

## ORIGINAL ARTICLE

# Determinants of Malaria in Pregnancy and women's experiences with prevention in Mansa District, Zambia: A Mixed-Methods Exploratory Study

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## ABSTRACT

**Background:** Malaria in pregnancy is predominant in Sub-Saharan Africa. It is one of the major causes of abortion, prematurity low birth weight and anaemia in pregnancy. One of the legacy goals for Ministry of health in Zambia was to eliminate Malaria by the year 2021. Many efforts are put in place but the prevalence is still high in some parts of Zambia. Therefore, this study explored the determinants of malaria in pregnancy and experiences of women on access to resources meant for Malaria prevention in Mansa district.

**Method:** A mixed-methods and exploratory research design was conducted in four selected settings of Mansa district. Quantitative data was retrospectively collected from 236 antenatal records sampled by systematic random method. Qualitative data was collected from 25 post-natal women and 5 Nurses through in-depth face-to-face interviews; using semi-structured interview guide and

participants were purposively sampled. Chi-square and thematic analysis were used for quantitative and qualitative data respectively.

**Results:** Prevalence of Malaria in pregnancy was at 14.8% and ownership of insecticide-treated bed-nets was at 72%. Late antenatal booking led women to miss insecticide-treated bed-nets and Sulphadoxine-Pyrimethamine doses. Knowledge gap also affected the uptake of Sulphadoxine-Pyrimethamine and Insecticide treated bed-nets.

**Conclusion:** The primary prevention of malaria in pregnancy was sub-optimal in Mansa district. This calls for improvement of timely antenatal booking and ensuring distribution of Insecticide-treated bed-nets to every pregnant woman. More resources are needed as well as civic education and effective participation of women attending antenatal services.

## INTRODUCTION

Malaria in pregnancy is a major public health problem globally and about 90% of cases occur in

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**Keywords:** Pregnancy complications, parasitic (Malaria in pregnancy), Antenatal Care (ANC), Insecticide-treated bed-nets (ITNs), Intermittent-presumptive treatment of malaria in pregnancy with Sulphadoxine-Pyrimethamine (IPTp-SP).

This article is available online at: <http://www.mjz.co.zm>, <http://ajol.info/index.php/mjz>, doi: <https://doi.org/10.55320/mjz.52.4.734>

The Medical Journal of Zambia, ISSN 0047-651X, is published by the Zambia Medical Association

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sub-Saharan Africa and it is one of the predisposing factors to maternal death in developing countries.<sup>1</sup> Globally, different strategies such as use of insecticide treated bed nets (ITNs), intermittent-presumptive treatment with Sulphadoxine-pyrimethamine (IPTp-SP) and indoor residue spray (IRS) have been put in place in order to eliminate malaria in pregnancy but the problem is still higher than expected in some African countries such as Zambia. Despite these interventions, malaria in pregnancy rates in our setting remain high, suggesting gaps in implementation or uptake. Little is known about pregnant women's experiences and factors contributing to these persistently high rates in Mansa. Hence, this study aimed at exploring the determinants of malaria in pregnancy and assess the experiences of women towards Malaria preventive measures.

In 2019, there were an estimated 33 million pregnancies in 33 moderate-to-high malaria transmission countries in the WHO African Region.<sup>2</sup> Thirty-five percent of these pregnancies were exposed to malaria infection, and it was estimated that malaria infection during pregnancy resulted in 822,000 infants with low birth weight and an estimated 11% of neonatal deaths in sub-Saharan Africa are due to low birth weight associated with malaria in pregnancy.<sup>2</sup> The pandemic of COVID-19 disruptions led to about 13 million more malaria cases and 63 000 more malaria deaths with African region carrying a high share of the global malaria burden.<sup>3</sup> Studies conducted in rural part of India estimated malaria in pregnancy cases from 183,000 to 1.5 million per year, with 73,000 to 629,000 abortions and 1,500 to 12,600 maternal deaths attributed to malaria in pregnancy. A study in Eastern Sudan showed prevalence of malaria in pregnancy at 13.7% while the ones in Burkina-Faso and Malawi highlighted the prevalence of 18.1%, and 19. % respectively. In different parts of Ethiopia prevalence was said to be 16.3% among pregnant women.<sup>5</sup>

Malaria remains an endemic disease in Zambia and affects all age groups with more serious effects on pregnant women and children under five years. One

of the legacy goals by MoH in Zambia was to eliminate Malaria by 2021 and reduce maternal mortality rate.<sup>6</sup> Despite many efforts, malaria prevalence in Mansa district of Luapula province remains high of which 12, 918 cases were recorded from 2015-2019.<sup>7</sup> This exploratory mixed method study was conducted in selected urban settings of Mansa district so as to assess the determinants of malaria in pregnancy and understand the experiences of women towards resources meant for malaria prevention. The study uses health belief model (HBM) to interpret women's preventive actions. According to the HBM, a woman's likelihood of using malaria prevention tools depends on her perceived susceptibility to malaria, perceived benefits of the tools, and other factors. Therefore, women's perceived threat of malaria or perceived barriers to uptake of ITNs and IPTp-SP could be influencing their actions.<sup>8</sup>

## METHOD

### Research design

An exploratory mixed-methods (quantitative and qualitative) exploratory study was used to obtain an in-depth understanding about the problem. A convergent mixed-methods approach was used in which data was presented and analysed separately and later merged. Finally, we synthesized insights from both the quantitative and qualitative results to form a comprehensive interpretation, as presented in the Discussion.

### Study setting

The study was conducted in four selected urban setting of Mansa district, Luapula province-Zambia (Central clinic, Buntungwa, Senama and Musumali clinic) because the district continued recording high cases of Malaria in pregnancy since 2015 and these sites had characteristics to represent health status of pregnant women in Mansa district. The study population comprised of all women of childbearing age from 15 to 49 years. The data collection was done in 2021.

### Recruitment of participants

For quantitative data, Krejcie and Morgan<sup>9</sup> formula

i.e.,  $n = Z^2 \times P \times (1-P)/d^2$ ; was used for determining sample size of 236 ANC records for the year 2020. A systematic simple random sampling method ( $k=N/n$ ) was used to select ANC records. Non-probability purposive sampling method was used to select 30 participants (25 women and 5 health workers from MCH departments) for qualitative data. The sample size was based on data saturation in that sampling of participants continued until no new substantive information was acquired.<sup>10</sup> To ensure triangulation of data, the key informants were postnatal women with history of malaria in pregnancy and health workers at MCH departments from study settings. Mothers with no history of malaria in pregnancy and below 15 years old and those who were not staying in study settings were excluded from the study.

### Pilot study

A pilot study was done at Namwandwe Health Centre to determine the feasibility of the proposed study, cultural appropriateness, reliability and validity of the research instrument. The tool was good though conducting interviews in English was a barrier to women. Therefore, questions were translated in Bemba except for Nurses whose interviews were done in English. Researchers were conversant with both languages and there was no need to look for an interpreter.

### Data collection

Collection of quantitative data from ANC records was guided by a structured questionnaire (check list) that contained specific questions related to the study. This data was retrospectively collected from 2020 ANC registers using systematic simple random sampling method with an interval of 7 to minimize biasness. A semi-structured interview guide was used to collect qualitative data through an in-depth face to face interviews which were audio-recorded and transcribed them into themes, and each interview lasted about 30-40 minutes for in-depth inquiry. Twenty-five post-natal women gave their responses in Bemba which were further translated to English while five nurses gave interviews in English and their inputs were summarized separately.

### Data management and analysis

Both quantitative and qualitative data were presented and analysed separately and later merged so as to have more understanding about the problem. Quantitative data from ANC records was entered on Statistical Package for Social Sciences (SPSS) version 20.0 and analysed by Chi-square method at 0.05 significant level. Deductive thematic analysis was used to make conclusions for qualitative data and HBM guided the coding of themes which were framed corresponding to the model. Two authors (MM and ANH) independently coded the interview notes and discussed differences to reach consensus and themes. We followed thematic analysis procedures, starting with familiarization by reading transcripts multiple times, then generated initial codes manually, collated codes into potential themes, and reviewed and refined themes in team discussions, following the framework of Braun and Clarke.<sup>11</sup> Data triangulation was done by cross-referencing between ANC records and participants (nurses and post-natal women).

### Ethical considerations

Permission and ethical approval were granted by National Health Research Authority (REF. No: NHRA 000022/04/03/2022) and Biomedical Research Ethics Committee (REF. No. 2430-2021). The formal request was made to the Provincial and District Health Office. Permission was also sought from the nurse in-charges in study settings to access ANC records. Verbal and written informed consent were obtained from every participant and assured of confidentiality. Participants were not coerced and were free to withdraw from the study at any time without any penalties.

### RESULTS

Both quantitative and qualitative data were collected separately and merged for interpretation. To ensure triangulation of data, 236 ANC records were reviewed while twenty-five post-natal women and five nurses were interviewed and their responses were presented separately.

## Characteristics of ANC women assessed for quantitative data

Quantitative data was collected from 236 ANC records for the year of 2020 using systematic simple random sampling method with an interval of 7. About 68 records were reviewed at Senama, 68 at Central, 50 at Buntungwa and 50 at Sumbu clinic were reviewed based on their catchment population.

**Table 1: Results of variables from ANC records**

Characteristics	Number	Percent
<b>Total</b>	<b>236</b>	<b>100.0</b>
<b>Age group in years</b>		
15-20	17	7.2
21-25	61	25.8
26-30	63	26.7
31-35	62	26.3
36-40	25	10.6
41+	1	3.4
<b>Marital status</b>		
Married	216	91.5
Not married	20	8.5
<b>Parity</b>		
Prime-gravid	52	22.0
Multi-gravid	184	78.0
<b>Time of ANC booking</b>		
First trimester	73	30.9
Second trimester	141	59.7
Third trimester	22	9.3
<b>ITN received</b>		
Yes	171	72.0
No	66	28.0
<b>Number of ANC visits</b>		
1-3 Visits	120	50.8
4-6 Visits	116	49.2
7-8 Visits	0	0.0
<b>Number of IPTp doses received</b>		
1-3 doses	127	53.8
4-6 doses	109	46.2
7-8 doses	0	0.0
<b>Had IRS</b>		
Yes	157	66.5
No	79	33.5
<b>Had MiP</b>		
Yes	35	14.8
No	201	85.2

Table 1 shows the distributions of selected variables from ANC records. From the 236 records reviewed, 35(14.8%) of women had malaria in pregnancy and majority of pregnant women 186(78.8%) were aged between 21-35 years old. Most of women 216(91.5%) were married and majority of them 184(78.0%) were multi-gravid. A lot of women 141(59.7%) reported for ANC booking in second trimester. About 171(72.0%) got ITNs during ANC booking and majority of them 120(50.6%) had 1-3 ANC visits throughout pregnancy. Majority of women 127(53.8%) had received 1-3 doses of IPTp-SP and none of them got 7 or 8 doses of IPTp-SP. About 157(66.5%) of women had their houses sprayed during IRS campaign.

We found a significant association between the number of IPTp-SP doses received and occurrence of malaria in pregnancy ( $\chi^2$  test,  $p=0.001$ ), with malaria rates higher among those who received fewer doses. Similarly, late ANC booking (booking in second vs first trimester) was significantly associated with higher malaria in pregnancy incidence ( $p<0.001$ ).

## Characteristics of postnatal women interviewed for qualitative data

This consists of twenty-five post-natal women who were purposively selected with history of malaria in pregnancy.

**Table 2: Demographic variables for post-natal women**

Characteristics	Number	Percent
<b>Total</b>	<b>25</b>	<b>100.0</b>
<b>Age</b>		
18-25 Years	13	52.0
26-30 Years	7	28.0
31-35 Years	5	20.0
<b>Marital Status</b>		
Single	5	20.0
Married	20	80.0
<b>Education level</b>		
Primary	7	28.0
Secondary	15	60.0
Tertiary	3	12.0

<b>Denomination</b>		
Catholic	5	20.0
Pentecostal	5	20.0
SDA	7	28.0
J. Witness	1	4.0
CMMML	3	12.0
UCZ	4	16.0
<b>Number of children</b>		
Prime gravida/para	6	24.0
Multi gravida/para	19	76.0
<b>Employment status</b>		
Informal	22	88.0
Formal	3	12.0

Table 2 demonstrates that most of participants (thirteen women) interviewed were in the age group of 18-25 years old and majority of them (twenty) were married with the highest denomination (seven) being Adventist. Most of participants (seventeen) attained secondary school education and majority of them (nineteen) were multi-paras mothers. Only three participants were in formal employment.

### Characteristics of Health Workers interviewed for qualitative data

This consist of five nurses who were selected from study settings and working at MCH department for more than one year.

**Table 3: Demographic variables for Health Workers**

Characteristics	Number	Percent
<b>Total</b>	<b>5</b>	<b>100.0</b>
<b>Qualification</b>		
Registered Midwife	3	60.0
Enrolled Midwife	1	20.0
Certified Midwife	1	20.0
<b>Duration in service</b>		
1-5 Years	1	20.0
5-10 Years	2	40.0
10 years and above	2	40.0

Table 3 demonstrates that most of the health workers (three) interviewed were Registered Midwives and had served in the Ministry for more than five years.

### Thematic Analysis for Qualitative Data

#### Circumstances of Malaria Infection

Majority of women had malaria in second trimester and were not using ITNs at the time they got sick.

Most women had family members with malaria infection prior to sickness.

*"I had Malaria during pregnancy while using ITN and I don't know how I got it. ...maybe it was because my child and other family member had malaria", (Woman 7). ... "I had Malaria during Pregnancy... I never used to sleep under ITN before I got malaria". (Woman 3).*

#### Uptake of ITNs and IPTp-SP

Nearly all women were not using ITNs consistently at the time they had malaria. Majority of them slept under ITNs night before interview. None of participant got five IPTp doses and above.

*"From the time I had MiP, I use ITN every day... and I slept under ITN last night", (Woman 18). ... "I don't have ITN... health workers denied me an ITN because of late ANC booking", (Woman 25). ... "I never got an ITN during ANC booking due to stock-out, but I was later given during follow-up visits", (Woman 22). ... "I used to get Fansidar (IPTp) on every ANC visit and take it in the presence of health workers", (Woman 12).*

#### Access to Preventive Resources

Some women got ITNs on their first ANC visit while others found ITNs out of stock. Few participants were denied ITNs due to late ANC booking. Majority of participants were not given IEC on how to use ITNs and only few participants had their RDTs done during ANC visits.

*... "I went for ANC booking at six months and I was given ITN ... health workers never explained to us on how to use ITNs", (Woman 7). .... "Nurses never did RDT on me during ANC booking", (Woman 5). .... "I found ITNs out of stock", (Woman 20). ... "I was not given ITN because of late ANC booking", (Woman 23)*

#### Knowledge on preventive measures

Majority of women knew the importance of IPTp in malaria prevention, but they did not know the total number of IPTp-SP doses a pregnant woman should get throughout pregnancy, and the gestational age at which to start taking IPTp-SP. All women knew the importance of ITNs and few of them knew the



gestation age at which the woman should go for ANC booking. All women were not aware of RDT being the routine test during ANC visit.

*“Emhh... I am not sure if sleeping under ITN prevents MiP because people get malaria even if they use bed nets” (Woman 11). ... “I don't know the gestational age to start taking Fansidar (IPTp)” (Woman 9). .”We are given Fansidar(IPTp) on every ANC visit, but I don't know the total number of Fansidar (IPTp) doses to receive through-out pregnancy”, (Woman 16)...”I saw nurses doing RDT on us but not know if it should be done routinely”, (Woman 3). ...”Yes...I agree that both ITNs and Fansidar (IPTp) prevent malaria in pregnancy”, (Woman 21)*

### Attitude

Majority of participants felt that sleeping under ITN causes discomfort and reduce Oxygen while others felt good with ITN use. Nearly all participants felt that having maternity dress is more important than ITN.

*...“Sleeping under ITN makes me feel discomfort and reduces oxygen”, (Woman 14). ...”I have no problem with ITN use”, (Woman3). ..”Having maternity dress is more important than ITN”, (Woman 6).*

### Health workers' experiences on resources for Malaria prevention

All health workers stated that they give ITNs to all pregnant women during antenatal booking, except when ITNs are out of stock. Majority of health workers were not doing RDT as a routine test for malaria on every pregnant woman during ANC except to those with symptoms of malaria. They all mentioned that few women go for ANC booking on time and most of women are not consistent with ANC follow-up visits.

*.... “We give pregnant women ITNs on ANC booking ...though sometimes we run-out of stock. ...”We don't do RDT on every pregnant woman...because RDT kits not enough”, (HW 4). ... “We don't have a plan in place to follow up pregnant women and monitor how they use ITNs” (HW 5). ...”We use DOT method for Fansidar (IPTp) to promote drug*

*compliance ...and we never experience shortage of IPTp-drugs”, (HW 2). ....”Few pregnant women come for ANC booking at 12 weeks gestation and below”, (HW 1).*

## DISCUSSION

Our study identified several factors contributing to persistent malaria in pregnancy: late initiation of ANC (leading to missed preventive measures), inconsistent use of ITNs prior to illness, incomplete IPTp prophylaxis, and gaps in health system resources (like RDT kit shortages and limited patient education). We also found that personal experience of malaria illness served as a wake-up call that improved preventive behaviours in many women. Prevalence of malaria in pregnancy stood at 14.8% while ownership of ITNs was at 72%.

### Demographic Information

Majority of women were aged between 20-35 years old, and nearly all women were married with economic and social support provided by their husbands. Study revealed that only few participants were in formal employment, and this could have affected their purchasing power of ITN as reported by Kanmiki's study.<sup>12</sup> As a result, most pregnant women depended on free ITNs supplied by the government in health facilities. Contrary to Kanmiki<sup>12</sup> in which ownership of ITNs was more among the working class people, our study showed that; regardless of the economic status, women had good ownership of ITNs due to free distribution during ANC booking.

### Uptake of ITNs and IPTp-SP

The study revealed that although ownership of ITNs was fair (72.0%), women were not using them consistently before they suffered from malaria. Therefore, uptake could have been improved if women believed that they were at risk of getting malaria if they do not use ITNs and IPTp-SP effectively as illustrated in HBM (Perceived susceptibility).<sup>8</sup> This is similar to the findings observed by Taremwa<sup>13</sup> in which 33.9% of respondents possessed ITNs but never use them consistently. Our study further reported that uptake of ITNs improved after women suffered from

malaria as most of them slept under ITNs night before interviews. This shows that participants' exposure to the disease made them change their behaviours towards uptake of ITNs as described in HBM (Perceived severity).<sup>8</sup> Majority of women (53.8%) received 1-3 doses of IPTp-SP and there was a significant association ( $p=0.001$ ) between number of IPTp doses and malaria in pregnancy. In addition, no woman received 7 or 8 doses of IPTp-SP throughout pregnancy as recommended by WHO<sup>1</sup> IPTp guideline. The study indicates that low uptake of IPTp was attributed to late ANC booking among women ( $p<0.001$ ) as IPTp-SP is given to pregnant women on every ANC visit starting from 13 weeks of gestation.<sup>6</sup> This is also in line with the study done in Ghana by Amoakoh<sup>15</sup> in which IPTp-SP doses were determined by the number of ANC visits. This shows that there is need to encourage women for early ANC booking to promote uptake of IPTp-SP and ITNs.

### Access to Preventive Resources

The study further revealed that there were some gaps in accessing resources meant for malaria prevention by pregnant women during ANC visit; whereby some participants never got ITNs during ANC booking due to stock-out and late ANC booking. This is contrary to MoH strategy of ensuring that every pregnant woman gets ITN during ANC booking.<sup>6</sup> Data collected from both women and nurses indicates that there was availability of IPTp drugs at clinics and all women who attended antenatal had good access to it as it was given under directly observation therapy. Therefore, the low uptake of IPTp among women in this study could not be attributed to shortage of drugs as observed by Konlan<sup>16</sup> but late ANC booking. The study also indicates that RDT was not done on majority of women during ANC visit (except those with suspected signs and symptoms of malaria) due to inadequate RDT kits. This is contrary to the MoH guidelines which advocates for RDT to be a routine procedure during ANC visit.<sup>6</sup> Health workers were not making follow-up on utilization of ITNs by women during ANC as they had no plans in place to conduct such activities. This could have impacted the utilization of ITNs because follow-up visit influences good health seeking behaviours as

observed by Konlan.<sup>16</sup>

### Knowledge

Our study reveals that during ITNs distribution, majority of women were not given information on utilization of ITNs by health workers at MCH department. This is different from the study by Jumbam<sup>17</sup> where most of respondents received information from health centres and community health workers. Though nurses claimed to be giving health education on the uptake of IPTp and ITNs, none among women knew the total number of IPTp doses; a woman should get throughout pregnancy. Furthermore, majority women never knew the gestational age for ANC booking and when to start IPTp-SP. The study further observed that majority of women possessed ITNs but never had adequate information on proper utilization. The knowledge gap had impact on the low uptake of these services because; if women had knowledge on uptake of IPTp-SP and ITNs, it could have increased confidence on the use of these resources as demonstrated by HBM (Self-efficacy).<sup>8</sup> Hence, there is need for health workers to provide comprehensive counselling of women on IPTp-SP and ITN use during ANC, as information is critical for proper utilization of these services.

### Attitude

Majority of women felt that sleeping under ITN reduces oxygen as well as produces bad smell which make them feel discomfort while few women expressed comfort with the use of ITNs. This was regarded as a perceived barrier to ITNs utilization in relation to HBM.<sup>8</sup> Furthermore, majority of women felt that it is important to have maternity dress than ITN. This demonstrates that some women do not consider ITNs to be an important item during pregnancy thinking that they are not at risk of malaria (low perceived susceptibility).<sup>8</sup> This might have affected the ownership of ITNs as reported by Taremwa<sup>13</sup> in which there was low ownership of ITNs among women. Our study also reveals that most women had ITNs but were not using them consistently before they had malaria infection (low perceived susceptibility).<sup>8</sup> Similar to Taremwa,<sup>13</sup> we found that ITN ownership did not guarantee

effective utilization; a reminder that distribution programs must be coupled with health education and behavioural change efforts.

## CONCLUSION

In summary, primary prevention of malaria in pregnancy in Mansa District is sub-optimal. Although most pregnant women receive ITNs and IPTp, many do not use or complete these preventive measures due to late antenatal attendance, lack of knowledge, and misconceptions. Health system limitations (like RDT kit shortages and inconsistent follow-up) further hinder effective prevention. Prevalence of malaria in pregnancy was at 14.8% while the ownership of ITNs stood at 72% which is below MoH target. Therefore, there is need to strengthened activities meant for primary prevention of malaria in pregnancy as well as effective participation by women.

## RECOMMENDATIONS

Government should be supplying health centres with enough ITNs to cater for every woman as some women never received ITNs due to stock-outs. Health facilities should be supplied with adequate RDT kits to cater for all pregnant women during ANC visit as some women were not tested for Malaria due to inadequate RDT-kits. There is a need to establish active malaria champion groups or strengthening SMAG members within the community to sensitize and make follow-ups on how pregnant women use ITNs so as to bridge the knowledge gap. During ITNs distribution, health workers should be encouraged to demonstrate to women on how to effectively use ITNs in order to promote knowledge and compliance. Pregnant women should be given ITNs regardless of late ANC booking because some women were denied of ITNs due to late antenatal booking. There should be massive sensitization on early ANC booking as uptake of IPTp was affected by late ANC booking. Women should be informed to take an active role by adopting positive behaviours towards malaria prevention.

## LIMITATIONS

The major limitation was that the study had a narrower scope of coverage of health facilities as it was only conducted in four urban health centres because researchers did not have enough resources to do the study at large scale. The sample size was small for the researcher to generalize the study to the whole district. Excluding women without malaria in pregnancy means the study emphasizes on “failures” in prevention rather than learning from any “successes” (those who stayed malaria-free). Post-natal women were interviewed about their experiences during antenatal care, and this could lead to recall bias. In addition, ANC registers were reviewed, and some valuable information could have been not documented during antenatal reviews. Interviews were conducted in Bemba for women, and this could have led to some errors in translation to English.

## Recommendation for future Research

Other studies to be conducted on unanswered questions; include: understanding the perspectives of women who do manage to avoid malaria in pregnancy: what are they doing differently? Testing targeted interventions (like ITN use education or reminder systems for IPTp) to see if they improve outcomes. A future study might also explore rural versus urban differences in malaria prevention uptake among ANC mothers. These studies will broaden an understanding about malaria in pregnancy.

## Conflict of interest

The authors declare that they have no competing interest.

## Acknowledgement

The authors would like to thank Luapula PHO and Mansa DHO for the access to use their health facilities to conduct the study. The authors would also like to thank all the participants in this study for their valuable insights.



## Funding

We did not receive any funding to conduct this analysis.

## Authors' contributions

Dr. Alice Ng'oma Hazemba supervised the project. Winstone Felix Ng'ambi and Dr. Cosmas Zyambo advised on the data analysis and policy insights on the paper. Elias Brighton Simusamba and Joseph Mutambo assisted in revising the article. All authors read and approved the final manuscript.

## REFERENCES

1. World Health Organization. World Malaria Report 2019. Geneva: WHO; 2019.
2. Bakken L, Iversen PO. The impact of malaria during pregnancy on low birth weight in East-Africa: a topical review. *Malar J*. 2021;20:348. <https://doi.org/10.1186/s12936-021-03883-z>
3. World Health Organization. World Malaria Report 2021. Geneva: WHO; 2021. ISBN: 9789240040496.
4. Diamond-Smith N, Singh N, Gupta RD, Dash A, Thimasarn K, Campbell OM, et al. Estimating the burden of malaria in pregnancy: a case study from rural Madhya Pradesh, India. *Malar J*. 2009;8:24. <https://doi.org/10.1186/1475-2875-8-24>
5. Gontie GB, Wolde HF, Baraki AG. Prevalence and associated factors of malaria among pregnant women in Sherkole district, Benishangul Gumuz regional state, West Ethiopia. *BMC Infect Dis*. 2020;20:573. <https://doi.org/10.1186/s12879-020-05289-9>
6. Ministry of Health. Guidelines on the distribution and utilization of long-lasting insecticide nets for malaria prevention. Lusaka: National Malaria Elimination Centre; 2021.
7. Ministry of Health. District Health Information System (DHIS) 2 data, Mansa District, Luapula Province; 2019.
8. Champion VL, Skinner CS. The health belief model. In: Glanz K, Rimer BK, Viswanath K, editors. Health behaviour and health education: theory, research, and practice. 4th ed. San Francisco: Jossey-Bass; 2008. p. 45–65.
9. Krejcie RV, Morgan DW. Determining sample size for research activities. *Educ Psychol Meas*. 1970;30(3):607–610.
10. Miles MB, Huberman AM. Qualitative data analysis: an expanded sourcebook. 2nd ed. Thousand Oaks, CA: Sage; 1994.
11. Braun V, Clarke V. Using thematic analysis in psychology. *Qual Res Psychol*. 2006;3(2):77–101. <http://eprints.uwe.ac.uk/11735>
12. Kanmiki EW, Awoonor JK, Phillips JF, Kachur SP, Achana SF, James A, et al. Socioeconomic and demographic disparities in ownership and use of insecticide-treated bed nets for preventing malaria among women in northern Ghana. *PLoS One*. 2019;14(1):e0211365. <https://doi.org/10.1371/journal.pone.02211365>
13. Taremwa IM, Scholastic A, Harriet OA, Carlrona A, Daniel O, Imelda K, et al. Knowledge, attitude and behaviour towards the use of insecticide treated mosquito nets among pregnant women and children in rural Southwestern Uganda. *BMC Public Health*. 2017;17:794. <https://doi.org/10.1186/s12889-017-4824-4>
14. World Health Organization. New guidelines for preventing and treating malaria in pregnancy. Geneva: WHO; 2016.
15. Amoakoh-Coleman M, Arhinful DK, Klipstein-Grobusch K, Daniel K, Evelyn K, Kwadwo A, et al. Coverage of intermittent preventive treatment of malaria in pregnancy (IPTp) influences delivery outcomes among women with obstetric referrals at the district level in Ghana. *Malar J*. 2020;19:222. <https://doi.org/10.1186/s12936-020-03288-4>
16. Konlan KD, Kossi VN, Gegefe I, Hayford L. Factors associated with ownership and utilization of insecticide treated nets among children under five years in sub-Saharan Africa. *BMC Public Health*. 2022;22:940. <https://doi.org/10.1186/s12889-022-13347-x>
17. Jumbam DT, Stevenson JC, Matoba J, Grieco JP, Ahern LN, Hamainza B, et al. Knowledge, attitudes and practices assessment of malaria interventions in rural Zambia. *BMC Public*

- Health*. 2020;20(1):216. <https://doi.org/10.1186/s12889-020-8235-6>
18. Christian OA, Joshua OA, Chukwuma DU, Eniola AB, Tukur D, Ayo SA, et al. Uptake of intermittent preventive treatment for malaria in pregnancy among women in selected communities of Ebonyi State, Nigeria. *BMC Pregnancy Childbirth*. 2019. <https://doi.org/10.1186/s12884-019-2629-4>
  19. Central Statistical Office (CSO), Ministry of Health (MOH), Tropical Diseases Research Centre (TDRC), University of Zambia, and Macro International Inc. Zambia Demographic and Health Survey 2018. Lusaka: CSO; 2018.
  20. Asuquo EF, Edet OB, Akpan PE, Duke E, Nsemio DA, Ajah CI. Utilization of insecticide treated nets among pregnant women and mothers with under five children in Ikot Omin community, Calabar, Nigeria. *Glob J Pure Appl Sci*. 2017;23:167–175. <https://doi.org/10.4314/gjpas.v23i1.17>
  21. Fokam EB, Ngimuh L, Anchang-Kimbi JK, Wanji S. Assessment of the usage and effectiveness of intermittent preventive treatment and insecticide-treated nets on the indicators of malaria among pregnant women attending antenatal care in the Buea Health District, Cameroon. *Malar J*. 2016;15:172. <https://doi.org/10.1186/s12936-016-1228-3>
  22. Kalubula M, Li XF. Assessment of utilization of intermittent preventive treatment of malaria among pregnant women in Lusaka Province of Zambia. *Epidemiology* (Sunnyvale). 2016;6:236. <https://doi.org/10.4172/2161-1165.1000236>
  23. Dako-Gyeke M, Kofie HM. Factors influencing prevention and control of malaria among pregnant women resident in urban slums, Southern Ghana. *Afr J Reprod Health*. 2015;19(1):44–53. PMID: 26103694
  24. Muhumuza E, Namuhani N, Balugaba BE, Namata J, Kiracho EE. Factors associated with use of malaria control interventions by pregnant women in Buwunga subcounty, Bugiri District. *Malar J*. 2016;15:342.
  25. Phiri ML, Chasaya M, Ngomah MA. A retrospective analysis of maternal deaths in Zambia (2019–2020). *Health Press Zambia Bull*. 2020;4(3):10–15.
  26. Osaro E, Abdullahi A, Tosan E. Risk factors associated with malaria infection among pregnant women of African descent in Specialist Hospital; Sokoto, Nigeria. *Obstet Gynecol Int J*. 2019;10(4):274–280. <https://doi.org/10.15406/ogij.2019.10.00454>
  27. Sikambale C, Halwindi H, Baboo S. Factors influencing utilization of intermittent presumptive treatment of malaria (IPTp) services by pregnant women in Sesheke District of Western Province Zambia. *Med J Zambia*. 2013;40(1).