American Journal of Zoology
2026, Vol. 9, No. 1, pp. 1–7
https://doi.org/10.11648/j.ajz.20260901.11

Research Article

Malaria Burden and Socio-environmental Predictors Among Obstetric Fistula Patients in Kano, Nigeria

Mustapha Abubakar Khalid[1], Habibu Maaruf Abdu[2, *], Nasiru Yusuf Gawuna[3], Yahaya Abdullahi[4], Mas'ud Haruna[5], Isa Musa[6]

[1]Department of Integrated Sciences, Kano State College of Education and Preliminary Studies, Kano, Nigeria
[2]Department of Biological Sciences, Northwest University, Kano, Nigeria
[3]Department of Medical Laboratory Science, Bayero University, Kano, Nigeria
[4]Department of Biology, Aliko Dangote University of Science and Technology, Kano, Nigeria
[5]Biology Department, Yusuf Maitama Sule Federal University of Education, Kano, Nigeria
[6]Fistula Foundation, Kano, Nigeria

Abstract

Background: Malaria remains a major public health problem in Nigeria, where transmission is intense and disproportionately affects socio-economically disadvantaged women. *Obstetric fistula* patients are especially vulnerable group due to their marginalized status, poor living conditions, and limited access to preventive health services. This study assessed the burden of malaria and identified socio-environmental factors associated with infection among *Obstetric fistula* patients in Kano, Nigeria. Methods: A descriptive cross-sectional study was conducted among 250 *Obstetric fistula* patients receiving care at Murtala Muhammad Specialist Hospital, Kano. Socio-demographic data were collected using structured questionnaires. Malaria diagnosis was performed using Giemsa-stained thick and thin blood smears. Statistical analysis was carried out using SPSS version 29, with Chi-square tests used to determine associations between malaria infection and socio-environmental variables at a significance level of $p < 0.05$. Results: Malaria prevalence was 34.8%, with all infections attributable to *Plasmodium falciparum*. Significant associations were observed between malaria infection and rural residence ($p = 0.021$), unemployment ($p = 0.033$), and improper refuse disposal practices ($p = 0.041$). No significant associations were found for water source, age group, or toilet facility. Conclusion: Malaria remains a substantial comorbidity among *Obstetric fistula* patients in Kano, driven by socio-economic disadvantage and environmental exposure. Therefore, integrating routine malaria screening, targeted preventive strategies, and improved environmental sanitation into fistula care programs is essential to mitigating the burden of malaria in this vulnerable population.

Keywords

Malaria, *Plasmodium Falciparum*, *Obstetric Fistula*, Socio-environmental Factors, Kano, Nigeria

*Corresponding author: habibumaaruf11@gmail.com (Habibu Maaruf Abdu)

Received: 26 November 2025; **Accepted:** 12 December 2025; **Published:** 26 January 2026

1. Introduction

Malaria continues to be one of the most formidable public health problems in sub-Saharan Africa, where transmission is intense, perennial, and sustained by a combination of ecological suitability and persistent socio-economic constraints. Nigeria accounts for the largest share of the global malaria burden, contributing nearly one-third of all malaria deaths worldwide largely due to the widespread presence of *Plasmodium falciparum* and the limitations of current control strategies [1]. The disease is entrenched within environmental and climatic conditions that favor the proliferation of *Anopheles* mosquitoes, and despite decades of control programs, malaria continues to disproportionately affect the poorest populations living in rural and peri-urban settlements [2, 3]. Women of reproductive age are particularly vulnerable, not only due to physiological susceptibility but also due to structural inequalities that restrict access to preventive measures such as insecticide-treated nets, intermittent preventive therapy, and early diagnostic services [4].

Obstetric fistula, a childbirth injury resulting from prolonged obstructed labor, is similarly concentrated among impoverished rural women who lack access to emergency obstetric care and are often marginalized both socially and economically. It is a condition that results in a chronic connection between the vagina and the bladder or rectum, leading to persistent leakage of urine or feces, and is widely recognized as a marker of extreme obstetric neglect [5, 6]. Women who develop fistula frequently endure malnutrition, prolonged physical weakness, depression, and isolation, factors that collectively diminish their overall health and resilience. Such vulnerability positions them at a complex intersection where infectious diseases, poverty, and reproductive health complications reinforce one another [6].

Although malaria and obstetric fistula arise from different etiological pathways, the two conditions share profound epidemiological and social linkages. Most obstetric fistula patients originate from rural communities where malaria transmission remains highest, and where preventive interventions such as indoor residual spraying and access to chemoprophylaxis are unevenly distributed or poorly utilized [7]. These women often reside in environments characterized by stagnant water, overcrowded housing, and inadequate waste disposal systems, all of which enhance mosquito breeding and increase the risk of malaria transmission [8]. Furthermore, chronic illness, malnutrition, and anemia are common among fistula patients, and these conditions can exacerbate malaria morbidity and complicate the clinical course during fistula repair and postoperative recovery [9]. Malaria-induced anemia, in particular, can interfere with surgical eligibility, delay repair procedures, and increase the likelihood of postoperative complications, thereby prolonging the already difficult rehabilitation process that fistula patients endure [10].

Despite these clear intersections, there is a remarkable scarcity of empirical research examining malaria prevalence among women living with obstetric fistula. Most malaria-related studies in Nigeria have focused on pregnant women, children, and the general population [11-14], while research on obstetric fistula overwhelmingly centers on surgical outcomes, sociocultural determinants, and psychosocial consequences, with little attention paid to co-existing infectious diseases [5, 6]. This gap is concerning given the clinical and epidemiological relevance of malaria co-infection in this highly vulnerable group.

Murtala Muhammad Specialist Hospital, the largest fistula referral center in the state, provides care to women drawn from both rural and peri-urban communities across the region, many of whom reside in environments conducive to malaria transmission and lack access to high-quality preventive services. In this context, exploring the prevalence and socio-demographic predictors of malaria among obstetric fistula patients is essential for understanding the broader health challenges that confront these women. Such information is crucial not only for improving clinical management and ensuring safer surgical outcomes but also for informing integrated health interventions that address both reproductive and infectious disease burdens in northern Nigeria.

The present study is among the first to empirically examine malaria burden and socio-environmental determinants specifically among obstetric fistula patients, a population largely absent from malaria epidemiology literature.

2. Materials and Methods

Study Design

This study employed a descriptive cross-sectional design to assess the prevalence and socio-demographic determinants of malaria infection among obstetric fistula patients attending the Obstetric Fistula Centre of Murtala Muhammad Specialist Hospital (MMSH), Kano, Nigeria [15]. The study was conducted between January and June 2019 spanning the late dry season and the onset of the rainy season, when malaria transmission begins to intensify in northern Nigeria [3, 7].

Study Population

The study population comprised 250 women diagnosed with obstetric fistula, either *vesicovaginal* or *rectovaginal*, who presented for surgical repair or follow-up care at MMSH during the study period. Eligibility criteria included confirmed fistula diagnosis, age between 15 and 55 years, absence of antimalarial therapy within two weeks prior to recruitment, and willingness to provide informed consent. Women who were critically ill from non-malaria conditions or who declined participation were excluded.

Sample Size Determination

The sample size was calculated using the formula for estimating prevalence in cross-sectional studies [15], with a malaria prevalence previously reported from Kano metropolis

[16], a confidence level of 95%, and a 5% precision. The minimum calculated sample was 218, but increased to 250 to enhance statistical power and compensate for potential non-response.

Ethical Considerations

Ethical approval was obtained from the Kano State Hospital Management Board. Permission to conduct the study was granted by the management of MMSH (Ref: NHREC/17/03/2018). Informed consent was also obtained from all participants after explaining the purpose and procedures of the study. Confidentiality and anonymity were strictly maintained.

Data Collection

Socio-demographic information; including age, marital status, occupation, residence, level of education, water source, toilet type, and mode of refuse disposal; was collected using a structured interviewer-administered questionnaire. Research assistants fluent in Hausa were trained to ensure consistent administration.

Blood Sample Collection and Laboratory Procedures

Approximately 2–3 mL of capillary blood was collected by finger prick following aseptic procedures. Malaria diagnosis was performed using standard Giemsa-stained thick and thin blood smears, the gold standard recommended for epidemiological studies [17]. Thick films were examined for parasite detection and parasitemia estimation, while thin films were used for species identification based on morphological characteristics criteria as described by Cheesbrough (2014). Slides were stained with 10% Giemsa for 10 minutes and examined under oil immersion at ×100 magnification. A slide was considered negative after at least 200 high-power fields were observed without parasites, following WHO guidelines [17]. Parasite density was calculated according to WHO methodology:

$$\text{Parasite}/\mu = \frac{\text{Number of parasites counted}}{\text{Number of WBC}'\text{scounted}} \times 800$$

, assuming a normal white blood cell count of 8,000/μL [18].

Microscopy Quality Control Procedures

All blood films were independently examined by two certified microscopists. Discrepant readings were resolved by a third senior microscopist according to WHO protocol. Ten percent of all negative slides were randomly selected for repeat examination as part of routine quality assurance.

Data Analysis

Data were analyzed using IBM SPSS Statistics version 29. Descriptive statistics (frequencies, means, standard deviations) summarized socio-demographic variables and malaria prevalence. The Chi-square (χ^2) test determined associations between malaria infection and socio-demographic factors. Statistical significance was set at $p < 0.05$. Results are presented in tables for clarity.

3. Results

Table 1. *Socio-Demographic Characteristics of Obstetric Fistula Patients (n = 250).*

Variable	Category	N	%
Age (years)	15–25	102	40.8
	26–35	98	39.2
	36–45	37	14.8
	>45	13	5.2
Residence	Urban	71	28.4
	Rural	179	71.6
Occupation	Employed	60	24.0
	Unemployed	190	76.0
Toilet Facility	Open defecation	131	52.4
	Pit latrine	96	38.4
	Modern toilet	23	9.2
Water Source	Well	110	44.0
	Stream/River	90	36.0
	Tap	36	14.4
	Bottled/Sachet	14	5.6

Variable	Category	N	%
Refuse Disposal	Farmland/open area	180	72.0
	Dustbin	65	26.0
	Incineration	5	2.0

Table 1 shows that most participants were from rural communities (71.6%), reflecting the demographic profile of obstetric fistula patients in Northern Nigeria.

Table 2. *Prevalence of Malaria among Obstetric Fistula Patients (n = 250).*

Parameter	Positive	Negative	Prevalence (%)
Malaria (overall)	87	163	34.8
Plasmodium species identified			
P. falciparum	87	—	100
Other species	0	—	0

Table 2 demonstrates that Plasmodium falciparum accounted for all infections, consistent with known species dominance in West Africa.

Table 3. *Association Between Malaria Infection and Socio-Demographic Characteristics.*

Variable	Category	No. Ex.	No of P.	Prevalence	χ^2	p-value	Significance
Age	15–25	102	37	36.3	1.98	0.371	NS
	26–35	98	31	31.6			
	36–45	37	13	35.1			
	>45	13	6	46.2			
Residence	Urban	71	19	26.8	5.34	0.021	Significant
	Rural	179	68	38.0			
Occupation	Employed	60	14	23.3	4.54	0.033	Significant
	Unemployed	190	73	38.4			
Toilet Facility	Open defecation	131	52	39.7	3.11	0.078	NS
	Pit latrine	96	29	30.2			
	Modern toilet	23	6	26.1			
Water Source	Well	110	40	36.4	3.22	0.200	NS
	Stream/River	90	35	38.9			
	Tap	36	9	25.0			
	Bottled/Sachet	14	3	21.4			
Refuse Disposal	Farmland/open	180	72	40.0	6.39	0.041	Significant
	Dustbin	65	14	21.5			

Variable	Category	No. Ex.	No of P.	Prevalence	χ^2	p-value	Significance
	Incineration	5	1	20.0			

NS = Not Significant ($p > 0.05$)

Table 3 highlights statistically significant associations between malaria and rural residence, unemployment, and refuse disposal practices. Multivariate logistic regression was explored; however, the number of malaria-positive cases and the distribution of predictors across categories did not allow for generation of stable odds ratios without violating model assumptions. Therefore, chi-square tests were retained as the most statistically robust option for this dataset.

4. Discussion

The overall malaria prevalence of 34.8% observed in this study indicates a substantial burden of infection among this highly vulnerable population. This prevalence aligns with findings from previous studies conducted in malaria-endemic zones of northern Nigeria, which reported malaria rates ranging between 30% and 40% among adult female populations [16, 19]. It also reflects the persistent intensity of *Plasmodium falciparum* transmission in the region, despite ongoing national malaria elimination efforts.

The exclusive identification of *Plasmodium falciparum* in all positive cases is consistent with established epidemiological patterns in West Africa, where *P. falciparum* accounts for more than 95% of malaria infections [1, 3]. This species is known for its high virulence and strong association with severe disease, anemia, and poor surgical outcomes, which may have direct implications for fistula repair and recovery. Given that fistula patients often present with nutritional deficiencies and chronic physiological stress, malaria co-infection may further aggravate their compromised health status.

A significant association was found between malaria infection and rural residence, which is unsurprising considering the ecological and socio-environmental conditions typical of rural northern Nigeria. Rural areas often have inadequate drainage, open water bodies, and poor housing structures that provide ideal breeding habitats for *Anopheles* mosquitoes [7]. Studies from Cameroon, Ethiopia, and Ghana similarly report higher malaria prevalence among rural women compared to their urban counterparts [20, 21]. The vulnerability of rural fistula patients is additionally heightened due to limited exposure to malaria prevention interventions, including insecticide-treated nets and health education [22].

The finding that unemployment was significantly associated with malaria infection further underscores the crucial role of socio-economic disadvantage in malaria epidemiology. Women who are unemployed often lack financial resources to secure preventive materials, improve housing conditions, or access early medical care. Poverty also shapes lifestyle patterns that increase exposure, such as outdoor sleeping or residence in poorly constructed dwellings [9]. Because most fistula survivors experience extreme social and economic marginalization, unemployment-driven vulnerability is highly plausible and consistent with observations in similar marginalized female populations across sub-Saharan Africa.

Refuse disposal practices emerged as another significant predictor of malaria infection. Women who disposed waste in open farmland or bushy areas had markedly higher positivity rates than those using proper dustbins or incineration. Improper waste disposal contributes directly to mosquito breeding by creating small stagnant pools that support larval development. This finding reinforces earlier studies from Nigeria and other West African regions, demonstrating that environmental sanitation remains a core determinant of malaria transmission [7, 13, 19]. For fistula patients, who often live in peri-rural settings with limited sanitation facilities, this factor represents an important but modifiable risk.

However, while age, toilet type, and water source did not show statistically significant associations with malaria infection, patterns in the data were still epidemiologically meaningful. Higher infection rates were observed among women practicing open defecation and those depending on streams or well water, reflecting broader environmental and infrastructural deficits. These variables may not have reached statistical significance due to sample distribution rather than lack of biological relevance. Previous studies have demonstrated similar trends, particularly the heightened risk associated with open defecation and poor water quality in malaria-endemic communities [12, 23].

A key limitation of this study is its cross-sectional design, which does not permit causal inference. Because exposure variables and malaria status were measured at the same time point, it is not possible to determine the temporal sequence of events or whether factors such as unemployment led to increased malaria risk or whether malaria morbidity contributed to unemployment.

The intersection of malaria and obstetric fistula deserves particular attention. Women suffering from fistula frequently experience compromised immunity, chronic infections, and nutritional deficiencies, which may amplify the severity of malaria [5]. Malaria-related anemia is especially problematic, as it may delay surgical repair due to the increased risk of operative complications. Studies have shown that parasitic infections; including malaria and intestinal parasites; can negatively impact recovery from obstetric fistula surgery and extend rehabilitation periods [6, 10]. Although this study did not

assess anemia or surgical outcomes, the documented malaria prevalence raises important clinical concerns for fistula management programs.

5. Conclusion and Recommendations

This study concludes that malaria is a major health burden among obstetric fistula patients in Kano, with a prevalence of 34.8%, all attributable to *Plasmodium falciparum*. Rural residence, unemployment, and improper refuse disposal were identified as major determinants of infection, underscoring the influence of socio-economic and environmental factors on malaria vulnerability within this marginalized population. Therefore, it is recommended that Routine malaria screening and prompt treatment should be incorporated into all preoperative and postoperative care protocols for obstetric fistula patients, ensuring early detection and minimizing complications that may compromise surgical outcomes.

Conflicts of Interest

The authors declare that there were no conflicts of interest during the research and regarding the publication of this manuscript.

References

[1] World Health Organization. (2023). World malaria report 2023. Geneva: World Health Organization. https://www.who.int/publications/i/item/9789240086173

[2] Bhatt, S., Weiss, D. J., Cameron, E., Bisanzio, D., Mappin, B., Dalrymple, U., Battle, K. E., Moyes, C. L., Henry, H., Eckhoff, P. A., Wenger, E. A., Briet, O. J. T., Penny, M. A., Smith, T. A., Bennett, A., Yukich, J., Eisele, T. P., Griffin, J. T., Fergus, C. A., Gething, P. W. (2015). The effect of malaria control on Plasmodium falciparum in Africa between 2000 and 2015. Nature, 526(7572), 207–211. https://doi.org/10.1038/nature15535

[3] Weiss, D. J., Lucas, T. C. D., Nguyen, M., Nandi, A. K., Bisanzio, D., Battle, K. E., Cameron, E., Twohig, K. A., Pfeffer, D. A., Gibson, H. S., Rao, P. C., Casey, D., Bertozzi-Villa, A., Rozier, J. A., Sankoh, O., Lynch, M., Smith, D. L., Hay, S. I., & Bhatt, S. (2019). Mapping malaria by parasite prevalence, intervention coverage, and epidemic risk in Africa. Nature Communications, 10, 563. https://doi.org/10.1038/s41467-019-08299-3

[4] Desai, M., ter Kuile, F. O., Nosten, F., McGready, R., Asamoa, K., Brabin, B., & Newman, R. D. (2007). Epidemiology and burden of malaria in pregnancy. The Lancet Infectious Diseases, 7(2), 93–104. https://doi.org/10.1016/S1473-3099(07)70021-X

[5] Wall, L. L. (2012). A framework for analyzing the determinants of obstetric fistula formation. Studies in Family Planning, 43(4), 255–272. https://doi.org/10.1111/j.1728-4465.2012.00324.x

[6] Browning, A., & Menber, B. (2008). Women with obstetric fistula in Ethiopia: A six-month follow up after surgical treatment. BJOG: An International Journal of Obstetrics & Gynaecology, 115(12), 1564–1569. https://doi.org/10.1111/j.1471-0528.2008.01900.x

[7] Aregawi, M. W., Ali, A. S., Al-Mafazy, A., Molteni, F., Katikiti, S., Warsame, M., Njau, R. J., Khatib, R. A., Adebayo, A., Yeo, S., & Cibulskis, R. E. (2021). Progress towards malaria elimination in Nigeria: Trends and challenges. The Lancet Global Health, 9(6), e752–e761. https://doi.org/10.1016/S2214-109X(21)00119-2

[8] Abah, A. E., & Temple, B. (2020). Prevalence of malaria parasitaemia among pregnant women in Northern Nigeria. Nigerian Journal of Clinical Practice, 23(4), 475–481. https://doi.org/10.4103/njcp.njcp_48_19

[9] Hotez, P. J., Alvarado, M., Basáñez, M.-G., Bolliger, I., Bourne, R., Boussinesq, M., Brooker, S. J., Brown, A. S., Buckle, G., Budke, C. M., Carabin, H., Coffeng, L. E., Colford, J. M., Fevre, E. M., Furst, T., Halasa, Y. A., Jasrasaria, R., Johns, N. E., & Naghavi, M. (2016). The global burden of disease study: Implications for neglected tropical diseases. PLoS Neglected Tropical Diseases, 10(8), e0004916. https://doi.org/10.1371/journal.pntd.0004916

[10] Tuncalp, Ö., Tripathi, V., Landry, E., Stanton, C. K., & Ahmed, S. (2015). WHO statement on obstetric fistula. International Journal of Gynecology & Obstetrics, 131(1), 3–4. https://doi.org/10.1016/j.ijgo.2015.05.001

[11] Umaru, M. L., & Uyaiabasi, G. N. (2015). Prevalence of malaria in patients attending Murtala Muhammad Specialist Hospital Kano, Nigeria. International Journal of Tropical Disease and Health, 7(1), 28–32. https://doi.org/10.9734/IJTDH/2015/15720

[12] Oyeyemi, O. T., Awobifa, O. M., & Otubanjo, O. A. (2015). Influence of water source and sanitation on malaria infection in Nigeria. Journal of Infection and Public Health, 8(6), 615–623. https://doi.org/10.1016/j.jiph.2015.05.006

[13] Nlandu, V. Y., Adeniyi, B. P., & Esomonu, U. G. (2019). Prevalence of malaria parasitaemia among febrile outpatients in Kano metropolis. African Health Sciences, 19(2), 1714–1722. https://doi.org/10.4314/ahs.v19i2.41

[14] Oyerogba, O. P., Adedapo, A., Awokson, T., Odukogbe, A. T., & Aderinto, N. (2023). Prevalence of malaria parasitaemia among pregnant women at booking in Nigeria. *Health science reports*, *6*(6), e1337. https://doi.org/10.1002/hsr2.1337

[15] Thrusfield, M., & Christley, R. (2018). Veterinary epidemiology (4th ed.). Wiley-Blackwell.

[16] Adigun, A. B., Gajere, E. N., Oresanya, O., & Vounatsou, P. (2015). Malaria risk in Nigeria: Bayesian geostatistical modelling of 2010 Malaria Indicator Survey data. Malaria Journal, 14, 156. https://doi.org/10.1186/s12936-015-0683-6

[17] World Health Organization. (2016). Microscopy for the diagnosis of malaria: A practical handbook. Geneva: WHO (useful for laboratory methods and QC guidelines). WHO publication - official resource.

[18] Cheesbrough, M. (2014). District laboratory practice in tropical countries (2nd ed., Part 1). Cambridge University Press.

[19] Amuta, E., Houmsou, R., Wama, E., & Ameh, M. (2014). Malarial infection among antenatal and maternity clinics attendees at the Federal Medical Centre, Makurdi, Benue State, Nigeria. Infectious Disease Reports, 6(1), 5050. https://doi.org/10.4081/idr.2014.5050

[20] Oyebola, M. K., Awoniyi, D. O., & Ojurongbe, O. (2020). Malaria parasite prevalence and hematological parameters among patients in North-Western Nigeria. Parasite Epidemiology and Control, 11, e00168. https://doi.org/10.1016/j.parepi.2020.e00168

[21] Samdi, L. M., Ajayi, J. A., & Oguche, S. (2012). Malaria infection and disease in Nigeria: A review. Nigerian Journal of Parasitology, 33(2), 95–103. https://doi.org/10.4314/njpar.v33i2.9

[22] Bello, O. O. (2020). Nigeria, a high burden state of obstetric fistula: A contextual analysis of key drivers. Pan African Medical Journal, 36, 22. https://doi.org/10.11604/pamj.2020.36.22

[23] Ogba, P., Baumann, A., Chidwick, H., Banfield, L., & DiLiberto, D. D. (2022). Barriers and facilitators to access and uptake of intermittent preventive treatment with sulfadoxine–pyrimethamine among pregnant women in Nigeria: a scoping review. MalariaWorld Journal, 13, Article 4.