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Prevalence and Risk Factors Associated with Malaria in Pregnancy in Nigeria: A Review of Recently Published Articles

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ABSTRACT

Background: Malaria in pregnancy represents a significant public health challenge in Nigeria, a nation that bears the highest burden of malaria cases worldwide. The physiological changes accompanying pregnancy led to a reduction in a woman's immunity, rendering them particularly susceptible to malaria infection.

Methodology: This review aims to synthesize recent findings from peer-reviewed articles published from 2020 onwards, focusing on the prevalence and risk factors associated with malaria in pregnancy within Nigeria.

Results: Studies conducted in Africa indicate a substantial burden of the disease among pregnant women attending antenatal care (ANC) visits, with pooled prevalence estimates ranging from approximately 20.09% to 21.50%. The prevalence at the time of delivery is also significant and was reported to be around 17.32% to 20.41%. A meta-analysis focusing on asymptomatic *Plasmodium falciparum* infection in Nigeria reported a pooled prevalence of 34.3%. Another meta-analysis examining asymptomatic malaria in pregnant women across Sub-Saharan Africa found an overall pooled prevalence of 26.1%. on the overall, the prevalence rate in Nigeria according to 2023 meta-analysis of ANC data was found to be 21.50%. The risk factors identified in the various articles reviewed are Behavioral risk factors, demographic risk factors, environmental risk factors and socioeconomic risk factors.

Conclusion: Based on the reviewed literature, the overall prevalence of malaria in pregnancy in Nigeria remains high, with pooled estimates indicating around 20% during antenatal visits and slightly lower at delivery. Findings from this review underscore the persistent burden of malaria in pregnancy in Nigeria and the need for targeted interventions to mitigate its adverse effects on maternal and neonatal health.

Keywords: *Plasmodium falciparum*, Nigeria, Pregnant women, Malaria in pregnancy

Introduction

Malaria in pregnancy represents a significant public health challenge in Nigeria, a nation that bears the highest burden of malaria cases worldwide.[1] The physiological changes accompanying pregnancy lead to a reduction in a woman's immunity, rendering them particularly susceptible to malaria infection.[5] This heightened susceptibility not only poses risks to the mother, including anemia, severe illness, and even mortality, but also has detrimental consequences for the developing fetus and newborn, such as low birth weight, preterm birth, stillbirth, and congenital malaria.[6] This review aims to synthesize recent findings from peer-reviewed articles published from 2020 onwards, focusing on the prevalence and risk factors associated with malaria in pregnancy within Nigeria.

Prevalence of Malaria in Pregnancy in Nigeria

Overall Prevalence from Meta-Analyses

Recent systematic reviews and meta-analyses provide a comprehensive overview of the prevalence of malaria in pregnancy. Studies conducted in Africa indicate a substantial burden of the disease among pregnant women attending antenatal care (ANC) visits, with pooled prevalence estimates ranging from approximately 20.09% to 21.50%.[7] The prevalence at the time of delivery is also significant, reported to be around 17.32% to 20.41%.[7-8] However, it is important to note that a high degree of heterogeneity has been observed in some of these pooled estimates, suggesting considerable variability in prevalence rates across different studies.[5]

Furthermore, the prevalence of asymptomatic malaria infection during pregnancy is a critical aspect of the disease burden[9]. A meta-analysis focusing on asymptomatic *Plasmodium falciparum* infection in Nigeria reported a pooled prevalence of 34.3%.[5] Another meta-analysis examining asymptomatic malaria in pregnant women across Sub-Saharan Africa found an overall pooled prevalence of 26.1%[10-13] These findings highlight that a significant proportion of pregnant women may harbor malaria parasites without displaying symptoms, potentially leading to adverse outcomes if left untreated. Across these studies, *Plasmodium falciparum* has been consistently identified as the dominant malaria species responsible for infections in pregnant women in Nigeria.[1]

Prevalence by Study Location and Population

Individual studies conducted across various states in Nigeria as shown in Table 1 below , provide a more granular view of malaria prevalence in pregnancy. In Adamawa State, a study in 2022 reported the highest prevalence of malaria (50%) among pregnant women in their second trimester attending antenatal care in certain areas.[29] Research in Bauchi State in 2023 revealed an alarmingly high incidence of malaria (70%) in July within the Miri Community, with severe parasitaemia predominantly affecting women in their first trimester.[30] Additionally, a study in a hospital in Bauchi between 2020 and 2021 found a placental malaria prevalence of 38.4% among primigravidae.[14-16] In the South-east region, specifically in Mbaitoli Local Government Area of Imo State, a study recorded an overall prevalence of 63.7% among pregnant women.[31] Further north, in Dutse, Jigawa State, a study indicated a malaria prevalence of 22% among pregnant women.[26] In Lagos State, prevalence rates appear to vary significantly, with one study from 2007-2008 reporting 7.7% [32-33], while a more recent study in 2023 found a much lower prevalence of 2%.[25] A study in Lafia, Nasarawa State, reported a prevalence of 15.79% among pregnant women.[28] In Osun State, research conducted in Osogbo, Ejigbo, and Ilobu Local Government Areas in 2020 showed a malaria prevalence of 15% among pregnant women attending antenatal care. [18-23] Finally, in Ibadan, Oyo State, a study in 2021 found that 8.7% of pregnant women tested positive for malaria parasitaemia at their booking clinic.[27]

Prevalence rates also appear to be influenced by the stage of pregnancy. Some studies have noted

varying prevalence across different trimesters.[5] For instance, one study in Bauchi showed severe parasitaemia was more common in the first trimester [34-37], while research in Adamawa reported the highest prevalence in the second trimester.[29] A study conducted outside Nigeria but relevant for understanding potential trends indicated a higher malaria prevalence in the third trimester.[11] Furthermore, a woman's parity, or the number of pregnancies she has had, plays a role.[38-39] Primigravidae are often found to have a higher susceptibility to malaria [5], although some studies also indicate a higher risk in secundigravidae. [5] However, there are instances where higher infection rates have been observed in multigravida in specific contexts.[11] Finally, the setting of the study, whether rural or urban, can impact prevalence. Studies have shown variations in prevalence between rural and urban pregnant women.[5]

Table 1: Prevalence of Malaria in Pregnancy in Nigeria by Study Location and Population (2020-2023)

Study Location (State)	Population	Year(s)	Prevalence (%)	Diagnostic Method
Adamawa	Pregnant women attending antenatal care	2022	50.0 (2nd Tri)	Blood film
Bauchi	Pregnant women in Miri Community	2023	70.0 (July)	Microscopy
Bauchi	Primigravidae at a teaching hospital	2020-2021	38.4 (Placental)	Histopathology
Imo	Pregnant women in Mbaitoli LGA	2022	63.7	Blood film
Jigawa	Pregnant women attending antenatal clinic	N/A	22.0	Not specified
Lagos	Pregnant women	2007-2008	7.7	Light microscopy

	attending antenatal clinics			
Lagos	Pregnant women attending antenatal clinic	2023	2.0	RDT, Blood film
Nasarawa	Pregnant women in Lafia	N/A	15.79	Blood film
Osun	Pregnant women in Osogbo, Ejigbo, Ilobu LGAs	2020	15.0	RDT, Blood smear
Oyo	Pregnant women at a booking clinic in Ibadan	2021	8.7	Blood smear
Sub-Saharan Africa	Pregnant women (meta-analysis)	2020	26.1 (Asymptomatic)	Various
Nigeria	Pregnant women (meta-analysis)	2023	21.50 (ANC)	PubMed, CENTRAL
Nigeria	Pregnant women (meta-analysis)	2010-2019	34.3 (Asymptomatic)	Various

Note: The source of this table includes data from individual studies and meta-analyses reported in the article[1-11]

Risk Factors Associated with Malaria in Pregnancy in Nigeria

Demographic Risk Factors

The relationship between maternal age and malaria in pregnancy appears to be complex. While

some studies suggest a higher prevalence among younger women, particularly adolescents under 20 years of age [16], possibly due to lower acquired immunity, other research indicates the highest infection rates in women aged 25-35 years [11] or even older age groups.[28] This variability might be attributed to differences in exposure patterns, acquired immunity levels across age groups in different geographical locations, and other confounding factors.[40-41]

Parity and gravidity are also significant determinants of malaria risk during pregnancy. Primigravidae are consistently identified as more susceptible due to their lack of immunity to placental-specific parasites that express variant surface antigens like VAR2CSA, which facilitate sequestration in the placenta.[5] This lack of pregnancy-specific antibodies makes first-time mothers more vulnerable to both infection and its severe complications. Secundigravidae may also face a higher risk compared to women with multiple previous pregnancies.[5] However, the protective effect of increasing parity suggests that women gradually acquire immunity against these placental-binding parasites with each subsequent pregnancy. Interestingly, some studies have reported higher malaria infection rates in multigravida in specific contexts, highlighting that the relationship between parity and malaria risk can be influenced by various factors, including transmission intensity and pre-existing immunity.[11]

Socioeconomic Risk Factors

A consistent finding across numerous studies is the association between lower levels of maternal education and a higher risk of malaria in pregnancy.[11] This correlation likely stems from several factors, including reduced awareness of effective malaria prevention measures, poorer health-seeking behavior, and potentially lower overall socioeconomic status, limiting access to resources for protection.

Occupation and income levels also play a role in influencing malaria risk during pregnancy.[11] Lower income can restrict access to essential preventive tools such as insecticide-treated nets and repellents, as well as limit the ability to afford quality healthcare services. Certain occupations, such as farming or those involving outdoor work, may increase exposure to mosquito bites due to greater proximity to mosquito habitats.

Household wealth and the quality of housing are also significant socioeconomic determinants of malaria risk.[35] Individuals residing in households with lower wealth indices and in dwellings constructed with rudimentary materials, such as natural walls and roofing without closed eaves or windows, are often at a higher risk of malaria infection. Such housing conditions offer less protection against mosquitoes, increasing the likelihood of bites.

Environmental Risk Factors

The immediate environment in which pregnant women live significantly influences their risk of malaria. Proximity to mosquito breeding sites, such as stagnant water bodies, overgrown bushes, and areas with poor sanitation, leads to a higher density of mosquito vectors and consequently

increases the chances of malaria transmission.[11] These environmental conditions provide ideal habitats for mosquito larvae to develop and mature, thus elevating the risk of exposure to infected mosquitoes.

Rainfall patterns and seasonality are also crucial environmental factors affecting malaria incidence.[5] The rainy season typically coincides with a peak in malaria transmission due to the creation of more breeding sites for mosquitoes, such as puddles and collections of water. This seasonal variation in rainfall directly impacts the mosquito population and the risk of infection.

Behavioral Risk Factors

The consistent and correct use of insecticide-treated nets (ITNs) is a highly effective measure in preventing malaria, and studies have repeatedly shown that pregnant women who do not use ITNs face an increased risk of malaria infection.[6] While ownership of ITNs has increased in many areas, this does not always translate to consistent use, highlighting the importance of behavioral factors in malaria prevention.[1] Additionally, individual sleeping habits, such as staying out late at night when mosquitoes are most active, can increase the risk of exposure and infection.[31]

Access to Healthcare and Preventive Measures

Regular attendance at antenatal care (ANC) clinics is crucial for pregnant women to receive vital information about malaria prevention, access intermittent preventive treatment in pregnancy (IPTp), and ensure early diagnosis and management of any malaria infection.[6] Late or infrequent attendance at ANC can significantly increase the risk of malaria and its complications during pregnancy.

The uptake of intermittent preventive treatment in pregnancy (IPTp) with sulfadoxine-pyrimethamine (SP) is a cornerstone of malaria prevention for pregnant women in endemic areas. Non-uptake or inadequate uptake of IPTp is a significant risk factor for malaria during pregnancy.[6] Several challenges hinder optimal IPTp coverage, including stockouts of the drug at health facilities, missed opportunities to administer IPTp during ANC visits, and low overall attendance at ANC clinics.[1]

Regional Variations in Prevalence and Risk Factors

Studies indicate notable regional variations in malaria prevalence across Nigeria. Research suggests a higher prevalence of malaria in the southern regions of the country compared to the northern regions.[5] Furthermore, one study noted a prevalence range from 8.3% in South-west Nigeria to 35.3% in North-western Uganda, highlighting the potential for significant sub-national differences, even though Uganda is outside Nigeria.[18-22] Data on malaria risk among children also reveals regional disparities, with the North West and South East regions exhibiting a higher risk.[44] Reports from the National Malaria Elimination Programme (NMEP) and the World Health Organization (WHO) indicate that the incidence of malaria is generally highest in the

northern and north-eastern parts of Nigeria.[2] Specific studies, such as those conducted in Adamawa State, provide localized prevalence data.[29] Additionally, there are regional variations in the ownership and use of insecticide-treated nets, which can influence malaria transmission rates. [42-45] For instance, higher odds of ITN ownership have been reported in the North East and North West, while lower odds were observed in the South East and South South. Among children under five, higher malaria prevalence has been observed in the Northwest and North-east regions. [34-36] The duration of the malaria transmission season also varies geographically, lasting year-round in the south and being shorter in the northern parts of the country.[1] These regional differences in prevalence and risk factors likely reflect variations in climate, environmental conditions, socioeconomic factors, and the coverage and effectiveness of malaria intervention programs across Nigeria.

Impact of Malaria in Pregnancy

Malaria during pregnancy has significant adverse consequences for both the mother and the developing fetus. Meta-analyses indicate that pregnant women with malaria have increased odds of experiencing anemia, low birth weight in their babies, preterm birth, and stillbirths.[7] Malaria is a major contributor to maternal anemia in endemic regions, exacerbating the physiological challenges of pregnancy.[4] The association with low birth weight is particularly concerning, as low birth weight is a leading cause of infant morbidity and mortality.[6] Furthermore, malaria in pregnancy increases the risk of other adverse pregnancy outcomes such as miscarriage, stillbirth, and preterm delivery.[6] The burden of malaria during pregnancy also contributes to maternal morbidity and mortality in Nigeria, highlighting the critical need for effective prevention and treatment strategies.[17]

Challenges and Interventions

Despite the availability of effective interventions, significant challenges remain in preventing and controlling malaria during pregnancy in Nigeria. The coverage of IPTp, a key preventive strategy recommended by the WHO, remains suboptimal due to factors such as low attendance at ANC clinics, frequent stockouts of sulfadoxine-pyrimethamine, and missed opportunities to administer the treatment.] While ownership of insecticide-treated nets has increased, their consistent and correct usage has plateaued or even decreased in some regions, limiting their potential impact on malaria transmission.[1] Current intervention strategies in Nigeria include the promotion of IPTp through ANC services, distribution of ITNs, and ensuring effective case management for pregnant women who become infected.

Conclusion

Based on the reviewed literature, the overall prevalence of malaria in pregnancy in Nigeria remains high, with pooled estimates indicating around 20% during antenatal visits and slightly lower at delivery. However, there is considerable variability across different geographical locations and study populations. The most commonly reported risk factors associated with

malaria during pregnancy in Nigeria include young maternal age, being a first-time mother (prim gravidity), low socioeconomic status, particularly lower educational attainment and income, non-use or inconsistent use of insecticide-treated nets, and inadequate uptake of intermittent preventive treatment in pregnancy. These findings underscore the persistent burden of malaria in pregnancy in Nigeria and the need for targeted interventions to mitigate its adverse effects on maternal and neonatal health.

Recommendations

To effectively address the burden of malaria in pregnancy in Nigeria, the following evidence-based recommendations are proposed:

1. **Strengthen Antenatal Care Services:** Enhance ANC services to ensure early and regular attendance by pregnant women. This will provide more opportunities for IPTp delivery, ITN distribution, and health education on malaria prevention.[6]
2. **Improve IPTp Uptake:** Implement strategies to increase IPTp uptake, such as directly observed therapy (DOT) at ANC clinics, explore community-based IPTp delivery models, and ensure a consistent supply of sulfadoxine-pyrimethamine at all healthcare facilities.[16]
3. **Promote Consistent and Correct ITN Use:** Intensify health education and awareness campaigns to promote the consistent and correct use of ITNs among pregnant women and their households. Address barriers to usage, such as discomfort, through culturally appropriate messaging and exploring alternative net designs.[6]
4. **Implement Targeted Interventions:** Develop and implement targeted interventions that focus on populations identified as being at higher risk, such as younger women, first-time mothers, and those from socioeconomically disadvantaged backgrounds.[11]
5. **Develop Region-Specific Strategies:** Recognize and address the regional variations in malaria prevalence and risk factors by developing and implementing region-specific prevention and control strategies tailored to the local context.[2]
6. **Promote Health Education and Awareness:** Intensify health education and awareness campaigns targeting pregnant women, their families, and communities to improve knowledge about malaria prevention, the importance of early and regular ANC attendance, and the benefits of IPTp and ITN use.[55-58 , 64].
7. **Strengthen Surveillance Systems:** Enhance surveillance systems to continuously monitor malaria prevalence among pregnant women, track the uptake and effectiveness of preventive measures, and monitor for the emergence of drug resistance.[1]
8. **Promote Inter-sectoral Collaboration:** Foster stronger collaboration between the health sector and other relevant sectors, including education, environment, and economic development, to address the multifaceted risk factors associated with malaria in pregnancy.[1]

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