Lafia Journal of Scientific & Industrial Research (LJSIR), Vol. 4(1), 2026
p-ISSN: 3026 – 9288 e-ISSN: 3027 – 1800 pages: 219-225
https://lafiascijournals.org.ng/index.php/ljsir/index ⇒ Published by the Faculty of Science,
Federal University of Lafia, Nasarawa State, Nigeria

A Risk-Based Analysis of Malaria Transmission and Healthcare Needs among Nomads in North Central Nigeria

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Abstract

Nigeria continues to bear a disproportionate share of the global malaria burden, with nomadic populations remaining one of the most underserved and vulnerable groups. This study presents a risk-based and spatiotemporal assessment of malaria transmission and healthcare access among nomadic communities in North Central Nigeria. A cross-sectional mixed-methods design was employed, integrating quantitative surveys (rapid diagnostic tests and structured questionnaires), qualitative interviews, and geospatial analysis. Data were obtained from 100,000 nomadic individuals across six states. Results indicate that malaria prevalence among febrile individuals was 45 %, with significantly higher rates among children under five years (63 %). Overall transmission was influenced by seasonal patterns, with prevalence rising to 67 % during the rainy season. Logistic regression analysis identified key determinants of malaria infection, including age under five (AOR = 2.53), distance greater than 5 km to health facilities (AOR = 1.88), and lack of formal education (AOR = 1.62), while insecticide-treated net (ITN) use (AOR = 0.69) and formal healthcare utilization (AOR = 0.75) were protective. Despite high awareness of malaria (85 %), preventive practices and healthcare utilization remain suboptimal, with only 28 % reporting ITN use and 18 % accessing formal health facilities. Structural barriers such as distance (55 %), cost (48 %), and cultural factors continue to limit access to care. The study highlights significant spatial clustering of malaria risk in riverine and hard-to-reach areas. The findings underscore the urgent need for mobile, culturally sensitive, and geographically targeted malaria interventions to improve prevention, diagnosis, and treatment among nomadic populations.

Keywords: Malaria, Nomadic populations, Nigeria, Health access, GIS, Logistic regression

Article History

Submitted
February 03, 2026

Revised
April 24, 2026

First Published Online
April 26, 2026

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doi.org/10.62050/ljsir2026.v4n1.818

Introduction

Malaria remains a leading cause of morbidity and mortality in Nigeria, contributing significantly to the global disease burden. Despite progress in malaria control, nomadic populations particularly pastoralist groups remain underserved due to their mobility, remote settlements, and limited interaction with formal healthcare systems. Nomadic communities often settle near rivers and forested areas, increasing exposure to mosquito breeding sites. Their frequent migration disrupts access to preventive interventions such as insecticide-treated nets (ITNs) and timely treatment. Additionally, socio-cultural practices and economic barriers further limit healthcare utilization.

One particularly vulnerable group is the Fulani, who are nomadic pastoralists. Their exposure to malaria vectors is increased by their frequent migrations between ecological zones in pursuit of pasture and water for cattle [1]. These nomadic groups frequently set up camps close to rivers, woodlands, or other areas of standing water, all of which serve as breeding grounds for Anopheles mosquitoes [2]. Because of this, their risk of infection is consistently elevated all year round. To address these limitations, there is a growing need for approaches that integrate epidemiological, behavioral, and spatial dimensions of malaria risk. Nomadic populations, particularly pastoralist groups such as the Fulani, present unique challenges that conventional static healthcare delivery models fail to adequately capture their movement across ecological zones increases exposure to malaria vectors, while exclusion from routine health surveillance systems leads to underrepresentation in national datasets. Advances in geospatial analysis, combined with mixed-methods epidemiological approaches, provide an opportunity to bridge this gap [3]. By incorporating risk-based modeling, spatial mapping, and assessments of Knowledge, Attitudes, and Practices (KAP), it becomes possible to better understand both the distribution of malaria risk and the structural barriers to healthcare access in these populations [4].

Although North Central Nigeria experiences seasonal malaria transmission influenced by ecological diversity, data on malaria burden among nomadic populations remain limited [5, 6]. This study therefore provides a risk-based and spatiotemporal analysis of malaria transmission and healthcare needs among nomadic communities in North Central Nigeria. Specifically, it aims to (i) quantify malaria prevalence and identify key demographic and environmental risk factors, (ii) examine healthcare access, utilization patterns, and socio-cultural determinants of health-seeking behavior, and (iii) map the spatial distribution of malaria risk in relation to nomadic settlement patterns. The study seeks to provide a technical foundation for designing targeted, mobile, and context-specific malaria control interventions tailored to the unique needs of nomadic populations.

Materials and Methods

Study area

The study was conducted in North Central Nigeria, a region characterized by diverse ecological and socio-cultural landscapes. The area comprises six states which are Benue, Kogi, Kwara, Nasarawa, Niger, and Plateau located between latitudes approximately 6°N and 10°N and longitudes 4°E and 10°E (Fig. 1). This region serves as a major transitional zone between the forested south and the savannah-dominated northern Nigeria, with climatic conditions that strongly influence malaria transmission dynamics.

Figure 1: Map of North Central Nigeria showing the study area

North Central Nigeria experiences a tropical climate with distinct wet (April–October) and dry (November–March) seasons. The rainy season promotes the formation of stagnant water bodies, floodplains, and temporary pools, which serve as breeding sites for Anopheles mosquitoes. Vegetation ranges from Guinea savannah to derived savannah, supporting both agricultural activities and pastoralism. The presence of major rivers such as the Niger and Benue further contributes to environmental suitability for malaria transmission.

The region is also notable for its substantial nomadic and semi-nomadic populations, particularly Fulani pastoralists, who migrate seasonally in search of pasture and water. These populations often settle in remote and hard-to-reach areas with limited access to formal healthcare infrastructure. Their mobility across ecological zones increases exposure to malaria vectors and complicates the delivery of routine health interventions.

Study design

In this study, a cross-sectional mixed-methods approach was employed. Quantitative methods were used to assess malaria prevalence, knowledge, attitudes, and practices (KAP), whereas qualitative methods provide a deeper comprehension of health-seeking behavior, cultural factors, and obstacles to healthcare access. Geospatial technologies were used to map the danger of malaria in relation to nomadic settlement patterns. 100,000 study participants visited a number of randomly selected health centers since 2022 were investigated using a cross-sectional methodology. Every outpatient suspected of having malaria who lived among nomads in every state in the North Central region was documented. Sociodemographic information was gathered using a standardized questionnaire. A randomized cross-sectional survey was carried out at a hospital and nomadic locations. Each nomad patient who came to the clinic was required to fill out a pre-assessed, structured Quantitative methods were used to assess malaria prevalence, knowledge, attitudes, and practices (KAP), whereas qualitative methods provide a deeper comprehension of health-seeking behavior, cultural factors, and obstacles to healthcare access. Geospatial technologies were used to map the danger of malaria in relation to nomadic settlement patterns.

A face-to-face interview was conducted to collect data on the participants, including their age, sex, occupation, education, use of mosquito nets, and whether or not there was a river or stream within a mile of their residence. Additional details, such as their hemoglobin genotype and blood type, were disclosed in their medical records. The enumerators and field supervisors were both qualified field research assistants with degrees and post-secondary education certificates. Prior to the final version being issued and used by the enumerators, the questionnaire underwent pretesting.

Additionally, secondary (quantitative) data from DHIS2 was used in the study analysis. Every medical facility in the 4 selected LGAs of the states were included in the study analysis. The average test positivity rate is 77.4. Additional details, such as their hemoglobin genotype and blood type, were disclosed in their medical records. The enumerators and field supervisors were both qualified field research assistants with post-secondary and degrees education certificates. Prior to the final version being issued and used by the enumerators, the questionnaire underwent pretesting.

Study population and sampling

A total of 100,000 nomadic individuals were selected using cluster sampling across 1,000 clusters. Eligible participants were nomads residing in the study area for at least six months.

Data collection

Semi-structured key informant interviews (KIIs) and Focus Group Discussions (FGDs) were used to obtain information from key stakeholders at all levels. Qualitative interviews were conducted by the recruited enumerators at all levels. Meanwhile, where possible, data collectors were responsible for data transcription by the end of the exercise using the provided template.

The participants were selected through a purposive sampling technique to undertake semi-structured key informant interviews (KIIs). The interviewees were informed individuals with leadership and program management experience in various organizations at different levels. Program management, case management, laboratory, and staff responsible for surveillance, monitoring, and evaluation were given priority at the FMoH level. The public and private health facilities selections were based on high malaria burden. Only employees with a minimum of one year of service were included in the sample. The stakeholder's interviews that were done are as detailed in Table 1, unless saturation has been reached with fewer numbers.

Focus group interviews (FGDs) were conducted with several groups of nomads, including community leaders, elders, women, youth, health professionals, traditional leaders, herders, parents, and caregivers. The selected participants were individuals with leadership and general malaria experience. At the community level, we used purposive sampling to interview a total of 12 FGDs across all the selected LGAs using semi-structured interview guides. Two communities were selected per LGA per State/region, and each of the above positions was interviewed.

Ethical approval

The full ethical approval was granted by a committee from the National Health Research Ethics Committee (NHREC) under the Federal Ministry of Health. Reference No: NHREC/01/1/2025, Protocol No: MOH/NC/2025/047

Statistical analysis

Descriptive statistics and chi-square tests, and logistic regression were applied using SPSS (version 27.0). The dependent variable was malaria infection status (RDT positive/negative).

Logistic regression model equation

$$\log\left(\frac{\text{P(Malaria Positive)}}{1-\text{P(Malaria Positive)}}\right) = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \varepsilon$$

Where: P(Malaria Positive) = Probability of testing positive for malaria; X_1 = distance to Health Facility; X_2 = use of Mosquito Nets; X_3 = good Knowledge of Symptoms; X_4 = Malaria Knowledge Level; X_5 = the Proximity to Water Bodies; β_0 = the intercept; β_1, β_2,…,β_6 = coefficients of predictors; ϵ = error term

Results and Discussion

Table 1 presents the socio-demographic profile of the study population. The sample consisted predominantly of males (55 %), reflecting the gendered structure of pastoralist mobility, where men are more actively involved in herding activities. A substantial proportion of respondents (60 %) had no formal education, indicating low literacy levels among nomadic populations.this finding aligns with previous studies that report limited educational attainment among nomadic groups, which significantly influences health awareness and utilization of preventive measures [8]. Low education has been consistently linked to poor malaria prevention practices and reduced uptake of interventions such as ITNs.

Table 1: Socio-demographic characteristics of respondents

Variable	Category	Frequency (%)
Sex	Male:	55,000 (55)
	Female:	45,000 (45)
Age group	<5:	15,000 (15)
	5–17:	28,000 (28)
	18–49:	42,000 (42)
	50+:	15,000 (15)
Education level	No formal:	60,000 (60)
	Islamic:	40,000 (20)
	Primary+:	40,000 (20)
Duration in location	≥6 months:	100 % (inclusion criterion)

Table 2: Malaria RDT results and prevalence

Indicator	Value
Total individuals surveyed	100,000
Individuals with fever (last 2 weeks)	25,000
RDT-positive cases	11,250
Malaria prevalence among febrile cases	45 %

Table 3: Malaria prevalence by age group

Age Group	Prevalence (%)
<5 years	63
5–17 years	47
Adults	38

Children under five recorded the highest prevalence (63 %)

Table 2 summarizes malaria prevalence among respondents, showing that 45 % of febrile individuals tested positive for malaria. Table 3 further indicates that children under five years recorded the highest prevalence (63 %), followed by individuals aged 5–17 years (47 %).

These results are consistent with earlier findings that identify children less than five years of age as the most vulnerable group due to immature immunity [7]. Similar high prevalence rates among nomadic populations have been reported in Nigeria and other sub-Saharan African contexts, where mobility and environmental exposure increase infection risk [8].

Table 3 presents the distribution of malaria prevalence across different age groups in the study population. The results indicate that children under five years exhibit the highest prevalence rate (63%), followed by individuals aged 5–17 years (47 %), while adults (≥18 years) show comparatively lower prevalence.

This pattern reflects well-established epidemiological trends in malaria-endemic regions, where younger children are more susceptible due to underdeveloped immunity. Repeated exposure over time enables older individuals to acquire partial immunity, thereby reducing both the frequency and severity of infections. The elevated prevalence among children in this study underscores their heightened vulnerability, particularly within nomadic populations where access to preventive interventions and timely treatment is limited.

The findings are consistent with prior studies across sub-Saharan Africa, which consistently identify children under five as the most at-risk group for malaria infection and complications. However, the relatively high prevalence observed among older children (5–17 years) suggests sustained exposure and possible gaps in preventive coverage, such as low utilization of insecticide-treated nets (ITNs) and limited access to structured healthcare services.

In the context of nomadic communities, this trend may be further exacerbated by frequent movement across malaria-endemic zones, increasing cumulative exposure to infected mosquito vectors. Additionally, healthcare delivery models that rely on fixed facilities may fail to adequately reach these populations, resulting in delayed diagnosis and treatment.

Overall, the age-specific distribution highlighted in Table 3 emphasizes the need for targeted malaria control strategies, particularly focusing on children under five and school-aged populations within nomadic groups. Interventions such as mobile health services, seasonal malaria chemoprevention (SMC), and improved ITN distribution tailored to migratory populations are critical for reducing disease burden in these high-risk groups.

As shown in Table 4, malaria prevalence was slightly higher among males (47 %) than females (43%). This difference may be attributed to increased outdoor exposure among males due to occupational activities such as herding.

This observation supports findings from nomadic and rural malaria studies, which indicate that occupational exposure significantly contributes to infection risk [9]. However, the relatively small difference suggests that malaria risk remains widespread across both genders.

Table 4: Malaria Prevalence by Sex

Sex	Prevalence (%)
Male	47
Female	43

Table 5: Knowledge and preventive practices related to malaria

Indicator	%
Awareness of malaria (heard of malaria)	85
Correctly identified mosquito bites as cause	60
Ownership of insecticide-treated nets (ITNs)	40
Slept under ITN (previous night)	28
Reliance on traditional remedies	55

Table 5 presents findings on malaria-related knowledge and preventive practices. Although awareness of malaria was high (85 %), only 60 % correctly identified mosquito bites as the cause, while just 28 % reportedly slept under ITNs.

This gap between awareness and practice is widely documented in malaria research. For instance, Barrow *et al.* [10] reported that while ITN ownership may be moderate, actual utilization remains low due to behavioral, cultural, and environmental constraints. Similarly, studies among nomadic Fulani populations show persistent misconceptions about malaria causation and prevention [11].

The low utilization of ITNs observed in this study underscores structural and behavioral barriers, including mobility, sleeping arrangements, and discomfort associated with net use.

Table 6 highlights treatment-seeking patterns, showing that only 18 % of respondents accessed formal health facilities, while a larger proportion relied on chemists (44 %) and traditional healers (25 %).

Table 6: Health-seeking behavior among nomadic populations

Variable	Category	%
Treatment source	Chemists/Patent Medicine Vendors	44
	Traditional Healers	25
	Formal Health Facilities	18
Barriers to health facility utilization	Distance to Facility	55
	Cost of Treatment	48
	Language/Cultural Barriers	20
	Perceived Discrimination/ Poor Treatment	15

Table 7: Barriers and Access to Health Services

Category	Indicator	%
Barriers	Distance to health facility	55
	Cost of treatment	48
	Cultural/Language barriers	20
Access Indicators	Within 5 km of facility	22
	Received outreach services	14
	Awareness of free services	35

Table 7 further identifies major barriers, including distance (55 %), cost (48 %), and cultural factors (20 %). These findings are consistent with existing literature demonstrating that nomadic populations face significant barriers to healthcare access. Ugwu *et al.* [12], Sheik-Mohamed and Velema [13] emphasize that geographic isolation and mobility limit engagement with formal health systems. Similarly, Audu *et al*. [14] identified cost and distance as major determinants of poor healthcare utilization in rural Nigeria. The reliance on informal healthcare providers increases the risk of delayed or inappropriate treatment, contributing to higher malaria morbidity.

Malaria prevalence and transmission factors

The prevalence of malaria among the nomadic population was found to be around 62 %, based on RDT (Rapid Diagnostic Test) and the survey examination. Seasonal variations significantly affected malaria incidence, with higher transmission rates recorded during the rainy season (67 % prevalence) compared to the dry season 33 % prevalence. The presence of breeding sites near settlements, such as stagnant water bodies and poorly drained grazing areas, contributed to the high transmission rates with percentage distribution of 23 % from stagnant water, 12 % from temporary pool, 15 % from ponds created, 27 % from drained grazing area, 5 % from river bank and 18 % from dirty environment .Usage of insecticide-treated nets (ITNs) was reported at 3 %, while 45 % of respondents did not use any form of vector control measures. Knowledge about malaria prevention was low, with 35 % of respondents incorrectly associating malaria with exposure to cold weather rather than mosquito bites with response of only 15 %. The details of the responses are presented in percentages in Figs 1–5.

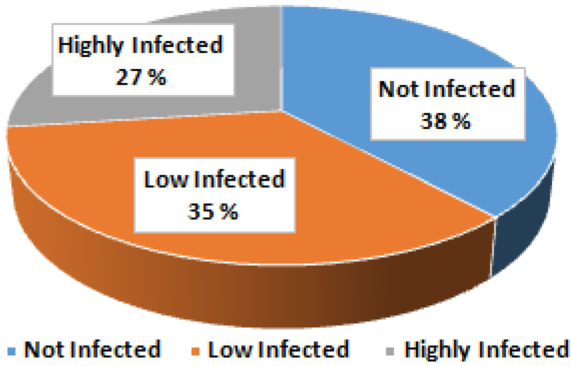

Figure 1: The prevalence of malaria among the nomadic population

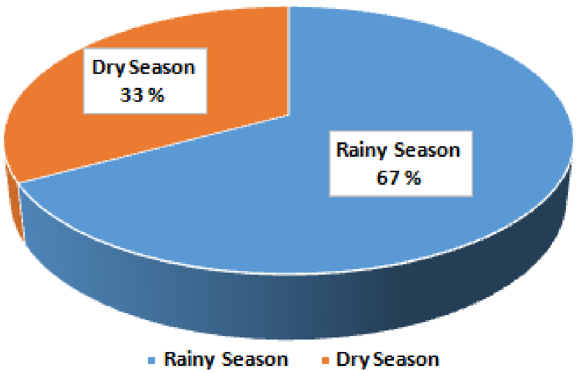

Figure 2: Prevalence of malaria according to seasonal variations

The study found that malaria prevalence increased significantly during the rainy season (67 %) compared to the dry season (33 %). Environmental factors such as proximity to stagnant water and grazing areas were also strongly associated with transmission.

These findings are in line with established evidence that malaria transmission is highly seasonal and closely linked to ecological conditions [15]. Nomadic settlements near water bodies further amplify exposure to mosquito breeding sites.

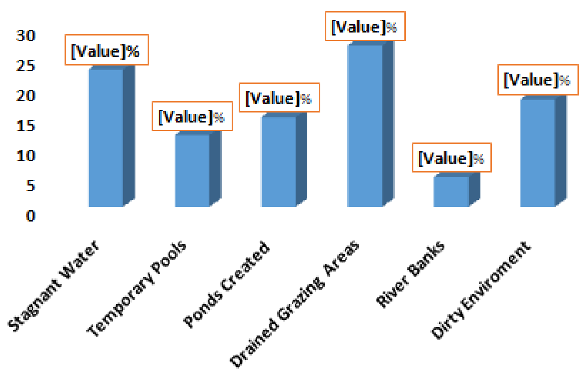

Figure 3: The presence of breeding sites near settlements

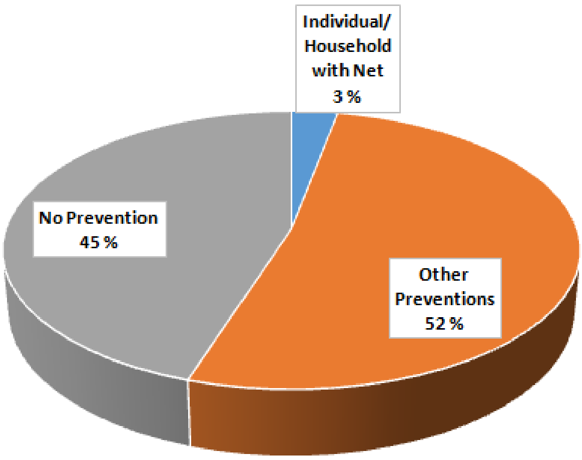

Figure 4: Usage of insecticide-treated nets (ITNs)

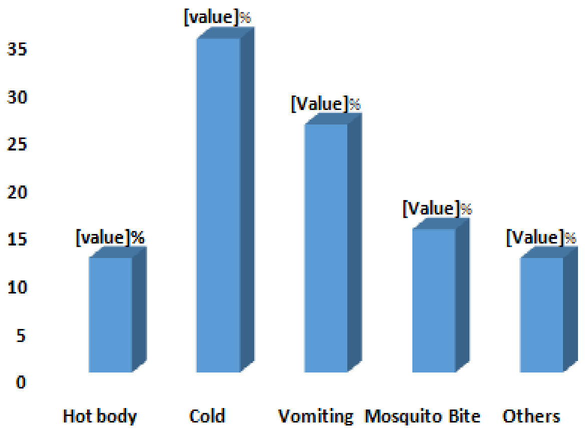

Figure 5: Knowledge about malaria transmission

Table 8: Logistic regression findings

Variable	AOR	Interpretation
Age <5 years	2.53	Higher risk
Male sex	1.14	Slightly higher risk
No formal education	1.62	Higher risk
ITN use	0.69	Protective
Distance >5 km	1.88	Higher risk
Formal treatment	0.75	Protective

The model explained 28 % of variance (Nagelkerke R^2 = 0.28) and had good fit

Table 8 presents the results of the logistic regression model. Key risk factors included age under five (AOR = 2.53), distance greater than 5 km to health facilities (AOR = 1.88), and lack of formal education (AOR = 1.62). Protective factors included ITN use (AOR = 0.69) and formal healthcare utilization (AOR = 0.75).
These findings are strongly supported by prior research. Distance to healthcare facilities has been consistently identified as a critical determinant of malaria outcomes [9, 15]. Similarly, ITN use remains one of the most effective protective interventions, although its uptake is often limited in nomadic populations [10].

The model's explanatory power (Nagelkerke R^2 = 0.28) suggests that while these factors are significant, malaria transmission is influenced by a complex interplay of environmental, behavioral, and systemic variables which is in line with [16] research outcome.

Conclusion

This study provides robust empirical evidence on the burden, determinants, and spatial distribution of malaria among nomadic populations in North Central Nigeria. The findings reveal persistently high malaria prevalence, particularly among vulnerable groups such as children under five, and highlight the significant role of environmental exposure, mobility patterns, and socioeconomic disadvantage in shaping transmission dynamics.
Although awareness of malaria is relatively high, this does not translate into effective preventive practices or timely healthcare utilization. The low uptake of insecticide-treated nets and the heavy reliance on informal healthcare providers reflect both behavioral and systemic constraints. Importantly, physical access to health care especially distance to facilities emerged as a critical determinant of malaria risk, underscoring the limitations of conventional, facility-based healthcare delivery models for mobile populations. The integration of epidemiological, behavioral, and spatial analyses in this study demonstrates that malaria risk among nomads is not only a health issue but also a function of geographic exclusion and health system inequities. The persistence of these gaps poses a significant threat to Nigeria's malaria elimination goals.
In conclusion, achieving equitable malaria control requires a paradigm shift from static, facility-based interventions to adaptive, mobile, and community-centered strategies that are responsive to the unique needs of nomadic populations.

Recommendations

The following recommendations are made from findings

i. Deploy mobile health clinics to reach nomadic settlements
ii. Expand community health worker (CHW) programs
iii. Increase ITN distribution tailored to migration patterns
iv. Integrate GIS-based surveillance for hotspot tracking
v. Promote culturally adapted health education
vi. Strengthen multi-sectoral collaboration

Conflict of interest: There is no conflict of interest among the authors.

Acknowledgments: The authors acknowledge the support of TETFund, Federal University of Lafia, participating communities, and health stakeholders.

References

1. Usman, M. & Akeyede, I. (2025). Population estimation and evaluation of causes of malaria transmission among nomads in Taraba State, Nigeria. *FULafia J. of Sci. & Techn.*, 9(1), 21-29. https://doi.org/10.62050/fjst2025.v9n1.499
2. Njobdi, S. (2022). Malaria transmission and asymptomatic malaria during rainy season among nomads, North-eastern Nigeria. *International Journal of Tropical Disease & Health*, 43(23), 1-9. DOI: 10.9734/IJTDH/2022/v43i231368
3. National Malaria Elimination Programme (NMEP) (2021). *National Malaria Strategic Plan 2021–2025*. Federal Ministry of Health, Nigeria.
4. Adebayo, A. M., Akinyemi, O. O. & Cadmus, E. O. (2015). Knowledge, attitudes, and practices of malaria prevention among nomadic pastoralists in Southwest Nigeria. *Malaria Research and Treatment*, Article 243561. https://doi.org/10.1155/2015/243561
5. Nwankwo, E. O., Adekeye, O. A. & Musa, A. Z. (2020). Health-seeking behaviour and access to malaria treatment among rural populations in Nigeria. *Afri. J. of Health Sci*, 33(2), 45–53.
6. Ajayi, I. O., Falade, C. O., Olley, B. O., Yusuf, B., Gbotosho, G. O., Iyiola, T. & Oladipo, O. (2019). Community perceptions and treatment practices for malaria in rural Nigeria. *BMC Public Health*, 19(1), 6752. https://doi.org/10.1186/s12889-019-6752-0
7. Akogun, O. B., Adesina, A. O., Njobdi, S. & Okoye, C. (2012). Febrile illness experience among Nigerian nomads. *International Journal for Equity in Health*, 11, 5. https://doi.org/10.1186/1475-9276-11-5
8. Seck, M. C., Thwing, J., Fall, F. B. & Gueye, C. S. (2017). Malaria among nomadic pastoralists: A systematic review. *Malaria J.*, 16, 460. https://doi.org/10.1186/s12936-017-2055-x
9. Ajala, A. & Onyima, B. N. (2021). Healthcare access among nomadic populations in Nigeria: Challenges and implications. *Journal of Asian and African Studies*, 56(6), 1243–1257. https://doi.org/10.1177/0021909620975806
10. Barrow, A., Jallow, S., Cham, B. & Ceesay, S. J. (2025). Determinants of insecticide-treated net use in Nigeria. *PLOS Global Public Health*, 5(4), e0004207. https://doi.org/10.1371/journal.pgph.0004207
11. Moukénet, A., Honoré, B., Smith, H. & Koffi, A. A. (2022). Knowledge and perceptions of malaria among nomadic groups in sub-Saharan Africa. *Malaria Journal*, 21, 74. https://doi.org/10.1186/s12936-022-04074-0
12. Ugwu, C., Okeke, T., & Eze, P. (2024). Malaria control strategies in Nigeria: Progress and challenges. *Malaria Journal*, 23, 15-19. https://doi.org/10.1186/s12936-024-04954-3
13. Sheik-Mohamed, A. & Velema, J. P. (1999). Where health care has no access: The nomadic populations of sub-Saharan Africa. *Tropical Medicine & Int. Health*, 4(10), 695–707. https://doi.org/10.1046/j.1365-3156.1999.00473.x
14. Audu, O., Idris, S. H., Oladipo, A. R., & Ejembi, C. L. (2013). Determinants of health care utilization in rural communities of Nigeria. *International Journal for Equity in Health*, 12, 24. https://doi.org/10.1186/1475-9276-12-24
15. Alao, J. O., Adeyemi, A. S. & Bello, M. O. (2025). Socioeconomic influences on malaria prevention in Nigeria. *BMC Public Health*, 25, Article 24326. https://doi.org/10.1186/s12889-025-24326-3
16. Perugini, E., Martinez, R. & Okell, L. C. (2023). Malaria transmission dynamics in Africa: A review of environmental and behavioral drivers. *Parasites & Vectors*, 16, 571. https://doi.org/10.1186/s13071-023-05710-7

Citing this Article

Akeyede, I., Yusuf, S. A., Saleh, I. M., & Emmanuel, A. Y. (2026). A risk-based analysis of malaria transmission and healthcare needs among nomads in North Central Nigeria. *Lafia Journal of Scientific and Industrial Research*, *4*(1), 219–225. https://doi.org/10.62050/ljsir2026.v4n1.818