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Full Length Research Article

AN ASSESSMENT OF MALARIA PARASITE INFECTIONS AMONG INDIVIDUALS SEEKING MEDICAL CARE IN SELECTED HEALTHCARE FACILITIES IN KADUNA METROPOLIS, KADUNA, NIGERIA

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ABSTRACT
Malaria continues to be a major public health challenge in Nigeria, with Kaduna State among the regions with endemic transmission. This study was conducted to determine the prevalence and demographic distribution of malaria parasite infections among individuals seeking medical care in selected healthcare facilities in Kaduna Metropolis. A cross-sectional, facility-based study was conducted across selected public and private health facilities in Kaduna State. Of the 464 (100%) examined for the presence of malaria parasites, 267 (57.5%) were infected. Females have a much higher prevalence rate, 169 (67.3%), than males, 98 (46.0%). Hospital C reported the highest number of infected cases, 88 (33.0%), followed by Hospital B with 69 (25.8%), while Hospital A and Hospital D had lower numbers of infected cases, 54 (20.2%) and 56 (21.0%), respectively (P>0.05). Ages 11–15 and 16–20 years had the highest prevalence rates of malaria parasites, 35 (63.6%) and 35 (67.3%), respectively (*P*< 0.05). The highest infection was recorded in June, with 69 (70.8%), followed by October, September, July, and August, with 34 (59.7%), 38 (58.5%), 44 (57.1%), and 32 (56.1%), respectively. Prevalence of Malaria Parasite in relation to the Risk factors revealed that a higher prevalence among participants without formal education (63.3%) as compared to those with formal education (36.7%). Occupation showed that self – employed (29.6%) and unemployed (26.6%) had the highest numbers of infected participants; based on place of residence, it showed that rural residents account for nearly two – thirds (64.4%) of all the malaria cases, while urban residents make up only (35.6%). The prevalence of malaria parasites was also analyzed by use of Insecticide-Treated Nets (ITNs). The results showed that more malaria infection occurred among Insecticide Treated Nets (ITNs) non – users (57.7%) than Insecticide Treated Nets (ITNs) users (42.3%). Malaria remains a significant burden among healthcare-seeking individuals in Kaduna State, particularly among young children and rural residents.

Keywords: *Plasmodium falciparum*, Epidemiology, Healthcare facilities, Insecticide-treated nets, Kaduna Metropolis.

INTRODUCTION

Malaria remains a significant public health challenge in sub-Saharan Africa, with Nigeria bearing the highest global burden (WHO, 2022). According to the World Health Organization (WHO, 2020), Nigeria accounted for approximately 27% of global malaria cases and 31% of malaria deaths in 2022. Children under five years of age are particularly vulnerable, representing about 76% of all malaria deaths in the WHO African Region (WHO, 2022). The World Malaria Report indicated that Nigeria accounts for a quarter of all malaria cases in the 45 malaria-endemic countries in Africa, showing clearly the challenge of malaria in Nigeria (WHO, 2019).

Malaria remains a worldwide health concern, instigating 216 million infections and approximately 655,000 deaths in the year 2010 (WHO, 2018). The disease is prevalent in parts of Africa, Oceania, Asia, and Central and South America, with approximately 90% of the global malaria burden borne by Sub-Saharan Africa (Oshikoya, 2006; WHO, 2021).

The WHO (2022) described malaria as a widely distributed tropical disease caused by a protozoan parasite of the genus *Plasmodium*. The disease is transmitted by the pathogenic bite of an infected female *Anopheles* mosquito (Alioune *et al.,* 2010).

There are five species of *Plasmodium* protozoans known to elicit human malaria: Plasmodium falciparum, P. vivax, P. Ovale, P. malariae, *and P. knowlesi* (Caraballo, 2014). Out of these, the most severe form of human malaria is caused by *P. falciparum,* while the others generally cause a milder form of malaria (WHO, 2017; Shigeharu, 2021). In Africa, *P. falciparum* is the major cause of the most severe form of malaria, which accounts for over 60% of outpatient visits and 30% of hospital admissions in Nigeria (Federal Ministry of Health, 2010).

Kaduna State, located in North-West Nigeria, experiences endemic malaria transmission, with seasonal peaks corresponding to the rainy season. Recent studies have highlighted the persistent high prevalence of malaria in the region (Akogwu *et al*., 2018). For instance, a study conducted in General Hospital Kawo, Kaduna State, reported a malaria prevalence of 77.6% among children. Another study in Kaduna North Local Government Area utilized geospatial techniques to assess malaria vulnerability, emphasizing the need for targeted interventions (Eke *et al*., 2022; Otuu *et al*., 2026).

Despite ongoing control efforts, including the distribution of insecticide-treated nets (ITNs) and the introduction of malaria vaccines, malaria continues to pose a significant health threat in Kaduna State. Understanding the current epidemiological patterns of malaria parasite infections among individuals seeking medical care is crucial for informing effective control strategies and resource allocation (Ayogu *et al*., 2016; Osagiede *et al*., 2017). This study aimed to assess the prevalence of malaria

parasite infections among individuals attending selected healthcare facilities in Kaduna State. The findings will provide insights into the current burden of malaria in the region and inform public health interventions to reduce malaria transmission and associated morbidity and mortality (Oche & Aminu, 2012; Sultan *et al*., 2017).

MATERIALS AND METHODS

Study Design

A cross-sectional descriptive study was conducted. The study was conducted from June to December 2025.

Study Area

The study was conducted in the Kaduna Metropolis, Kaduna State, Nigeria. The state comprises both urban and rural areas, with a tropical climate characterized by distinct wet and dry seasons, conducive to malaria transmission. Selected healthcare facilities included a mix of public and private hospitals and clinics across various local government areas to ensure representative coverage.

Kaduna metropolis has four (4) LGAs: Igabi, Kaduna North, Kaduna South, and Chikun. It is located in the North-western geopolitical zone, lies at latitude 10°21'12 "N and longitude 70°26'12" E, and is 608 meters above sea level. It is characterized by two distinct seasons viz: The dry season commences in the months of November to March and the rainy season usually from April through October and lasts between 4-5 months in the northern parts of the state, and 5-6 months in the southern parts of the state, with vegetation typically of guinea savannah type, and high temperatures during the dry season, the annual average high temperature is 31.6°C, relatively lower temperatures occur during the rainy season with annual low temperatures of 18.5°C.

Study Population and Sample Size

The study population comprised individuals across all age groups presenting with symptoms suggestive of malaria at the outpatient departments of the selected healthcare facilities during the study period. A total of 464 participants were recruited for the study.

Sampling Technique

A multistage sampling technique was employed. A purposive sampling method was used to select health facilities within Kaduna Metropolis. These institutions were chosen based on high patient turnout and the availability of laboratory diagnostic facilities for malaria. Subsequently, eligible patients presenting at these facilities were recruited using systematic random sampling until the required sample size was achieved.

Data Collection

Data were collected using a structured questionnaire and lab request forms. The questionnaire captured socio-demographic information, clinical symptoms, and use of malaria prevention measures. For laboratory diagnosis, capillary blood samples were collected via finger prick. Thick and thin blood smears were prepared and stained with Giemsa stain for microscopic examination to detect and identify *Plasmodium* species. Rapid diagnostic tests (RDTs) were also used where microscopy was unavailable (Cheesbrough, 2010; Dawaki *et al*., 2016).

Laboratory Analysis

Two milliliters of blood were collected from each participant by a trained laboratory technologist and placed in an ethylenediaminetetraacetic acid (EDTA) bottle, maintaining aseptic and universal precautions throughout. Each EDTA bottle was appropriately labeled. The collected blood was subjected to an RDT for malaria, following the manufacturer's instructions, within 24 hours of collection (Cheesbrough, 2010; Dawaki *et al*., 2016).

For microscopy, the thick- and thin-film smear method was used. For the thick film, a clean, grease-free slide was used, and a drop of the blood sample was applied to the middle of the slide, making it a bit thick. It was allowed to air-dry for about 5 minutes, and then stained with Giemsa stain and viewed under the microscope. Then, the result was recorded. For the thin film, a drop of blood was applied on the slide, another slide was used to spread the blood sample carefully and then it was allowed to dry for about 5 minutes before staining it with Giemsa stain and after drying it was viewed under microscope by a trained laboratory technologist and the result was recorded (Cheesbrough, 2010; Dawaki *et al*., 2016).

Data Analysis

Data were entered into and analyzed using Statistical Package for the Social Sciences (SPSS) version 23.0. Descriptive statistics, including frequencies and percentages, were used to summarize the numeric data. Chi-square tests were employed to assess associations between malaria infection and variables such as age, sex, and use of preventive measures. A p-value of less than 0.05 was considered statistically significant.

Ethical Considerations

Ethical approval was obtained from the Kaduna State Ministry of Health Research Ethics Committee. Written informed consent was obtained from all adult participants, and assent was obtained from the parents or guardians of minors. Confidentiality of participants' information was maintained throughout the study.

RESULTS

Prevalence of malaria parasite in relation to healthcare facilities and Gender among the sampled population in Kaduna

Of the 464 (100%) examined for the presence of malaria parasites, 267 (57.54%) were infected. The results showed that females have a much higher prevalence rate, 169 (67.3%), than males, 98 (46.0%). Hospital C reported the highest number of infected cases, 88 (33.0%), followed by Hospital B with 69 (25.8%), while Hospitals A and D had lower numbers of infected cases, 54 (20.2%) and 56 (21.0%), respectively. Statistically, there is no significant difference (P>0.05) in the prevalence of malaria parasites across healthcare facilities and gender among the study population.

Prevalence of Malaria Parasite in relation to healthcare facilities and different Age Groups

The prevalence of malaria parasites by age showed that among the 267 infected participants, those aged 11 – 15 and 16–20 years had the highest prevalence rates, 35 (63.6%) and 35 (67.3%), respectively. The lowest prevalence, 2 (28.6%), was recorded in the age group 1–5 years. The difference in the prevalence of malaria parasites among the study population by age, however, was statistically significant (P < 0.05), as shown in Table 2.

Prevalence of Malaria Parasite in relation to healthcare facilities and the Months of the Study

The association among participants over the months of the study was also observed, as shown in Table 3. The highest infection was

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recorded in the month of June with 69 (70.8%) followed by the months of October, September, July and August with the prevalence rates of 34 (59.7%), 38 (58.5%), 44 (57.1%) and 32 (56.1%) respectively while the least infection rate was recorded in the month of December with 22 (43.1%). Chi–square analysis showed no significant difference (P>0.05) between malaria parasites and the study months.

Prevalence of Malaria Parasite in relation to the Risk Factors

The results revealed that a higher prevalence among participants without formal education (63.3%) as compared to those with formal education (36.7%). Self – employed (29.6%) and unemployed (26.6%) had the highest numbers of infected participants followed by farmers (24.3%) while formally employed participants had the least infection rate (19.5%). Statistically, there is a significant difference (P<0.05) on the prevalence of malaria parasite based on occupation. Rural residents account for nearly two – thirds (64.4%) of all the malaria cases while urban residents make up only (35.6%) despite likely comprising a significant proportion of the population. Significant difference (P<0.05) exists between the prevalence of malaria parasites in relation to residential areas. More malaria infection occurred among Insecticide Treated Nets (ITNs) non – users (57.7%) than Insecticide Treated Nets (ITNs) users (42.3%). Statistically, there is a significant difference (P<0.05) on the prevalence of malaria parasite based on Insecticide Treated Nets (ITNs) as seen in Table 4.

Table 1: Prevalence of malaria parasite in relation to healthcare facilities and Gender among sampled population in Kaduna

	Male		Female		Total	
Health Facilities	**No. Examined (%)**	**No. Infected (%)**	**No. Examined (%)**	**No. Infected (%)**	**No. Examined (%)**	**No. Infected (%)**
Hospital A	45 (21.1)	17 (50.0)	58 (23.1)	37 (21.89.5)	103 (22.2)	54 (20.2)
Hospital B	55 (25.8)	23 (42.3)	69 (27.5)	46 (27.2)	124 (26.7)	69 (25.8)
Hospital C	62 (29.1)	31 (91.7)	75 (29.9)	57 (33.7)	137 (29.5)	88 (33.0)
Hospital D	51 (23.9)	27 (68.0)	49 (19.5)	29 (17.2)	100 (21.6)	56 (21.0)
Total	**213 (45.9)**	**98 (46.0)**	**251 (54.1)**	**169 (67.3)**	**464 (100)**	**267 (57.5)**

χ^2 Cal = 4.25; χ^2 tab = 7.81; Df = 3

Table 2: Prevalence of Malaria Parasite in relation to healthcare facilities and different Age Groups

Health care Facilities	**Hospital A**		**Hospital B**		**Hospital C**		**Hospital D**		**Total**	
Age groups (years)	**No. Examined (%)**	**No. Infected (%)**	**No. Examined (%)**	**No. Infected (%)**	**No. Examined (%)**	**No. Infected (%)**	**No. Examined (%)**	**No. Infected (%)**	**No. Examined (%)**	**No. Infected (%)**
1 – 5	2 (1.9)	0 (0.0)	4 (3.2)	2 (2.9)	0 (0.0)	0 (0.0)	1 (1.0)	0 (0.0)	7 (1.5)	2 (28.6)
6 – 10	6 (5.8)	3 (5.6)	11 (8.9)	5 (7.3)	13 (9.5)	7 (7.9)	10 (10.0)	2 (3.6)	40 (8.6)	17 (42.5)
11 – 15	11 (10.7)	6 (11.1)	15 (12.1)	9 (13.0)	21 (15.3)	15 (17.1)	8 (8.0)	5 (8.9)	55 (11.9)	35 (63.6)
16 – 20	14 (13.6)	8 (14.8)	17 (13.7)	12 (17.4)	12 (8.8)	9 (10.2)	9 (9.0)	6 (10.7)	52 (11.2)	35 (67.3)
21 – 25	15 (14.6)	8 (14.8)	8 (6.5)	4 (5.8)	20 (14.6)	13 (14.8)	8 (8.0)	4 (7.1)	51 (10.9)	29 (54.9)
26 – 30	5 (4.9)	2 (3.7)	12 (9.7)	8 (11.6)	15 (10.9)	10 (11.4)	5 (5.0)	2 (3.6)	37 (7.9)	22 (39.5)
31 – 35	3 (2.9)	1 (1.9)	10 (8.1)	6 (8.7)	13 (9.5)	9 (10.2)	17 (17.0)	12 (21.4)	43 (9.3)	28 (65.1)
36 – 40	16 (15.5)	10(18.5)	14 (11.3)	8 (11.6)	7 (5.1)	4 (4.6)	7 (7.0)	4 (7.1)	44 (9.5)	26 (59.1)
41 – 45	13 (12.6)	6 (11.1)	11 (8.9)	6 (8.7)	11 (8.0)	7 (7.9)	11 (11.0)	6 (10.7)	46 (9.9)	25 (54.4)
46 – 50	8 (7.8)	4 (7.4)	9 (7.3)	3 (4.4)	17 (12.4)	9 (10.2)	13 (13.0)	7 (12.5)	47 (10.1)	23 (48.9)
51 & above	10 (9.7)	6 (11.1)	13 (10.5)	6 (8.7)	8 (5.8)	5 (5.7)	11 (11.0)	8 (14.3)	42 (9.1)	25 (59.5)
Total	**103 (22.1)**	**54 (20.2)**	**124 (26.7)**	**69 (25.8)**	**137 (29.5)**	**88 (32.9)**	**100 (21.6)**	**56 (20.9)**	**464 (100)**	**267 (57.5)**

χ^2 Cal = 46.05; χ^2 tab = 43.77; Df = 30

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Table 3: Prevalence of Malaria Parasite in relation to healthcare facilities and the Months of the Study

Healthcare Facilities	Hospital A		Hospital B		Hospital C		Hospital D		Total	
Months	**No. Examined (%)**	**No. Infected (%)**	**No. Examined (%)**	**No. Infected (%)**	**No. Examined (%)**	**No. Infected (%)**	**No. Examined (%)**	**No. Infected (%)**	**No. Examined (%)**	**No. Infected (%)**
June	23 (22.3)	15(27.8)	26 (20.9)	19 (27.5)	26 (18.9)	19 (21.6)	23 (23.0)	16 (28.6)	98 (21.1)	69 (70.8)
July	19 (18.5)	10(18.5)	20 (16.1)	12 (17.4)	19 (13.8)	12 (13.6)	19 (19.0)	10 (17.9)	77 (16.6)	44 (57.1)
August	10 (9.7)	6 (11.1)	15 (12.1)	9 (13.0)	15 (10.9)	9 (10.2)	17 (17.0)	8 (14.2)	57 (12.3)	32 (56.1)
September	8 (7.8)	3 (5.6)	22 (17.7)	11 (15.9)	22 (16.1)	17 (19.3)	13 (13.0)	7 (12.5)	65 (14.0)	38 (58.5)
October	17 (16.5)	9 (16.7)	11 (8.9)	7 (10.1)	21 (13.3)	13 (14.8)	8 (8.0)	5 (8.9)	57 (12.3)	34 (59.7)
November	11 (10.7)	5 (9.3)	16 (12.9)	6 (8.7)	18 (13.1)	10 (11.4)	14 (14.0)	7 (12.5)	59 (12.7)	28 (47.5)
December	15 (14.6)	6 (11.1)	14 (12.3)	5 (7.2)	16 (11.7)	8 (9.1)	6 (6.0)	3 (5.4)	51 (10.9)	22 (43.1)
Total	103 (22.2)	54(20.2)	124 (26.7)	69 (25.8)	137 (29.5)	88 (32.9)	100 (21.6)	56 (20.9)	464 (100)	267 (57.5)

χ^2 Cal = 10.67; χ^2 tab = 28.87; Df = 18

Table 4: Prevalence of Malaria Parasite in relation to the Risk factors

Risk factors	No. Examined (%)	No. Infected (%)	χ^2	P – value
Educational Status				
Formal Education	**210 (45.26)**	**98 (36.70)**		
No formal Education	**254 (54.74)**	**169 (63.30)**		
Total	**464 (100)**	**267 (57.54)**	**18.58**	**3.84**
Occupation				
Farmers	**102 (21.98)**	**65 (24.34)**		
Self-employed	**142 (30.60)**	**79 (29.59)**		
Employed	**121 (26.08)**	**52 (19.48)**		
Unemployed	**99 (21.34)**	**71 (26.59)**		
Total	**464 (100)**	**267 (57.54)**	**20.46**	**7.81**
Residence				
Rural	**258 (55.60)**	**172 (64.42)**		
Urban	**206 (44.40)**	**95 (35.58)**		
Total	**464 (100)**	**267 (57.54)**	**19.80**	**3.84**
Preventive Measures				
Using of Insecticide-Treated Nets (ITNs) regularly	**228 (49.14)**	**113 (42.32)**		
Non-users of ITNs	**236 (50.86)**	**154 (57.68)**		
Total	**464 (100)**	**267 (57.54)**	**11.73**	**3.84**

DISCUSSION

This study recorded a high prevalence of malaria parasite (57.54%) among the four Healthcare facilities studied. This high prevalence is in agreement with the finding of Dawaki *et al*., (2016) who reported the prevalence of (60.6%) and Dikwa et al. (2023) who reported a high prevalence (65.0%) of *Plasmodium falciparum* among pregnant women in Kaduna North Local Government Area. The high prevalence of malaria parasite recorded in this study could be due to poor adoption of malaria prevention and control strategies, or the endemicity of malaria. Eke *et al*. (2018) reported a high prevalence (69.19%) of malaria parasite in Minna, Niger State. This high prevalence closely agreed with those of Iwuchukwu and Vincent (2021) who reported a prevalence of 65.5% in their study of the prevalence of malaria and its faetal outcomes among women attending antenatal care at the Federal Medical Centre Owerri. Similarly, Frank *et al*. (2016) reported that 66.7% of all pregnant women attending health centers in Ideato South Local Government Area of Imo State were positive for *Plasmodium*. Musa *et al*. (2023) reported a high prevalence (77.6%) among the children attending General Hospital Kawo in

Kaduna State. This result was found to be higher than the 43.1% prevalence recorded by Wogu *et al*., (2017) in University of Port Harcourt Teaching Hospital.

The high prevalence of malaria parasite in this area could be due to the effects of climatic factors such as temperature, humidity and rainfall which regulate the biology and development of both mosquito and parasite, as well as the behavioural attitude of the inhabitants of the areas. The study areas have climatic factors and environmental conditions which favour breeding of malaria vectors and parasites resulting in the probable abundance of malaria vectors.

Hospital D recorded the highest prevalence (33.0%) of malaria parasite among healthcare facilities studied. This might be due to infrequent use of insecticide treated nets and adoption of poor environmental sanitation practices. The result of this study contradicted the findings of Ebenezer *et al*. (2016) who noted that differences in prevalence by location were not significant in their study.

The gender-related prevalence of malaria parasite infection observed among individuals sampled revealed a higher prevalence among females (67.33%) than males (46.01%). Gender norms and behaviours have been shown to coincide with the pattern of malaria exposure The result of this study suggest that the females are more vulnerable to the infection and may be more prone to the disease and intensity of exposures to the mosquito vector responsible for the transmission of malaria parasite than male. Outdoor activities may expose women to mosquito vectors and consequently to malaria infection (WHO, 2020). In Nigeria, similar findings were reported by Kaderam *et al*. (2021) who reported a high prevalence of (44.66%) among females in parts of Kaduna Metropolis, Eke *et al*. (2022) reported a high prevalence of Malaria parasite (59.24%) in Kawo Metropolis, Kaduna State, Kalu *et al.* (2012) observed high prevalence of *falciparum* malaria among females in Aba (91.20%) and Umuahia, (80.80%) in Abia state. High prevalence of malaria parasite infection among female donors (51.6%) than their male counter parts (0.6%) in university college hospital, Ibadan was also reported (Alli *et al.,* 2010). The findings of this study do not agree with the work of Eke *et al*. (2018) who reported a higher prevalence of malaria parasite (54.52%) among males and lower prevalence of (45.48%) among in females in Minna, Niger State.

The age-related prevalence of malaria parasite showed that aged 11 – 15 and 16 – 20 years had higher prevalence of malaria. This result is not in agreement with the report of WHO, (2023) who also reported higher infection rate among children. The World Health Organization has emphasized the fact that children between the age of 5 years and below are the most vulnerable group of people, particularly in Africa. This had been attributed to the gradual loss of maternal immunity, coupled with a low level of acquired immunity among children compared to adults. Thus, as age and exposure increase, malaria infection decreases except among the elderly and the immunocompromised (Awosolu *et al*., 2021).

Prevalence of Malaria Parasite in relation to the Risk factors was also examined. The relatively higher prevalence (29.59%) of malaria parasite recorded among self-employed participants in this study might be attributed to the fact that self-employed individuals usually stay outdoors at late hours of the night and exposure conducting business and consequently gets bitten repeatedly by mosquitoes. This is in accordance with the work of Aliyu *et al*. (2017) who recorded higher prevalence of *P. falciparum* in pregnant women that engaged in trading. Based on the level of education, higher prevalence (63.3%) was recorded among those without formal education. This is attributed to the fact education directly impacts income and livelihood. Individuals lacking formal schooling often fall into lower wealth quintiles and cannot afford preventive tools or prompt healthcare (Kaderam *et al*., 2021; Eke *et al*., 2022). Rural dwellers recorded higher prevalence (64.42%) of malaria parasite. This is as a result of rural landscapes – farmland irrigation systems, puddles from rain, bushy surroundings which create ideal breeding grounds for the *Anopheles* mosquitoes. Agricultural practices, especially rice paddies and water storage for farming further sustain vector populations (WHO, 2023). The significant difference in prevalence between rural and urban residents highlights the impact of environmental and infrastructural factors on malaria transmission. Limited access to healthcare, lower socioeconomic status, and reduced implementation of preventive measures in rural areas may contribute to this disparity.

Non – users of ITNs had higher prevalence (57.68%). Without ITNs, sleeping individuals lack a physical barrier and insecticide protection. Study shows that non – users face increased mosquito bite rates, especially indoors at night thereby raising the risk of the infection (Dikwa *et al*., 2023). The protective effect of ITN usage observed in this study reinforces the importance of promoting and ensuring the consistent use of ITNs as a key malaria prevention strategy. The significant reduction in prevalence among ITN users aligns with existing literature on the efficacy of ITNs in reducing malaria transmission.

Conclusion

This study revealed that malaria parasite is prevalent among the patients attending selected Healthcare facilities within Kaduna Metropolis. The prevalence rate of malaria parasite varied with the selected Healthcare facilities sampled, gender, age of the participants, occupation, and ITNs usage; location-based prevalence showed significant difference ($p<0.05$). Enhancing the distribution and consistent use of ITNs, coupled with community education and improved access to healthcare services, is essential in mitigating the malaria burden in the region.

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