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Case Study

Malaria Status Among Internally Displaced Persons in Barkin-Ladi and Jos South Local Government Areas, Plateau State, Nigeria: A Cross-Sectional Study

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Abstract: Malaria remains a leading cause of morbidity in sub-Saharan Africa, yet its burden among internally displaced persons (IDPs) in Nigeria's Middle Belt is poorly documented. This cross-sectional study assessed malaria status among 180 consenting IDPs at Heipang (Barkin-Ladi) and Anguldi (Jos South) camps, Plateau State, Nigeria. Venous blood was screened by rapid diagnostic test (RDT) for Plasmodium falciparum antigen and confirmed by Giemsa-stained microscopy; associations with demographic and behavioural variables were tested using chi-square ($p<0.05$). Overall prevalence by microscopy was 8.9% (16/180); RDT detected 6.1% (11/180). Prevalence was highest among children aged 1–10 years (18.8%) and was non-significantly higher among males (13.0% vs 7.1%), non-users of insecticide-treated nets (9.4% vs 7.9%), and households with stagnant water (10.8% vs 5.0%) or uncleared bush (12.1% vs 4.1%). Although the overall prevalence was comparatively low relative to recent camp-based surveys in the state, children remained disproportionately affected. Strengthening net distribution and compliance, environmental sanitation, and age-targeted case management is recommended to protect this vulnerable population.

Keywords: Insecticide-treated Nets, Internally Displaced Persons, Malaria, Plateau State, Rapid Diagnostic Test

Introduction

Malaria is a life-threatening febrile illness caused by protozoan parasites of the genus Plasmodium and transmitted to humans through the bite of infected female Anopheles mosquitoes. Five Plasmodium species infect humans – P. falciparum, P. vivax, P. ovale, P. malariae, and the zoonotic P. knowlesi – and differ in morphology, geographic distribution and clinical severity. P. falciparum is the predominant species across tropical

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Africa, including Nigeria, and accounts for the greatest share of malaria-attributable morbidity and mortality.

Malaria continues to impose a disproportionate burden on the WHO African Region. Global surveillance data reported in the 2024 World Malaria Report indicate that malaria incidence rose to 60.4 cases per 1,000 people at risk in 2023, up from 58.6 in 2022, with a comparable rise across the African Region; Nigeria remained the country with the single largest share of global malaria cases and deaths (Venkatesan, 2025). These figures underscore that, despite two decades of scale-up in vector control, diagnosis and treatment, malaria elimination in Nigeria remains distant.

Populations displaced by conflict face compounded malaria risk. Breakdown of routine health services, crowded and poorly serviced shelters, and interruption of vector-control programmes all favour transmission, while movement between areas of differing endemicity can alter individual susceptibility. Globally, the number of people living in internal displacement reached a record high in the most recent reporting year, with conflict and violence, rather than disasters, the dominant driver (Internal Displacement Monitoring Centre [IDMC], 2025). Since the early 2000s, Nigeria has experienced a sustained rise in the number of internally displaced persons (IDPs), driven by insurgency in the North-East, communal and herder–farmer conflict in the North-Central zone, and related insecurity. Plateau State, situated in the North-Central zone, has hosted several IDP camps, including those at Heipang (Barkin-Ladi Local Government Area, LGA) and Anguldi (Jos South LGA), following episodes of communal violence. Elsewhere, conflict-driven displacement has been repeatedly linked to elevated malaria burden, with facility-based surveys in conflict-affected Sudan reporting malaria positivity above 50% among febrile patients, including IDPs (Jebreel et al., 2026).

Despite this, most assessments of IDP camps in Nigeria have prioritised shelter, water, sanitation and hygiene (WASH) and nutrition, with few incorporating malaria surveillance into camp health planning. This gap is notable given that malaria is consistently reported as a leading cause of morbidity among displaced populations, particularly women and children, and a recent facility-based evaluation of IDPs in Jos South LGA itself recorded a considerably higher malaria prevalence than reported here (Abba et al., 2025), underscoring the need for continued, camp-specific surveillance rather than reliance on a single historical estimate. This study was therefore designed to assess the malaria status of persons living in the Heipang and Anguldi IDP camps in Barkin-Ladi and Jos South LGAs of Plateau State, in relation to age, gender, and household- and behavioural-level risk factors, with the specific objectives of (i) determining malaria status in relation to gender, age and religion; (ii) assessing knowledge, attitude and practice regarding malaria prevention and control; and (iii) describing the socio-demographic characteristics of the study population.

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Methods

Study area

The study was conducted in IDP camps located in Barkin-Ladi and Jos South LGAs of Plateau State, north-central Nigeria. Plateau State lies between latitudes 8°24′N and longitudes 8°32′–10°38′E, at an elevation that gives it a near-temperate climate (mean temperature 13–22°C) relative to its tropical setting, with a wet season from April/May to September/October. Barkin-Ladi LGA covers approximately 1,032 km² and is predominantly inhabited by farming and mining communities of Berom, Foron and Gashish extraction. Jos South LGA, the seat of the State Government, covers approximately 510 km² and is likewise predominantly agrarian. The camps studied – Heipang (Barkin-Ladi) and Anguldi (Jos South) – were repurposed public buildings and market structures without dedicated on-site health facilities; residents accessed health care from nearby external facilities.

Study design and population

This was a descriptive cross-sectional study. The study population comprised 180 consenting adult males and females, pregnant women, and children resident in the Heipang and Anguldi IDP camps at the time of the survey (first week of December 2019).

Ethical consideration

Ethical approval was obtained from the Health Research Ethics Committee of Jos University Teaching Hospital (JUTH), Jos, in accordance with internationally recognised ethical principles for research involving human subjects. Written or witnessed verbal informed consent was obtained from each participant (or the parent/guardian of minor participants) before enrolment. Participant identity and results were kept confidential, testing was provided free of charge, and all participants found positive for malaria parasites received free antimalarial treatment.

Inclusion and exclusion criteria

Persons resident in the Heipang or Anguldi IDP camps who consented to participate were included. Persons not resident in these camps were excluded.

Sample size determination

The minimum sample size was calculated using the standard formula for single-proportion cross-sectional studies, $N = Z^2 \times Pexp(1-Pexp)/d^2$, where Z is the standard normal deviate (1.96 for 95% confidence), Pexp is the expected prevalence, and d is the desired absolute precision (5%). At the time of the survey, an expected prevalence of 30.5% was assumed based on the available regional evidence on malaria risk among Nigerian IDP populations; this range is consistent with the 28.7% malaria positivity subsequently reported for young children in Nigeria's 2021 Malaria Indicator Survey (Ujuju et al., 2023). This gave a minimum sample size of 166; 180 participants were ultimately recruited.

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Sample collection and laboratory analysis

Two millilitres of venous blood were collected aseptically from each participant into an EDTA bottle following standard phlebotomy procedure and labelled appropriately. Each sample was screened immediately by an HRP-II-based immunochromatographic rapid diagnostic test (RDT) for *P. falciparum* antigen. Thick (6µl) and thin (2µl) blood films were prepared on the same grease-free slide using a blood-film template in line with current WHO malaria case-management guidance (World Health Organization [WHO], 2025), fixed (thin film) in absolute methanol, and stained with 10% Giemsa solution (buffered water, pH 7.2) for 10 minutes before being rinsed and air-dried. Stained films were examined under oil immersion (x100 objective) at the Malaria Unit of the Infectious Disease Department, JUTH, Jos. Parasite density in positive samples was estimated using the Greenwood–Armstrong first-principle protocol: the average number of parasites per high-power field (10–50 fields examined, depending on parasitaemia) was multiplied by a factor of 500, verified as the standard conversion factor for an approximately 0.002µl field volume at x1000 magnification, to estimate parasites per microlitre of blood (Peletiri et al., 2021).

Statistical analysis

Data were entered in Microsoft Excel and analysed using SPSS version 25. The chi-square test was used to assess associations between malaria status and demographic/behavioural variables. A p-value <0.05 was considered statistically significant.

Study limitations

The RDT is susceptible to false positives, may be affected by recent antimalarial use, and can be insensitive at low parasite densities; microscopy, the reference method used for prevalence estimation in this study, was applied to mitigate this limitation.

Results

Of the 180 blood samples collected from residents of the Heipang and Anguldi IDP camps, 16 (8.9%) were positive for malaria parasites by microscopy, while 164 (91.1%) were negative (Table 1).

Table 1. Malaria status of persons living in IDP camps in Barkin-Ladi and Jos South LGAs (microscopy).

Malaria status	Frequency	Percentage (%)
Negative	164	91.1
Positive	16	8.9
Total	180	100

Malaria status did not differ significantly by gender. Although more females (n=126) than males (n=54) were screened, males had a higher prevalence (13.0%) than females (7.1%) ($\chi^2=1.581$, df=1, p=0.209) (Table 2).

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Table 2. Malaria status in relation to gender.

Gender	No. examined	No. positive	Prevalence (%)	χ^2	df	p-value
Male	54	9	13	1.581	1	0.209
Female	126	7	7.1			
Total	180	16	8.9			

Prevalence varied by age group, with children aged 1–10 years recording the highest prevalence (18.8%), followed by the 21–30-year group (14.3%); no positive cases were detected among participants aged 51 years and above. The overall difference across age groups was not statistically significant (χ^2=11.289, df=8, p=0.185) (Table 3).

Table 3. Malaria status in relation to age group (χ^2=11.289, df=8, p=0.185).

Age (years)	No. examined	No. positive	Prevalence (%)
1–10	48	9	18.8
11–20	33	1	3
21–30	21	3	14.3
31–40	27	1	3.7
41–50	26	2	7.7
51–60	9	0	0
61–70	11	0	0
71–80	4	0	0
81–90	1	0	0
Total	180	16	8.9

Prevalence was higher among participants reporting stagnant water near their dwellings (10.8%) than among those without (5.0%; χ^2=1.681, p=0.195), and among those with uncleared bush around their compounds (12.1%) than those who cleared surrounding bush (4.1%; χ^2=3.464, p=0.063) (Tables 4 and 5). Prevalence was also higher among those who did not sleep under insecticide-treated nets (9.4%) than those who did (7.9%; χ^2=0.109, p=0.742) (Table 6), though none of these associations reached statistical significance.

Table 4. Malaria status in relation to the presence of stagnant water.

Stagnant water	No. examined	No. positive	Prevalence (%)	χ^2	df	p-value
Present	120	13	10.8	1.681	1	0.195
Absent	60	3	5			
Total	180	16	8.9			

Table 5. Malaria status in relation to uncleared bush around the compound.

Bush around compound	No. examined	No. positive	Prevalence (%)	χ^2	df	p-value
Present	107	13	12.1	3.464	1	0.063

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Absent	73	3	4.1			
Total	180	16	8.9			

Table 6. Malaria status in relation to use of insecticide-treated nets (ITN).

Sleeps under ITN	No. examined	No. positive	Prevalence (%)	χ^2	df	p-value
Yes	63	5	7.9	0.109	1	0.742
No	117	11	9.4			
Total	180	16	8.9			

Comparison of the two diagnostic methods showed that the RDT detected fewer positives (11/180, 6.1%) than microscopy (16/180, 8.9%), consistent with the lower analytical sensitivity of antigen-based RDTs relative to expert microscopy at low parasite densities. Among the 16 microscopy-positive samples, parasite density ranged from 180 to 1,250 asexual parasites/µl of blood, with most positive samples clustering at the lower end of this range.

Discussion

This study found an overall malaria prevalence of 8.9% among residents of the Heipang and Anguldi IDP camps in Barkin-Ladi and Jos South LGAs, Plateau State. This is markedly lower than the 57.7% prevalence recently reported among IDPs in Jos South LGA itself (Abba et al., 2025), and also lower than the broader altitude-stratified community prevalence reported across Plateau State (Abba et al., 2024). Several factors may explain this comparatively low prevalence relative to these more recent camp-based estimates, including the timing of sample collection at the onset of the dry season (December), when Anopheles breeding and transmission intensity are reduced relative to the peak rainy-season months, differences in diagnostic sensitivity and case ascertainment between facility-based and community-based sampling, and the relatively high proportion of net users identified in this cohort (63/180).

Nonetheless, the presence of positive cases – particularly the marked concentration of infection among children aged 1–10 years (18.8%) – signals that malaria transmission is ongoing within these camps and disproportionately affects the most immunologically vulnerable age group. This pattern is consistent with the well-documented age-dependent acquisition of clinical immunity to Plasmodium infection, whereby repeated exposure in endemic settings confers partial protection in older children and adults but leaves infants and young children more susceptible to symptomatic infection and higher parasite densities.

Although more females than males were screened, males had a higher point prevalence of malaria parasitaemia (13.0% vs 7.1%), though the difference was not statistically significant. A comparable pattern of higher male prevalence has been reported among IDPs in Jos South LGA, where males recorded a significantly higher infection rate than females (Abba et al., 2025), and among displaced populations in conflict-affected Sudan, where male sex was independently associated with higher malaria positivity (Jebreel

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et al., 2026), suggesting that local behavioural and occupational exposure – rather than biological sex per se – likely drives this variation.

The higher, though statistically non-significant, prevalence observed among participants with stagnant water and uncleared bush around their dwellings, and among those who did not sleep under insecticide-treated nets, is consistent with the established role of peridomestic Anopheles breeding sites and personal protection behaviour in determining household-level transmission risk. This aligns with national evidence that insecticide-treated net use in Nigeria remains sub-optimal, with only around 41.5% of women of reproductive age nationally reporting net use, and with marked variation by socioeconomic status and region (Barrow et al., 2025). The borderline association with uncleared bush ($p=0.063$) in particular suggests that environmental vector-control measures – larval source management and clearing of vegetation that provides mosquito resting sites – warrant continued emphasis in camp-level malaria control planning, even where net usage is comparatively good.

Taken together, these findings reinforce that displacement settings, even where overall prevalence is moderate, concentrate malaria risk in specific subgroups – principally young children and households with inadequate environmental sanitation or incomplete net coverage – who should be prioritised for targeted intervention within broader camp health programming. Notably, more recent evidence from both Jos South LGA (Abba et al., 2025) and conflict-affected Sudan (Jebreel et al., 2026) points to a considerably higher malaria burden among IDPs than found in the present survey, indicating that malaria risk in displacement settings can shift substantially over time and by season, and reinforcing the case for repeated, rather than one-off, camp-level surveillance.

Conclusion

Malaria prevalence among residents of the Heipang and Anguldi IDP camps in Barkin-Ladi and Jos South LGAs, Plateau State, was comparatively low (8.9%) relative to other community surveys in the state, with Plasmodium falciparum identified as the predominant infecting species by rapid diagnostic testing and microscopy. Children aged 1–10 years bore a disproportionate share of the parasitological burden, underscoring the continued vulnerability of this age group even in settings of otherwise modest transmission. These findings support the case for integrating malaria surveillance and targeted vector-control interventions into routine IDP camp health programming in Plateau State.

Recommendations

1. IDP camps, alongside underserved rural and peri-urban communities lacking dedicated health facilities, should be designated as priority sites for malaria intervention and control programmes, with efforts intensified ahead of and during the rainy-season transmission peak.
2. Camp-based distribution of, and education on, insecticide-treated nets should be strengthened, alongside environmental sanitation measures targeting stagnant water and unmanaged bush around dwellings.

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3. Effective case management, use of insecticide-treated nets, and intermittent preventive treatment should be implemented in line with current WHO guidance (WHO, 2025) and Nigeria's National Malaria Strategic Plan, 2021–2025 (Federal Ministry of Health & National Malaria Elimination Programme, 2021).
4. Larger, longitudinal, multi-camp studies – including molecular species confirmation – are recommended to better characterise malaria transmission dynamics among Nigeria's internally displaced population.

Declarations

Ethics approval and consent to participate: Ethical approval was granted by the Health Research Ethics Committee of Jos University Teaching Hospital (JUTH), Jos. Informed consent was obtained from all participants, or from parents/guardians on behalf of minors, prior to enrolment.

Consent for publication: Not applicable (no individual identifying data are reported).

Availability of data and materials: The datasets analysed during the current study are available from the corresponding author on reasonable request.

Competing interests: The authors declare that they have no competing interests.

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Author contributions: MGY conceived and designed the study, collected and analysed data, and drafted the manuscript. BDG and PN contributed to data collection, interpretation of results, and critical review of the manuscript. All authors read and approved the final manuscript.

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