descriptive correlational study, with an exhaustive sample comprising pregnant women attending the Malende Health Centre. This sampling method allows for the inclusion of all pregnant women in the region over a three-month period, with monthly data collection in line with the antenatal consultation schedule. From January to June 2024, the centre registered 118 pregnant women.

### Selection criteria:

Inclusion criteria: All pregnant women residing in the Malende Health Area who were available to participate in the study.

Exclusion criteria: Women not residing in the Malende Health Area or those unable to answer questions for mental or physical reasons.

Data collection methods: Survey conducted via interviews using an interview guide designed to gather information directly from pregnant women.

### Data analysis:

The data were analysed quantitatively using SPSS version 20 software. Chi-square statistical tests were used to analyse the relationships between variables at a significance level of 0.05. This analysis identified the significant factors influencing the prevalence of malaria in the sample.

Ethical considerations: The study respected data confidentiality and the anonymity of the participants. Informed consent was obtained prior to any data collection.

## 2. Results

### 2.1. Sociodemographic characteristics

The majority of participants were aged between 20 and 29, accounting for nearly 42% of the sample. The under-20 age group was also well represented, at 30.6%. In contrast, those aged 40 and over were few in number (5.6%). More than half of the participants (51.4%) have a primary school education, whilst nearly 28% have received no formal education. Less than a quarter (20.8%) have completed secondary education. Cohabitation is the most common marital status in this sample (45.8%), followed by single people (29.2%) and married people (25%). Farming is the main occupation, with nearly 89% of participants identified as farmers. Other occupations, such as employee, entrepreneur and homemaker, are represented only marginally (less than 6% in total).

**Table 1:** Sociodemographic Characteristics

| | **Frequency** | **Percentage** |
|---|---|---|
| Age Group | | |

| | | |
|---|---|---|
| 20–29 years | 30 | 41.7 |
| 30–39 years | 16 | 22.2 |
| 40 years and over | 4 | 5.6 |
| Under 20 | 22 | 30.6 |
| Total | 72 | 100.0 |
| Level of education | | |
| None | 20 | 27.8 |
| Primary | 37 | 51.4 |
| Secondary | 15 | 20.8 |
| Total | 72 | 100.0 |
| Marital status | | |
| Living with a partner | 33 | 45.8 |
| Single | 21 | 29.2 |
| Married | 18 | 25.0 |
| Total | 72 | 100.0 |
| Occupation | | |
| Farmer | 64 | 88.9 |
| Office worker | 2 | 2.8 |
| Entrepreneur | 4 | 5.6 |
| Housewife | 2 | 2.8 |
| Total | 72 | 100.0 |

### 2.2. Prevalence of malaria among pregnant women

One third of the participants are in their fourth pregnancy or beyond, indicating a high prevalence of multiparity (multiple pregnancies) in this sample. Around 31% of participants are in their first pregnancy, a figure that is also significant. Malaria during pregnancy is fairly widespread, affecting nearly 44.4% of women in this sample, which could have significant implications for maternal and child health.

**Table 2:** Prevalence of malaria among pregnant women

| | **Frequency** | **Percentage** |
|---|---|---|
| How many pregnancies have you had, including the current one? | | |
| Second pregnancy | 16 | 22.2 |
| First pregnancy | 22 | 30.6 |
| Fourth pregnancy and beyond | 25 | 34.7 |
| Third pregnancy | 9 | 12.5 |
| Total | 72 | 100.0 |
| Have you ever had malaria during this pregnancy? | | |
| No | 40 | 55.6 |
| Yes | 32 | 44.4 |
| Total | 72 | 100.0 |

### 2.3. Health knowledge and practices

Certain protective behaviours, such as the regular use of an insecticide-treated mosquito net, may be associated with a reduced risk of malaria, although the results are not always statistically significant. Other variables, such as knowledge of symptoms or participation in educational sessions, have not shown a major influence on the prevalence of malaria. However, the small sample sizes for certain variables (such as non-use of repellents or lack of access to medicines) limit the scope of these conclusions.

**Table 3:** Health knowledge and practices

| | N | Malaria during pregnancy | | | | | |
|---|---|---|---|---|---|---|---|
| | | Absent | | Presence | | chi-square | p |
| | | actual | % | number of staff | % | | |
| Have you ever heard of malaria? | | | | | | | |
| NO | 2 | 2 | 100.00 | 0 | 0.00 | 1.646 | ,499 |
| YES | 70 | 38 | 54.29 | 32 | 45.71 | Fisher's exact test | |
| Total | 72 | 40 | 55.56 | 32 | 44.44 | ,315 | ,575 |
| Do you know the symptoms of malaria? | | | | | | | |
| NO | 2 | 2 | 100.00 | 0 | 0.00 | 1.646 | ,499 |
| YES | 70 | 38 | 54.29 | 32 | 45.71 | Fisher's exact test | |
| Total | 72 | 40 | 55.56 | 32 | 44.44 | ,315 | ,575 |
| Have you ever attended educational sessions on malaria prevention? | | | | | | | |
| NO | 11 | 5 | 45.45 | 6 | 54.55 | 0.537 | ,522 |
| YES | 61 | 35 | 57.38 | 26 | 42.62 | | |
| | 72 | 40 | 55.56 | 32 | 44.44 | | |
| Did you know that malaria can have serious consequences during pregnancy? | | | | | | | |
| No, I am not aware | 10 | 5 | 50.00 | 5 | 50.00 | 0.145 | ,743 |
| Yes, I am well informed | 62 | 35 | 56.45 | 27 | 43.55 | | |
| Total | 72 | 40 | 55.56 | 32 | 44.44 | | |
| Have you had a malaria screening test during this pregnancy? | | | | | | | |
| NO | 2 | 0 | 0.00 | 2 | 100.00 | 2.571 | ,194 |
| YES | 70 | 40 | 57.14 | 30 | 42.86 | Fisher's exact test | |
| Total | 72 | 40 | 55.56 | 32 | 44.44 | ,778 | ,378 |
| Do you use an insecticide-treated mosquito net when you sleep at night? | | | | | | | |
| No, never | 4 | 1 | 25.00 | 3 | 75.00 | 5.783 | ,056 |
| Yes, every night | 65 | 39 | 60.00 | 26 | 40.00 | | |
| Yes, rarely | 3 | 0 | 0.00 | 3 | 100.00 | Fisher's exact test | |
| Total | 72 | 40 | 55.56 | 32 | 44.44 | 5.268 | 0.057 |
| Have you received preventive treatment for malaria during this pregnancy? | | | | | | | |
| NO | 2 | 1 | 50.00 | 1 | 50.00 | 0.026 | 1.000 |
| YES | 70 | 39 | 55.71 | 31 | 44.29 | Fisher's exact test | |
| Total | 72 | 40 | 55.56 | 32 | 44.44 | 0.000 | 1.000 |
| Do you have access to anti-malarial drugs during your pregnancy? | | | | | | | |
| No, I do not have access | 1 | 1 | 100.00 | 0 | 0.00 | 4.639 | 0.079 |
| Yes, I have regular access | 68 | 39 | 57.35 | 29 | 42.65 | | |
| Yes, but access is irregular | 3 | 0 | 0.00 | 3 | 100.00 | Fisher's exact test | |
| Total | 72 | 40 | 55.56 | 32 | 44.44 | 4.145 | 0.079 |
| How many times have you received a dose of intermittent preventive treatment (IPT) during this pregnancy? | | | | | | | |
| 1–2 times | 26 | 15 | 57.69 | 11 | 42.31 | 0.938 | ,626 |
| 3 times or more | 45 | 24 | 53.33 | 21 | 46.67 | | |
| Never | 1 | 1 | 100.00 | 0 | 0.00 | | |
| Total | 72 | 40 | 55.56 | 32 | 44.44 | ,895 | 0.893 |
| How often do you apply mosquito repellents to your skin or clothing? | | | | | | | |
| Never | 70 | 39 | 55.71 | 31 | 44.29 | 0.026 | 1.000 |
| Every day | 2 | 1 | 50.00 | 1 | 50.00 | Fisher's exact test | |
| Total | 72 | 40 | 55.56 | 32 | 44.44 | 0.000 | 1.000 |

### 2.4. Symptoms and preventive measures for malaria during pregnancy

The majority of women associate malaria prevention during pregnancy with the use of insecticide-treated bed nets and antimalarial drugs, whilst the most commonly experienced symptoms during malaria episodes are headaches and extreme fatigue.

**Table 4:** Symptoms and prevention measures for malaria during pregnancy

| Value | Number | % |
|---|---|---|
| What symptoms did you experience during the bout of malaria? | | |
| Headache | 64 | 88.89 |
| Extreme fatigue | 59 | 81.94 |
| Muscle pain | 50 | 69.44 |
| Fever | 36 | 50 |
| Chills | 21 | 29.17 |
| In your opinion, what are the main measures for preventing malaria during pregnancy? | | |
| Use of insecticide-treated bed nets | 57 | 79.17 |
| Taking anti-malarial medication | 42 | 58.33 |
| Removal of sources of stagnant water | 3 | 4.17 |
| Wearing long clothing to avoid mosquito bites | 1 | 1.39 |

### 2.5. Episodes and symptoms of malaria

These results show a strong association between several factors (frequency of treatment, presence of fever, medical consultation, additional symptoms) and the risk of contracting malaria during pregnancy. The very low **p-values** indicate that these relationships are statistically significant, suggesting a direct correlation with the prevalence of malaria.

**Table 5:** Episodes and symptoms of malaria

| | N | Have you ever had malaria during this pregnancy? | | | | | |
|---|---|---|---|---|---|---|---|
| | | No | | Yes | | chi-square | |
| | | Squad | % | Headcount | % | | p |
| How many times have you been treated for malaria during this pregnancy? | | | | | | | |
| 3 times or more | 6 | 1 | 16.67 | 5 | 83.33 | 50.286 | 0.0000 |
| 2 times | 11 | 1 | 9.09 | 10 | 90.91 | | |
| 2. 1 time | 13 | 0 | 0.00 | 13 | 100.00 | | |
| Never | 42 | 38 | 90.48 | 4 | 9.52 | Fisher's exact test | |
| Total | 72 | 40 | 55.56 | 32 | 44.44 | 55.036 | 0.000 |
| Did you have a fever during this pregnancy? | | | | | | | |
| NO | 44 | 35 | 79.55 | 9 | 20.45 | 26,372 | ,000 |
| YES | 28 | 5 | 17,86 | 23 | 82.14 | | |
| Total | 72 | 40 | 55.56 | 32 | 44.44 | | |
| Have you consulted a healthcare professional about these fevers? | | | | | | | |
| NO | 45 | 37 | 82.22 | 8 | 17.78 | 34.56 | ,000 |
| YES | 27 | 3 | 11.11 | 24 | 88.89 | Fisher's exact test | |
| Total | 72 | 40 | 55.56 | 32 | 44.44 | 31,740 | ,000 |
| Have you experienced any other symptoms such as headaches, chills or muscle aches? | | | | | | | |
| NO | 39 | 35 | 89.74 | 4 | 10.26 | 40.28 | ,000 |
| YES | 33 | 5 | 15.15 | 28 | 84.85 | Fisher's exact test | |
| Total | 72 | 40 | 55.56 | 32 | 44.44 | 37,315 | ,000 |

### 2.6. Medical History

A history of malaria prior to pregnancy is significantly associated with the risk of contracting malaria during pregnancy, particularly among women who have had malaria on multiple previous occasions. In contrast, undergoing preventive treatment before pregnancy and having a medical history (such as anaemia or a chronic illness) did not show any statistically significant association with the onset of malaria during pregnancy.

**Table 6:** Medical History

| | N | Have you ever had malaria during this pregnancy? | | | | | |
|---|---|---|---|---|---|---|---|
| | | No | | Yes | | chi-square | p |
| | | actual | % | number | % | | |
| Have you had malaria before this pregnancy? | | | | | | | |
| Yes, once | 20 | 10 | 50.00 | 10 | 50.00 | 6.45 | 0.044 |
| No, never | 27 | 20 | 74.07 | 7 | 25.93 | | |
| Yes, several times | 25 | 10 | 40.00 | 15 | 60.00 | | |
| Total | 72 | 40 | 55.56 | 32 | 44.44 | | |
| Did you take preventive anti-malarial treatment before becoming pregnant? | | | | | | | |
| No | 68 | 38 | 55.88 | 30 | 44.12 | 0.053 | 1.000 |
| Yes | 4 | 2 | 50.00 | 2 | 50.00 | Fisher's exact test | |
| Total | 72 | 40 | 55.56 | 32 | 44.44 | 0.000 | 1.000 |
| Do you have any medical history that could complicate your pregnancy, such as anaemia or another chronic condition? | | | | | | | |
| no history | 70 | 40 | 57.14 | 30 | 42.86 | 2.571 | 0.187 |
| Anaemia | 1 | 0 | 0.00 | 1 | 100.00 | | |
| other chronic condition | 1 | 0 | 0.00 | 1 | 100.00 | Fisher's exact test | |
| Total | 72 | 40 | 55.56 | 32 | 44.44 | 2.429 | 0.187 |

## 3. Discussion of results

### 3.1. Sociodemographic characteristics

The majority of participants are aged between 20 and 29, accounting for nearly 42% of the sample. The under-20s are also well represented, at 30.6%. In contrast, those aged 40 and over are few in number (5.6%). More than half of the participants (51.4%) have a primary school education, whilst nearly 28% have received no formal education. Less than a quarter (20.8%) have completed secondary education. Cohabitation is the most common marital status in this sample (45.8%), followed by single people (29.2%) and married people (25%). Farming is the main occupation, with nearly 89% of participants identified as farmers. Other occupations, such as employee, entrepreneur and housewife, are represented only marginally (less than 6% in total).

Among the mothers surveyed, 45.1% were aged between 25 and 34, with ages ranging from 14 to 45. 61.8% of the mothers surveyed had no formal education; 90.7% were married and 89.8% were housewives. Among the mothers surveyed, of the Malinké ethnic group accounted for 82.9%; 36.7% resided in Bancoumana and 36.0% had 1 to 2 children in their care (COULIBALY, 2012)

### 3.2. Prevalence of malaria among pregnant women

One-third of the participants were in their fourth pregnancy or beyond, indicating a high prevalence of multiparity (multiple pregnancies) in this sample. Around 31% of participants are in their first pregnancy, a figure that is also significant. Malaria during pregnancy is fairly widespread, affecting nearly 44.4% of women in this sample, which could have significant implications for maternal and child health.

There was a high rate of use of IMMs (82.8%) and antenatal care at the health centre (71.2%). We thus found rates of 2.4%, 1.6% and 0.0% for maternal, placental and neonatal malaria, respectively. Low birth weight was observed in 12.1% of newborns.

Out of 3,135 antenatal consultations, 228 patients were diagnosed with malaria during pregnancy, representing 7.27% of cases of malaria in pregnancy. The most common age group was under 25 years, accounting for 58.8% of cases. The mean age of the patients was 26.10 ± 0.4 years, ranging from 16 to 48 years. The majority of patients were married (80.7%). (NIARE et al., 2023)

The prevalence of malaria in pregnancy was estimated at 21.6% across the entire study population. Susceptibility to malaria infection during pregnancy was associated with area

of residence, gestational age and intermittent preventive treatment with SP. Pregnant women living in rural areas, those in the early stages of pregnancy, and those who had not taken SP were the most affected by malaria. The in vivo efficacy of P. falciparum against SP at day 28 was 97.06%. (Samaké, 2021)

### 3.3. Health knowledge and practices

Certain protective behaviours, such as the regular use of an insecticide-treated mosquito net, may be associated with a reduced risk of malaria, although the results are not always statistically significant. Other variables, such as knowledge of symptoms or participation in educational sessions, did not show a major influence on the prevalence of malaria. However, the small sample sizes for certain variables (such as non-use of repellents or lack of access to medicines) limit the scope of these conclusions.

92 mothers or guardians of children under five were interviewed about malaria prevention in the Bépanda district of Douala. The largest proportion of those interviewed [45 (48.91%)] [95% confidence interval (CI): 38.70–59.12%] were young women aged 25–29. Almost all (97.85%) [95% CI: 94.89–100.81%] of the women demonstrated satisfactory levels of knowledge regarding the causes of malaria (mosquito bites). Factors predisposing children to malaria, particularly poor household hygiene, were clearly identified by 34 (36.96%) [95% CI: 30.11–43.81%] participants, the presence of stagnant water near dwellings [28 (30.43%)] (95% CI: 21.03–39.83%) and open windows and doors [11 (11.96%)] (95% CI: 5.33–18.59%). The majority (93.48%) [95% CI: 93.35–93.613%] of women knew at least one good sign of malaria. Knowledge of malaria prevention methods varied among women, but a considerable number of respondents mentioned the use of long-lasting insecticidal nets (

For the signs of uncomplicated malaria, 60.9% of mothers associated the following signs: hot body + diarrhoea + weakness and incessant crying. For the signs of severe malaria, 73.0% of mothers associated the following signs: high fever + coma + convulsions + cola-coloured urine + respiratory distress + jaundice and prostration. Regarding the causes of malaria, 66.9% associated mosquito bites with fatty foods, whilst only 12.2% cited mosquito bites alone. Among the mothers surveyed, 96.9% had a good understanding of the signs of uncomplicated malaria in children. Among the mothers surveyed, 69.0% were aware of insecticide-treated mosquito nets, the destruction of empty containers, the covering of jars and containers, and weeding as means of preventing malaria. Among the mothers surveyed, 90.3% knew of more than three methods of malaria prevention. Among the mothers surveyed, 99.3% cited poor sanitation as a factor favouring mosquito breeding. Among the mothers surveyed, 66.6% cited both pregnant women and children as groups at risk of malaria. 42.9% of the mothers surveyed cited the following as their sources of information: community meetings, television and radio, and 54.2% had access to a television; 93.6% of the mothers surveyed owned a radio. (COULIBALY, 2012)

Following the multivariate analysis, only the location where the TPIg-SP was administered and the women's level of knowledge about the TPIg-SP were significantly associated with receiving the optimal dose of the TPIg-SP. Indeed, on the one hand, we found that women who received TPIg-SP at the CSPS were approximately three times more likely to receive the optimal dose of TPIg-SP than those who received it at home (adjusted OR = 2.84; 95% CI: [1.34–6.04]). On the other hand, women who had a good level of knowledge about TPIg-SP were approximately 15 times more likely to receive the optimal dose of TPIg-SP compared to women who did not (adjusted OR = 14.89; 95% CI: [6.09–36.40]). (Ousmane, 2017)

Regarding chemoprophylaxis for malaria during pregnancy, the majority of women had received SP (88.8%); 84.7% had received it via DOTS; only 14.7% had received three or more doses during pregnancy, with an average of 1.61 doses, a minimum of one and a maximum of five doses. Those who had not received MII accounted for 67.8%. (Soumounou, 2021b) (Pafe Tendop, 2014)

We found no statistically significant relationship between receiving the MII, late antenatal care, the doses of SP received during pregnancy and malaria infection among our women; furthermore, taking SP during antenatal care provided protection (OR=0.16 [0.006–0.038] and p<0.002). Adherence to the DOTS programme was a protective factor (OR = 0.08 [0.04–0.15] and p < 0.001); in other words, those who did not adhere to the DOTS programme were 12.5 times more likely to have malaria compared to those who did [6.67–25.00]. In multivariate analysis, we found that neither pregnancy status nor age was associated with late antenatal care. In multivariate analysis, only the use of SP during antenatal care was associated with malaria in pregnant women. (Soumounou, 2021b) (Pafe Tendop, 2014)

### 3.4. Episodes of malaria and symptoms

These results show a strong association between several factors (frequency of treatment, presence of fever, medical consultation, additional symptoms) and the risk of contracting malaria during pregnancy. The very low **p-values** indicate that

these relationships are statistically significant, suggesting a direct correlation with the prevalence of malaria.

Nearly half of the women used insecticide-treated bed nets and had taken sulfadoxine-pyrimethamine for prophylaxis (50.8%). Fever was the main reason for seeking medical consultation, followed by headaches, accounting for 84.2% and 74.6% of cases respectively. Thick smear results were positive in 98.7% of cases. Hypoglycaemia was the most common complication , followed by threatened preterm labour, accounting for 25.9% and 19.7% of cases respectively. (NIARE et al., 2023)

### 3.5. Medical History

A history of malaria prior to pregnancy is significantly associated with the risk of contracting malaria during pregnancy, particularly for women who have had malaria several times previously. In contrast, undergoing preventive treatment before pregnancy and having a medical history (such as anaemia or a chronic illness) did not show any statistically significant association with the onset of malaria during pregnancy.

In Mali, the majority of pregnant women were under 19 years of age, married and uneducated. The prevalence of malaria among them was 61.1%. Irregular use of ITNs and non-use of IPT-P were observed. The majority of pregnant women with malaria did not use IMI regularly, at a rate of 71%. The incidence of malaria was high among pregnant women who had not taken any antimalarial drugs, at a rate of 66.2%. Severe anaemia was present in 13.5% of cases. Cases of preterm birth and intrauterine growth restriction (41.9%) were also observed, at 9.3% and 32.6% respectively. (DAO, 2022)

In the DRC, it is noted that there were more cases of malaria among pregnant women in 2017 (54.8%), with a decline in 2018 (45.5%) and a further decline in 2019 (33.5%). Since 2018 and 2019, malaria among pregnant women has been on the decline; however, 2017 saw the peak of the epidemic. (Faustine et al., 2022)

## Conclusion

Malaria remains a major public health challenge, particularly for pregnant women living in endemic areas such as the Malende Health Zone. This study has highlighted that, despite prevention efforts, a significant proportion of pregnant women continue to contract the disease, leading to serious complications for both mother and child. Medical and historical factors, such as multiparity, lack of preventive treatment and failure to use insecticide-treated bed nets regularly, increase vulnerability to malaria. Furthermore, socio-economic factors such as low levels of education and limited access to antenatal care are also important determinants.

To improve the situation, it is essential to strengthen health education, ensure better access to preventive treatments such as sulfadoxine-pyrimethamine (SP), and promote the regular use of insecticide-treated mosquito nets. It is also crucial to improve antenatal care coverage and raise awareness among pregnant women of the dangers of malaria and the importance of preventive measures.

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