

Article

Pregnancy-related malaria prevention with insecticide-treated nets (ITNs) : a review of the relevant literature

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A B S T R A C T

Introduction: Every year, an estimated 125 million pregnancies are at risk of contracting malaria. Malaria poses a risk to both the mother and the fetus since pregnant women are more likely to get it than non-pregnant women. Newborns, fetuses, and pregnant women are all susceptible to malaria infection. It is frequently associated with anemia, intrauterine growth restriction (IUGR), and issues such as low birth weight and trans placental parasitemia. From the first point of contact, insecticide-treated nets (ITNs) can help shield the pregnant mother and her unborn child from malaria. **Methods:** A range of English-language journal articles and case studies were reviewed in the development of this literature review that were released after 2018 in the field of study. Electronic searches were performed on a number of databases, including ScienceDirect and PubMed. **Results:** A screening procedure was carried out on 189 articles to show that the sources used were relevant and useful. Ultimately, it was determined that 5 papers would serve as the sources for this literature study. ITNs are an effective way to reduce the negative outcome for pregnant mothers who catch malaria during pregnancy, as our assessment of the literature has shown. Studies demonstrate the efficacy of ITNs in reducing the likelihood of unfavorable consequences for expectant mothers who catch malaria during pregnancy. **Conclusion:** the efficiency of ITNs in reducing the likelihood that pregnant women who catch malaria during pregnancy will experience unfavorable outcomes. Encouragement of husbands and other important family members to support their spouses' use of ITNs . Reiterating the policy's emphasis on malaria prevention education as a critical element is required to boost the use of free ITNs in healthcare settings

I. INTRODUCTION

An estimated 125 million pregnancies are susceptible to malaria annually. Because pregnant women are more likely than non-pregnant women to contract malaria, there is a danger of negative outcomes for both the mother and the fetus (WHO, 2018). Women do not develop significant antimalarial immunity in low- and unstable-transmission zones, like many parts of Asia and the Americas. As a result, they are vulnerable to bouts of acute and occasionally severe malaria as well as fetal and maternal mortality. Although these infections usually do not cause acute symptoms, they are a significant contributor to low birth weight (LBW) and severe maternal anemia, which makes them a possible indirect cause of early infant mortality. Preventing malaria in pregnancy is particularly crucial in these situations because the majority of these infections are silent, going unnoticed and untreated (Gamble et al., 2007).

Pregnant women, fetuses, and newborn children are all at risk from malaria infection. Anaemia, intrauterine growth restriction (IUGR), and problems like low birth weight and trans placental parasitaemia are often linked to it. In malaria-endemic areas, for example, malaria accounts for 20% of low-birthweight newborns and 25% of cases of severe maternal anemia. An estimated 200,000 infants and 100,000 neonates die each year, with malaria responsible for 18% of all newborn fatalities worldwide (Kassie et al., 2023).

The World Health Organization (WHO) suggests intermittent preventive treatment in pregnancy (IPTp) with at least three doses of sulphadoxine-pyrimethamine (SP) starting in the second trimester for pregnant women living in malaria-endemic areas of Africa, as well as universal coverage with long-lasting insecticide-treated nets (LLINs) for the prevention of malaria in pregnancy (WHO, 2018). The WHO prequalification (PQ) action is used to evaluate the efficacy and quality of public health treatments that have an established WHO recommendation, such as pyrethroid insecticide-treated nets (ITNs). In addition to offering protection from mosquito bites, ITNs should be able to repel insects up to 20 times after users have washed them numerous times (Skovmand et al., 2021)

As a result, it is advised that pregnant women sleep beneath insecticide-treated nets (ITNs) as early in their pregnancies as feasible, if not before. Insecticide-treated nets (ITNs) can help protect the woman who is pregnant and her fetus against malaria from the moment of first contact. Between 2000 and 2021, the proportion of pregnant women sleeping beneath insecticide-treated nets (ITNs) increased significantly globally, rising from 3 to 53% (WHO, 2018).

Our objective was to evaluate the efficacy of insecticide-treated nets (ITNs) in reducing unfavorable outcome in pregnant women in cases of malaria during pregnancy.

II. METHODS

This literature review was prepared using a strategy that draws from a variety of English-language Journal articles and case reports. Journal articles and case reports published from 2018 onwards, were included. Electronic searches of various databases including PubMed and ScienceDirect were conducted. Some sources were also included from hand searches to capture key references that may have been missed in the electronic searches. Search terms included “Malaria”, “insecticide-treated nets”, “pregnancy”, and the “efficacy”. Throughout the stages of the Pregnancy-related malaria prevention with insecticide-treated nets (ITNs) review, the number of records identified, included, and excluded is displayed in the PRISMA flow chart in Figure 1.

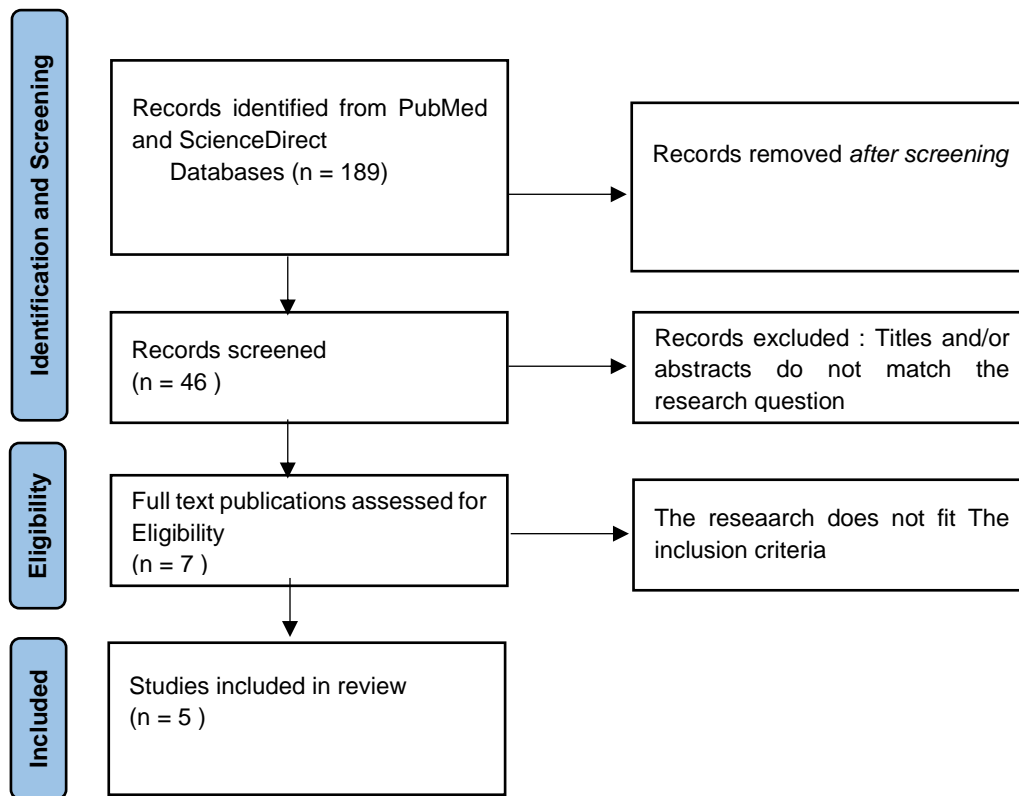


Figure 1. PRISMA Flow Chart : the Pregnancy-related malaria prevention with insecticide-treated nets (ITNs)

III. RESULT

To demonstrate that the sources utilised were practical and pertinent, a screening process was conducted on 189 articles. Finally, it was decided that this literature review will employ five articles as its sources. A wide range of geographic areas were covered in the publications. Journal articles constituted the majority of publications.

The utilization and efficacy of Long Lasting Insecticidal Nets during the early stages of pregnancy in Benin, as well as their influence on the risk of malaria infection, were evaluated by Hounkonnou et al. (2018). They monitored a group of 240 pregnant women in Southern Benin from the time of conception to the conclusion of the first trimester. Data on parasitology, mothers, and Long Lasting Insecticidal Nets were gathered proactively before to, throughout, and following the first trimester of pregnancy. The use, physical integrity, and bio-efficacy of the Long Lasting Insecticidal Nets were compared to the time to the commencement of the first malaria infection using a Cox regression model, with covariables that were important to the analysis taken into account. After controlling for other variables, the effective use, high physical integrity, and biological efficacy of long-lasting insecticidal nets were linked to a lower chance of developing the first malaria infection during the first trimester of pregnancy (HRa = 0.38; 0.18–0.80); $p < 0.001$; HRa = 0.59; 0.29–1.19); $p < 0.07$; HRa = 0.97; 0.94–1.00); $p < 0.04$, respectively). An earlier onset of malaria infection was linked to primi/secundigravidity and prior malaria infection. It's possible that the traditionally employed Long Lasting Insecticidal Nets indications of possession and use fall short of accurately describing pregnant women's actual protection during the first trimester of pregnancy. In evaluation studies, those metrics should be combined with markers of physical integrity and bioefficacy.

Kakaire et al. (2023) examined the associations between the usage of insecticide-treated nets and perceptions of severity, self-efficacy, vulnerability, and efficacy of reaction. The study found

that 49.78% of participants consistently used nets, whereas nearly one third (78.6%) reported using insecticide-treated nets the night before. The usage of insecticide-treated nets the night before and regular use have been related to high self-efficacy (AOR 9.48 95%CI 3.34–26.91). Insecticide-treated net use on a regular basis was associated with to a higher perceived threat (AOR 2.78, 95%CI 1.16–6.67), but not net use the night before. High levels of fear, as determined by perceived threat, were associated with consistent Despite increased coverage of Insecticide Treated Nets use, but not Despite increased coverage of Insecticide Treated Nets use the night before. Self-efficacy was also a significant predictor of Despite increased coverage of Insecticide Treated Nets use. The aim of social and behavior change communication interventions should be to strengthen the confidence of people who choose to utilize insecticide-treated nets regardless of their increasing prevalence.

Balami et al. (2018) report that there is still very little adherence to insecticide-treated nets (ITN) despite the high incidence of malaria in pregnant women and the problems that follow it. A pre-tested, structured questionnaire was used combined with a cross-sectional study design to collect data from 380 participants. If a respondent slept under an insecticide-treated net for three or more days per week, they were classed as users of insecticide-treated nets; those who did not use it at all or used it less frequently were classified as non-users. In this study, a significant number of pregnant women were not sleeping under nets treated with pesticide. Therefore, it is advised that health promotion initiatives be developed with the aim of increasing their perception of their own ability to use insecticide-treated nets and strengthening the social support system provided by their spouses.

Birth registry data ($n = 39,085$) were retrospectively gathered from 21 health facilities across 12 subsets of health subdistricts, 29 months prior to and 9 months following the Long-lasting insecticidal nets campaign (from 2015 to 2018). This study was carried out by Roh et al. (2022). Six conventional long-lasting insecticidal nets, five piperonyl butoxide long-lasting insecticidal nets, and one subset of the 12 health subdistricts that received a combination of conventional and piperonyl butoxide long-lasting insecticidal nets were given. Before and after the campaign, changes in the monthly incidence of stillbirth and low birthweight (LBW; <2500 g) were estimated using interrupted time-series analyses (ITSAs). Campaign effects were modeled using poisson regression with robust standard errors, which took into account variations in maternal characteristics across time, seasonal variation, and health facility-level variables. The campaign was related, according to interrupted time-series analyses, to a 26% [95% CI: 7–41] decrease in stillbirth incidence (incidence rate ratio (IRR) = 0.74 [0.59–0.93]) and a 15% [-7, 33] decrease in LBW incidence (IRR = 0.85 [0.67–1.07]) over a nine-month period. For women giving birth 7-9 months after the campaign (IRR=0.60 [0.41–0.87]), for whom the Long-lasting insecticidal nets would have covered the majority of their pregnancy, the effect on stillbirth incidence was largest. When piperonyl butoxide was compared to traditional long-lasting insecticidal nets, the estimated IRRs from difference-in-differences analyses were 1.15 [95% CI: 0.87, 1.52] for LBW incidence and 0.78 [95% CI: 0.52, 1.16] for stillbirth incidence. According to this study, a widespread campaign of long-lasting insecticidal nets has been related to a lower rate of stillbirths.

In 2020, Sonibare et al. studied pregnant women's awareness of malaria and examined the impact of malaria preventative education on the usage of long-lasting insecticidal nets. Pregnant women attending the Obafemi Awolowo University Teaching Hospitals Complex (OAUTHC) Ante-Natal Clinic (ANC) participated in a one group pretest-posttest quasi-experimental hospital study. A two-stage sample strategy was used to acquire 200 respondents in total for this study. Following the intervention, there was a statistically significant increase in the knowledge scores about malaria transmission ($\chi^2 = 8.862$, $p < 0.01$). Likewise, following the intervention, there was a statistically significant increase in the knowledge scores on malaria prevention ($\chi^2 = 10.023$, $p < 0.01$). Age, marital status, and gravidity of the respondents were associated with the use of long-lasting insecticidal nets. Following an intervention, the use of Long-Lasting Insecticidal Nets was

statistically positively correlated with knowledge of malaria preventative education ($r = 0.036$, $p < 0.01$), based on biserial correlation analysis. In this study, it found that the application of malaria preventative education was successful in raising the use of long-lasting insecticidal nets.

1. Table 1. Research screening results

No	Researcher (Year)	Title	Method	Number of Sample
1.	Hounkonnou C, Djènontin A, Egbinola S, Hounbegnon P, Bouraima A, Soares C, Fievet N, Accrombessi M, Yovo E, Briand V, Cottrell G. (2018)	<i>Impact of the use and efficacy of long lasting insecticidal net on malaria infection during the first trimester of pregnancy - a pre-conceptional cohort study in southern Benin</i>	Cohort study	240 Pregnant Women
2.	Roh ME, Oundo B, Dorsey G, Shiboski S, Gosling R, Glymour MM, Staedke SG, Bennett A, Sturrock H, Mpimbaza A (2022)	<i>A quasi-experimental study estimating the impact of long-lasting insecticidal nets with and without piperonyl butoxide on pregnancy outcomes.</i>	quasi-experimental	39,085 Birth registry data
3.	Kakaire CN, Christofides N. (2023)	<i>The role of perceived threat and self-efficacy in the use of Insecticide Treated Bednets (ITNs) to prevent malaria among pregnant women in Tororo District, Uganda</i>	cross-sectional study	230 pregnant women
4.	Balami AD, Said SM, Zulkefli NAM, Nors'a'adah B, Audu B. (2018)	<i>Knowledge, motivation, self-efficacy, and their association with insecticidal net use among pregnant women in a secondary health centre in Maiduguri, Nigeria.</i>	cross-sectional study	380 respondents
5.	Sonibare, O. O., Bello, I. S., Olowookere, S. A., Shabi, O., & Makinde, N. O. (2020)	<i>Effect of malaria preventive education on the use of long-lasting insecticidal nets among pregnant females in a Teaching Hospital in Osun state, south-west Nigeria.</i>	one group pre-test post-test quasi-experimental	191 pregnant women

IV. DISCUSSION

Our review of the literature has demonstrated the effectiveness of insecticide-treated nets (ITNs) in lowering the adverse result for expectant mothers who contract malaria during pregnancy. Research shows the effectiveness of insecticide-treated nets (ITNs) in lowering the risk of adverse outcomes for pregnant women who contract malaria during pregnancy. Early pregnancy malaria infection risk was found to be lower in cases where insecticide-treated nets were used properly and maintained their physical and biological integrity (Hounkonnou et al., 2018). According to the

study by Roh et al. (2022), during a nine-month period, the program was linked to a two-month decrease in the rate of stillbirths and a drop in the incidence of LBW. The women who gave birth 7–9 months following the campaign, for whom the Long-lasting insecticidal nets would have covered the majority of their pregnancy, saw the most impact on stillbirth incidence. The study calculated the incidence of stillbirths and LBWs by comparing piperonyl butoxide to traditional long-lasting insecticidal nets using difference-in-differences analysis. The research by Roh et al. (2022) highlights the significance of the first trimester of pregnancy as a crucial time for preventing stillbirth and living birth with disabilities and provides evidence for the benefit of insecticide-treated nets on pregnancy outcomes. These findings imply that mass distribution campaigns can increase the adoption of insecticide-treated nets early in pregnancy, thus supplementing current antenatal service delivery systems. In order to improve use, programs aimed at pregnant women who use ITNs should work to increase their sense of self-efficacy. High perceived severity levels have the unfavorable effect of inciting dread. High threat was not connected with the usage of ITNs, but it was associated with regular Net use, according to a study by Kakaire et al. (2023), indicating that there was a successful danger reaction. It has been shown that using malaria preventive education can effectively increase the adoption of ITNs. These results show that educational assistance is necessary while implementing ITNs. To increase its use, it is therefore necessary to reinforce the policy that regards the provision of free ITNs in health care settings as an essential part of malaria preventive education. In client and midwife relationships in the community, open communication and fairness are very important components. Midwives can encourage the use of ITNs to their clients, especially in malaria-endemic areas. (Sonibare et al., 2020; Yulizawati et al., 2022).

To prevent malaria during pregnancy, the World Health Organization (WHO) recommends providing long-lasting insecticide-treated nets to all pregnant women. The Malaria Policy Advisory Committee of WHO has suggested that regular distribution of long-lasting insecticide-treated nets (via ANC) continue "before, during, and after" campaigns; Ministries of Health and donors alike must accept this advice (WHO, 2018).

V. CONCLUSION

Our review of the literature indicates that the effectiveness of insecticide-treated nets (ITNs) in lowering the risk of adverse outcomes for pregnant women who contract malaria during pregnancy and treatments targeted at boosting their self-efficacy and awareness of ITN may improve ITN compliance. Health promotion programs should also emphasize encouraging husbands and other key family members to support their spouses' usage of ITNs. Interventions including social and behavior change communication should prioritize enhancing ITN users' self-efficacy. In order to increase the use of free ITNs in health care settings, it is necessary to reinforce the policy that addresses malaria prevention education as a crucial component.

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