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Research Article

Factors Associated with Malaria Infection Among Pregnant Women Attending Primary Healthcare Centres in Degema Local Government Area, Rivers State, Nigeria

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Abstract

Malaria remains an important cause of maternal morbidity in sub-Saharan Africa, including Nigeria, where pregnancy increases susceptibility to infection and complications such as maternal anaemia, placental malaria, low birth weight and preterm delivery. Despite recommended preventive measures, including intermittent preventive treatment with sulfadoxine-pyrimethamine (IPTp-SP), long-lasting insecticidal nets (LLINs) and antenatal care (ANC), malaria infection persists among pregnant women. Evidence on factors associated with malaria infection in riverine communities of Rivers State is limited, making context-specific evidence necessary to strengthen primary healthcare interventions. This study assessed factors associated with malaria infection among pregnant women attending selected primary healthcare facilities in Degema Local Government Area (LGA), Rivers State, Nigeria. A facility-based cross-sectional study was conducted among 422 pregnant women from August to October 2025. Participants were selected using multistage sampling. Data were collected using a structured interviewer-administered questionnaire and review of antenatal and facility records. Malaria infection was defined as a documented diagnosis during the current pregnancy. Descriptive statistics, chi-square tests and multivariable binary logistic regression were used; statistical significance was set at $p<0.05$. Malaria infection was confirmed during the current pregnancy in 266 women (63.0%). Diagnosis was based on RDT alone in 155 (36.7%), microscopy alone in 69 (16.4%), and both methods in 42 (10.0%). Verification was primarily through ANC/PHC registers, followed by laboratory records and patients' ANC cards or medical records. In multivariable analysis, women aged 25–34 years had lower odds of infection than those aged 18–24 years (AOR = 0.14, 95% CI: 0.03–0.74; p = 0.020). Failure to close doors and windows early was associated with higher odds of infection (AOR = 7.43, 95% CI: 3.45–15.98; $p < 0.001$). Receiving no or one dose of IPTp-SP was also associated with higher odds of infection compared with receiving three or more doses (both $p < 0.001$). Other examined factors were not statistically significant after adjustment. Documented malaria infection was common among antenatal attendees in Degema, and comprehensive use of prevention strategies was limited. Strengthening antenatal counselling, timely IPTp-SP and household protection, alongside improved diagnostic and preventive-record documentation, is warranted.

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1. Introduction

Malaria remains a major cause of preventable illness and death in malaria-endemic settings, with pregnant women vulnerable to maternal anaemia, placental infection, fetal growth restriction, preterm birth and low birth weight [1–4]. Pregnancy-associated changes in immunity and placental sequestration of Plasmodium falciparum contribute to this vulnerability [2, 3]. The burden remains concentrated in sub-Saharan Africa, and Nigeria contributes substantially to global malaria cases and deaths [1, 5]. Recommended malaria prevention during pregnancy includes intermittent preventive treatment with sulfadoxine-pyrimethamine (IPTp-SP), consistent use of insecticide-treated nets, timely antenatal care, prompt diagnosis and appropriate treatment [4, 6–8]. The protective value of these interventions depends on access, timing, adherence and quality of implementation. Evidence reviews show that both the delivery and uptake of interventions are influenced by health-system capacity, household resources and women's experiences of antenatal services [6, 9, 10]. Insecticide-treated nets reduce contact between people and malaria vectors when used correctly and consistently, although ownership does not necessarily translate into regular use [11–13]. Housing conditions and barriers to mosquito entry may also influence exposure, while environmental management can complement but may not replace personal protection and preventive treatment [14–16]. IPTp-SP uptake varies across and within countries and is affected by ANC attendance, timing of booking, availability of medicines, provider practices and women's knowledge [7, 9, 17]. These issues are relevant in riverine settings such as Degema LGA, Rivers State, where waterways, wetland environments and transport challenges may affect exposure and access to maternal healthcare. Studies in Nigeria and other malaria-endemic settings have identified maternal age, socioeconomic circumstances, housing, preventive practices and ANC use as potential correlates of infection or prevention uptake [18–24]. However, findings from other settings may not fully represent the circumstances of pregnant women attending primary healthcare centres in Degema. This study therefore examined factors associated with malaria infection among pregnant women attending selected primary healthcare facilities in Degema LGA, Rivers State, Nigeria. It focused on maternal characteristics, antenatal care, household practices and malaria prevention measures, using documented infection status from facility records rather than self-reported illness alone.

2. Methods

2.1. Study design and participants

A facility-based cross-sectional study was conducted among pregnant women attending selected government-owned primary healthcare facilities in Degema Local Government Area (LGA), Rivers State, Nigeria. The study was undertaken in a riverine area where local environmental conditions and geographic access are relevant considerations for malaria prevention and antenatal service delivery [18, 25]. The study was conducted in six selected facilities, namely Primary Health Centre (PHC) Bakana, PHC Oguru-Ama, PHC Usokun, Model Primary Health Centre (MPHC) Obuama, PHC Tombia, and Comprehensive Health Centre (CHC) Degema. These facilities provide antenatal care (ANC), malaria prevention and treatment services to pregnant women in their respective communities. Pregnant women aged 15–49 years with confirmed pregnancy, irrespective of gestational age, who attended ANC at the selected facilities during the study period and consented to participate were eligible for the study. Women who were critically ill or in active labour, unable to provide reliable responses, or unwilling to participate were excluded

2.2. Data collection instrument and procedures

Data were collected using a structured interviewer-administered questionnaire and review of available antenatal and health-facility records. The questionnaire was organized around the study objectives and domains covered in malaria-in-pregnancy literature, including maternal and household characteristics, IPTp-SP, LLINs, indoor residual spraying, household protection and environmental management [2, 6–9, 11, 17, 20, 26–29]. The questionnaire was also reviewed by experts in Public Health and Environmental Studies for relevance, adequacy, contextual appropriateness and alignment with the study objectives before administration. Data collection was conducted electronically using KoboToolbox. Trained research assistants administered the questionnaire face-to-face after orientation on study objectives, and ethical procedures and administration. Where available, antenatal records, facility registers, laboratory registers/results and ANC cards were reviewed to corroborate reported IPTp-SP uptake and malaria diagnosis. Malaria infection, the primary outcome, was operationally defined as a documented malaria diagnosis during the current pregnancy, supported by the available record of microscopy, rapid diagnostic test (RDT), or clinical diagnosis documented by a qualified provider. Because records were used, the outcome reflects documented diagnosis rather than universal study-specific laboratory testing.

2.3. Statistical analysis

Data were exported from KoboToolbox and analysed using IBM SPSS Statistics version 27. Descriptive statistics were presented as frequencies and percentages. Variables showing evidence of association at the bivariate stage were considered in the multivariable binary logistic regression model. Adjusted odds ratios (AORs), 95% confidence intervals (CIs), and p-values were reported. Statistical significance was set at $p < 0.05$.

3. Results

3.1. Sociodemographic characteristics

A total of 422 pregnant women were included, half were aged 25–34 years (50.2%), and most were married (76.8%) and Christian (83.2%). Over half had secondary education (51.7%), while traders/farmers constituted the largest occupational group (43.6%). Most respondents reported a monthly income of ₦70,000 or less (60.0%). Regarding gestational age, equal proportions were in the first and second trimesters (38.2% each). More than half had small household sizes (52.6%), lived in block or brick houses (66.4%), had corrugated iron-sheet roofs (78.2%), slept on beds (94.3%), and had ceilings in their homes (78.0%).

The sociodemographic characteristics of the respondents are presented in Table 1.

Table 1: Sociodemographic Characteristics of Pregnant Women Attending Primary Healthcare Centres in Degema LGA (N = 422)

Variable	Frequency (n)	Percentage (%)
Age at last birthday (years)		
15–24 years	143	33.9
25–34 years	212	50.2
35 and above	67	15.9
Marital status		
Married	324	76.8
Unmarried	33	7.8
Divorced/separated	53	12.6
Widow	12	2.8
Age at marriage		
Never married	33	7.8
Below 18 years	23	5.5
18 years and above	366	86.7
Religion		
Christian	351	83.2
Muslim	34	8.1
Others	37	8.8
Highest level of education		
No formal education	28	6.6
Primary	18	4.3
Secondary	218	51.7
Tertiary	158	37.4
Occupation		
Formal employment	73	17.3
Housewife	70	16.6
Student	81	19.2
Trader/farmer	184	43.6
Others	14	3.3
Monthly income (₦)		
≤70,000	253	60.0
71,000–100,000	93	22.0
101,000–150,000	41	9.7
151,000–200,000	25	5.9
Above 200,000	10	2.4
Gestational age (trimester)		
First trimester	161	38.2
Second trimester	161	38.2
Third trimester	100	23.7
Family size		
Below 2 persons	222	52.6
3–4 persons	128	30.3
≥5 persons	72	17.1
Type of housing		
Cement blocks/bricks	280	66.4
Makeshift/batcher	73	17.3
Plastered wall	41	9.7
Unplastered wall	28	6.6
Type of roof		
Corrugated iron sheet	330	78.2
Thatched/straw	92	21.8
Sleeping arrangement		
Bed	398	94.3
Floor (mat/mattress on floor)	24	5.7
Availability of ceiling		
Yes	329	78.0
No	93	22.0

3.2. Documented Malaria Infection

Malaria infection was confirmed during the current pregnancy in 266 (63.0%) women, while 156 (37.0%) had no documented confirmation. The diagnostic method used was rapid diagnostic test (RDT) alone in 155 (36.7%), microscopy alone in 69 (16.4%), and both methods in 42 (10.0%). The source of verification was the ANC/PHC register for 155 (36.7%), laboratory register/results for 85 (20.1%), and patients' ANC cards or medical records for 26 (6.2%).

The distribution of documented malaria infection, diagnostic methods and sources of verification is presented in Table 2.

Table 2: Malaria Infection Among Pregnant Women Attending Primary Healthcare Centres in Degema LGA, Rivers State, Nigeria

Variable	Frequency (n)	Percentage (%)
Was malaria infection confirmed during the current pregnancy based on health/ANC record?		
Yes	266	63.0
No / Not documented	156	37.0
What diagnostic method was used to confirm malaria?		
Microscopy (blood film) only	69	16.4
Malaria Rapid Diagnostic Test (RDT) only	155	36.7
Both microscopy and RDT	42	10.0
Not Applicable (No / Unconfirmed)	156	37.0
Total	422	100.0
What was the recorded malaria test result?		
Positive	266	63.0
Negative	156	37.0
Not documented	0	0.0
Total	422	100.0
Source of record verified:		
ANC/PHC register	155	36.7
Laboratory register/result	85	20.1
Patient ANC card/medical record	26	6.2
Not Applicable (No / Unconfirmed)	156	37.0
Total	422	100.0

3.3. Factors associated with malaria infection

Table 3: Factors associated with malaria Infection among pregnant women attending Primary Healthcare Facilities in Degema LGA

Variable	COR (95% CI)	p-value	AOR (95% CI)	p-value
Age at last birthday				
18–24 years	1.00	—	1.00	—
25–34 years	0.14 (0.03–0.74)	0.020	0.14 (0.03–0.74)	0.020
35 and above	0.23 (0.05–1.18)	0.078	0.23 (0.05–1.18)	0.078
Regular ANC attendance				
Yes	0.55 (0.30–1.00)	0.049	0.41 (0.16–1.04)	0.060
No (Reference)	1.00	—	1.00	—
Regular sleeping under mosquito net				
Yes	4.93 (2.88–8.45)	<0.001	1.90 (0.89–4.06)	0.096
No (Reference)	1.00	—	1.00	—
Standing water around residence				
Yes	0.53 (0.33–0.86)	0.010	0.62 (0.30–1.27)	0.188
No (Reference)	1.00	—	1.00	—
Closing doors/windows early				
Yes (Reference)	1.00	—	1.00	—
No	11.44 (6.28–20.84)	<0.001	7.43 (3.45–15.98)	<0.001
Seeking early treatment when unwell				
Yes	0.45 (0.26–0.81)	0.007	0.63 (0.27–1.45)	0.276
No (Reference)	1.00	—	1.00	—
Received IPTp during pregnancy				
Yes	0.19 (0.04–0.87)	0.033	1.85 (0.34–9.94)	0.475
No (Reference)	1.00	—	1.00	—
IPTp-SP doses received				
None	24.82 (12.33–49.93)	<0.001	24.82 (12.35–49.89)	<0.001
One dose	32.77 (17.18–62.48)	<0.001	32.77 (17.21–62.42)	<0.001
Two doses	1.22 (0.24–6.18)	0.812	—	—
Three or more (Reference)	1.00	—	1.00	—

In the multivariable analysis, age and closing doors/windows early were associated with malaria infection, while other factors lost statistical significance after adjustment. Women aged 25–34 years had lower odds of malaria infection than those aged 18–24 years (AOR = 0.14, 95% CI: 0.03–0.74; p = 0.020). Women who did not close doors and windows early had higher odds of infection than those who did (AOR = 7.43, 95% CI: 3.45–15.98; $p < 0.001$). IPTp-SP dose history was also significantly associated with malaria infection: women who received no dose and those who received one dose had higher odds of infection than women who received three or more doses (both $p < 0.001$). Regular ANC attendance, sleeping under a mosquito net, standing water around the residence, early treatment-seeking, and receipt of IPTp were not statistically significant in the adjusted analysis ($p > 0.05$).

The bivariate and multivariable factors associated with documented malaria infection are presented in Table 3.

4. Discussion

Malaria infection was common among pregnant women attending primary healthcare facilities in Degema LGA. This finding highlights the continuing burden of malaria during pregnancy in Nigeria, where infection remains an important public health concern because of its potential consequences for maternal and fetal health [1–4]. The finding can be compared with facility-based studies conducted in southern Nigeria and other malaria-endemic settings [20–25, 30–33]. Differences in reported infection patterns across studies may reflect variations in local malaria transmission, environmental conditions, study populations, diagnostic methods and the timing of assessment [1, 3, 20–25]. The occurrence of malaria infection in this population may be influenced by the riverine environment of Degema LGA, household conditions and the implementation of preventive measures. However, because environmental and entomological factors were not directly measured, their contribution cannot be established from this study. Furthermore, infection status was determined from existing health and antenatal records rather than through independent testing of every participant. Consequently, the finding represents documented malaria infection and may not capture infections that were undiagnosed or not recorded. These findings reinforce the need to strengthen malaria prevention and case management within antenatal services. Particular attention should be given to ensuring access to recommended IPTp-SP doses, promoting appropriate household mosquito-protection practices and improving the documentation of malaria testing and treatment during pregnancy [2, 5, 8, 9]. The multivariable analysis showed that women aged 25–34 years had lower odds of documented malaria infection than those aged 18–24 years, while the association among women aged 35 years and above was not statistically significant. This finding may reflect differences in parity, previous pregnancy-related experiences, socioeconomic circumstances or preventive behaviours. Previous studies investigating malaria infection among pregnant women in Nigeria and other endemic settings have examined age and related sociodemographic characteristics, although differences in population characteristics and transmission settings may contribute to varying findings [20–25]. Women who did not close doors and windows early had higher odds of documented malaria infection than those who practised this measure. This finding is consistent with broader evidence linking housing characteristics and household protection to malaria risk [14, 15, 34]. Inadequate household protection may facilitate mosquito entry and increase exposure to malaria vectors. Nevertheless, these housing studies do not necessarily investigate the specific timing of door and window closure, so the comparison should be interpreted as supporting the broader importance of housing-related protection. The number of IPTp-SP doses received was also significantly associated with documented malaria infection. Women who received no dose or only one dose had higher odds of infection than those who received three or more doses. This finding supports recommendations for repeated IPTp-SP administration during pregnancy and evidence concerning the delivery and uptake of malaria-prevention interventions [2, 3, 6–10, 17]. Studies from Nigeria and Ghana have also examined factors influencing IPTp uptake [7, 10, 17]. However, because those studies primarily address uptake and its determinants, they should not be treated as direct evidence of the same infection association unless their results specifically support that comparison. Regular antenatal care attendance, regular sleeping under a mosquito net, standing water around the residence, early treatment-seeking and receipt of IPTp during pregnancy were not statistically significant in the adjusted analysis. This differs from the broader evidence supporting insecticide-treated nets and recommended malaria-prevention interventions during pregnancy [2, 6, 11, 12, 26–29, 33, 35–37]. The absence of statistical significance in this study does not demonstrate that these interventions are ineffective. Differences in consistency of use, implementation, environmental exposure and adjustment for other variables may help explain the findings. The findings support strengthening antenatal counselling, promoting household mosquito protection, improving access to and completion of IPTp-SP, and enhancing the quality of clinical and laboratory records. These priorities align with established malaria-prevention strategies and national efforts to reduce malaria during pregnancy [1, 2, 5, 8, 9, 38, 39].

Strengths and Limitations

The study assessed malaria infection and associated factors among pregnant women across six primary healthcare facilities, using ANC and laboratory records to support outcome verification. However, its cross-sectional design limits causal inference, while incomplete records and self-reported practices may have introduced misclassification and recall or social desirability bias. The facility-based sample may limit generalisability, and environmental and entomological factors were not directly assessed.

5. Conclusion

Documented malaria infection was common among pregnant women attending selected primary healthcare facilities in Degema LGA. Younger age, failure to close doors and windows early, and inadequate IPTp-SP dosing were associated with higher odds of infection. Primary healthcare services should strengthen preventive counselling, promote household mosquito protection, ensure timely completion of IPTp-SP, and improve antenatal and laboratory record-keeping.

Abbreviations

ANC – Antenatal Care
AOR – Adjusted Odds Ratio
CHC – Comprehensive Health Centre

CI – Confidence Interval
COR – Crude Odds Ratio
IPTp – Intermittent Preventive Treatment in Pregnancy
IPTp-SP – Intermittent Preventive Treatment with Sulfadoxine-Pyrimethamine
LLIN – Long-Lasting Insecticidal Net
LGA – Local Government Area
MPHC – Model Primary Health Centre
PHC – Primary Health Centre
RDT – Rapid Diagnostic Test

Article Information

Ethical Approval: Ethical approval was obtained from the Rivers State Health Research Ethics Committee (RSHMB/RSHREC/2025/061) and the Faculty of Basic Medical Sciences, Rivers State University Ethics Review Committee (RSU/FBMS/REC/25/279).

Consent to Participate: Administrative permission was obtained from the relevant health authorities and participating facilities.

Informed Consent: Written informed consent was obtained from all participants. Participation was voluntary, confidentiality was maintained, and participants could withdraw at any time without affecting their care.

Consent for publication: Not applicable.

Data Availability: The datasets generated and/or analysed during the current study are available from the corresponding author on reasonable request, subject to applicable ethical and institutional restrictions.

Conflict of Interest: The authors declare that they have no conflict of interest.

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Author Contributions: Q.I.B. - Conceptualization, Methodology, Investigation, Data Curation, Formal Analysis, Resources, Writing – Original Draft, Writing – Review & Editing, Project Administration; A.A.O. - Writing – Review & Editing, Supervision; O.A. - Supervision; B.J.F. - Writing – Review & Editing; A.I.W. - Writing – Review & Editing, Supervision.

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