



Time-Series Analysis of Malaria Cases Among Suspected Febrile Patients Attending a Peri-Rural Health Centre Between February 2020- January 2021

Hafeez Aderinsayo Adekola^{1*}, Haneefat Olabimpe Egberongbe², Michael Olanrewaju³, Ismail Babatunde Onajobi⁴, Oyindamola John Samson⁵, Wahab Ademola Kareem⁶

^{1,2,4,5,6} Department of Microbiology, Olabisi Onabanjo University

³ Department of Pathology, St. Joseph Catholic Hospital

Abstract

Sub-Saharan Africa has a high rate of malaria-related morbidity and death, with Nigeria accounting for a substantial proportion of these cases owing to its malarious nature. Most Nigerians live in environments that encourage the development of mosquito vectors that are responsible for malaria transmission. This study aimed to determine the prevalence of malaria in the peri-urban areas. A time-series analysis was performed on 1,141 people with suspected febrile illness who visited a peri-urban health center over the course of a year (February 2020 – January 2021). Each person who presented to the hospital and was tested for malaria was included in the study. The 12-month study reported an overall prevalence of 24% ($p < 0.05$). A total of 273 individuals were found to be seropositive, with males (162) having a higher prevalence than females (111). Cases of seropositivity have been reported in all age groups. This study concluded that malaria remains a public health concern in the country, particularly in areas favorable for mosquito vector reproduction. Consequently, elimination approaches should be strengthened to safeguard people, particularly in vulnerable regions.

Keywords: Malaria, Nigeria, Peri-Urban, Sub-Saharan

Introduction

Malaria is a significant public health problem in Africa, where it is highly prevalent (Edosomwan et al., 2020). Every year, the African continent accounts for 90% of all malaria-related sickness and mortality (Hassen & Dinka; Okechukwu et al., 2020). The disease burden is believed to be heaviest in Sub-Saharan Africa, where more than 80% of deaths occur (Edosomwan et al., 2020). Most African cities have conditions that encourage malaria vector reproduction,

such as poor sanitation, a non-functioning drainage system, and bad housing (Hassen & Dinka, 2020). Consequently, malaria transmission occurs throughout the year in such settings, with higher rates occurring in rural villages and their environs (Hassen & Dinka, 2020).

Nigeria, which is located in sub-Saharan Africa, has historically been one of the countries that contribute the most to the worldwide malaria burden (Oboh et al., 2018). In 2017, the country was

*Corresponding Author: *Hafeez Aderinsayo Adekola*, Department of Microbiology, Olabisi Onabanjo University
Copyright © 2022 Al-Hayat: Journal of Biology and Applied Biology

responsible for approximately 27% of all the malaria cases worldwide (Obboh et al., 2018). Malaria spreads throughout the year in Nigeria, with almost the entire population being susceptible to the disease; however, children are the most vulnerable (Awosolu et al., 2021). The incidence rate may be three times higher in rural and peri-urban areas than in urban areas (Awosolu et al., 2021; Orevaghene et al., 2022). This might be connected to demographic, environmental, and socioeconomic factors that increase the likelihood of human exposure while also influencing preventative and therapeutic measures (Awosolu et al., 2021).

Malaria is a curable and preventable disease (Sankineni et al., 2023). However, if left untreated, it can be fatal. Plasmodium species cause this protozoan infection, and female Anopheles mosquito vectors help in disease transmission (Merrick et al., 2019). Because malaria clinical signs and symptoms are non-pathognomonic, diagnosis is necessary to establish infection; nonetheless, a diagnosis should be considered in all febrile patients (Merrick et al., 2019). Notably, when utilized correctly, early diagnostic methods such as RDTs and microscopy reduce the development of uncomplicated malaria and its subsequent mortality (Chanda-Kapata et al., 2014). This study examined malaria cases in a secondary healthcare facility in a peri-urban area over 12 months.

Research Methods

Ethical Approval: approval was obtained from the Human Research and Ethics Committee of the hospital before accessing patients' record.

Study Area and Design: Malaria cases were evaluated at St. Joseph's Catholic Hospital. in Ijebu Igbo, Nigeria. Ijebu Igbo (6.9792° N, 3.9980° E) is a town in Ogun

State that serves as the administrative center for the Ijebu North Local Government. The region is distinguished by fertile fields and forests, which support farming and sawmill occupations of the general population. The region is distinguished by a mean temperature of 27°C and a rainy season that lasts for ten months (January 25 to December 8). The area's population is estimated to be approximately 109,000, with over half of the people residing in the peri-urban area and the remainder in the rural area.

Sampling: This study included all patients registered between February 2020 and January 2021. The study enrolled 1,141 patients who visited the hospital with fever (temperature > 38°C). The hospital is well-stocked with malaria supplies, such as quick diagnostic test kits and antimalarials.

Data collection and analysis: Individuals who presented to the hospital and were screened for malaria were enrolled in this study. Each individual's information was double-checked and cross-checked with the patient's data. The data obtained mostly included age, sex, and the outcome of the malaria study. Frequencies and percentages were calculated using descriptive statistics, and the findings are presented in the tables and figures.

Research Results and Discussion

Malaria has been a substantial contributor to morbidity and mortality in Nigeria for many years. The time-series analysis indicated a significant seropositivity rate of almost a quarter (24%) among the tested participants (1,141) during the twelve-month period. Seropositivity was observed in 273 participants (M=22.75, SD=15.84; $t(11) = 4.98, p < 0.05$). (Table 1). This study found a statistically significant overall seroprevalence of 24 percent in the study

region over the 12-month period; however, this was lower compared to prior studies in other areas of southwest Nigeria that found a prevalence of > 50 percent (Ajakaye & Ibukunoluwa, 2020; Awosolu et al., 2021)

Although the highest incidence observed in this study for a single month was 49 percent, the prevalence of the disease might be substantially impacted by factors such as ambient activities and diagnostic procedures. Males (162) were found to have a higher seropositivity rate than females (111), as well as a higher

incidence each month during the 12-month period (Figure 1). This gender analysis indicated that more cases were recorded for males than females and that males had a greater range of individual cases each month. The observed seroprevalence of 59.3 percent in this study differs from other studies conducted in the same state where the study region is located; however, in other studies, females were found to have more cases of malaria with higher seroprevalence (Adeboye et al., 2019; Ayorinde et al., 2016).

Table 1
Seropositivity rate among tested individuals

<i>Months</i>	<i>Tested individuals</i>	<i>Seropositivity (%)</i>
February	90	22 (24)
March	112	23 (21)
April	73	16 (22)
May	70	12 (17)
June	91	10 (11)
July	104	4 (4)
August	90	19 (21)
September	76	14 (18)
October	86	12 (14)
November	112	55 (49)
December	123	46 (37)
January	114	40 (35)
Total	1141	273 (24)

The months were divided into quarters, and a comparative analysis revealed that seropositivity was highest in the fourth quarter and lowest in the second. Forty percent (141) of the tested individuals in the last quarter were seropositive, whereas 9.8 percent were seropositive in the second quarter (Table 2). An almost constant rising trend, with a greater frequency in the third and fourth quarters was observed. This finding is consistent with the traditional

view of having a higher malaria transmission potential during the rainy season because the study area still experiences rainfall during the supposed harmattan months, and the increase in cases could be due to the ease of lockdown due to the COVID-19 pandemic towards the end of the year. Malaria seropositivity was observed in all age categories and was statistically significant in all age groups: <30 years (48.4 %), 31-60 years old (38.5 %), and >60 years (13.1 %)

(Figure2). Although the number of cases was the highest among those under the age of 30 (0-30). This findings is similar to recent studies conducted in Southwest Nigeria by Adulraheem *et al.* (2021) and Awosolu *et al.* (2021). (Abdulraheem *et al.*, 2021; Awosolu

et al., 2021). This age group is likely to engage in outdoor activities, such as playing with friends at night or agricultural labor tasks during the day, which might expose them to Anopheles mosquito breeding sites, which carry malarial parasites.

Table 2
Quarterly distribution of seropositivity

<i>Quarters</i>	<i>Tested individuals</i>	<i>Seropositivity (%)</i>
Feb – Apr	275	61 (22.1)
May – July	265	26 (9.8)
Aug – Oct	252	45 (17.9)
Nov – Jan	349	141 (40.4)

Figure 1
Gender distribution plot of seropositive cases

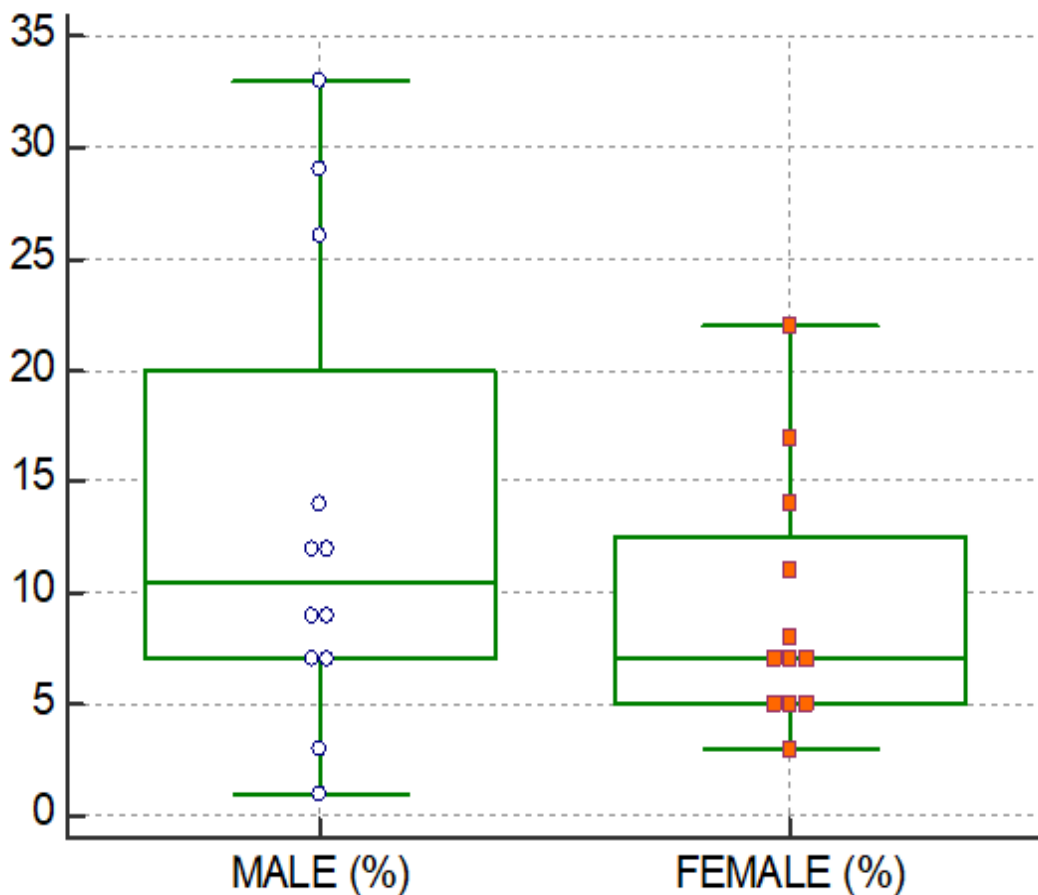
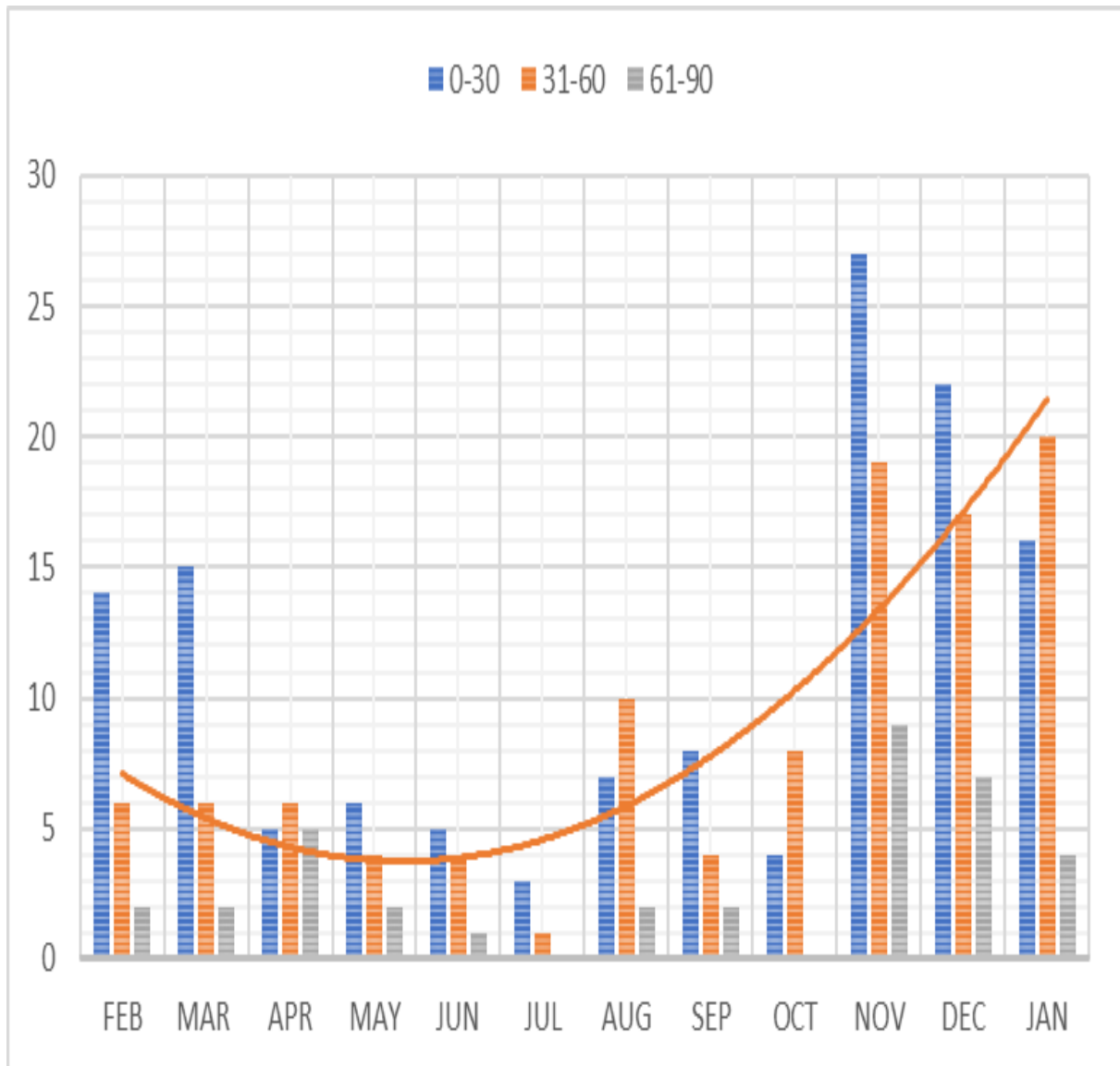


Figure 2*Seropositive cases during the February to January by age groups***Conclusion**

According to the time-series analysis, malaria prevalence remains high, particularly in rural and peri-urban regions, indicating the importance of the disease as a public health concern. The most active age group had the highest incidence, and there was an increasing trend following the relaxation of the COVID-19 lockdown. Malaria prevention

and eradication measures should be strengthened in rural and peri-urban regions to protect people from the spread of this silently lethal disease.

References

Abdulraheem, M. A., Ernest, M., Ugwuanyi, I., Abkallo, H. M., Nishikawa, S., Adeleke, M., Orimadegun, A. E., & Culleton, R. (2021). High prevalence of *Plasmodium malariae* and

- Plasmodium ovale in co-infections with Plasmodium falciparum in asymptomatic malaria parasite carriers in southwestern Nigeria. *International Journal for Parasitology*.
<https://doi.org/10.1016/j.ijpara.2021.06.003>
- Adeboye, N. O., Abimbola, O. V., & Folorunso, S. O. (2019). Malaria patients in Nigeria: Data exploration approach. *Data in Brief*, 28, 104997.
<https://doi.org/10.1016/j.dib.2019.104997>
- Ajakaye, O. G., & Ibukunoluwa, M. R. (2020). Prevalence and risk of malaria, anemia and malnutrition among children in IDPs camp in Edo State, Nigeria. *Parasite Epidemiology and Control*, 8, e00127.
<https://doi.org/10.1016/j.parepi.2019.e00127>
- Awosolu, O. B., Yahaya, Z. S., Farah Haziqah, M. T., Simon-Oke, I. A., & Fakunle, C. (2021). A cross-sectional study of the prevalence, density, and risk factors associated with malaria transmission in urban communities of Ibadan, Southwestern Nigeria. *Heliyon*, 7(1), e05975.
<https://doi.org/10.1016/j.heliyon.2021.e05975>
- Ayorinde, A. F., Oyeyiga, A. M., Nosegbe, N. O., & Folarin, O. A. (2016). A survey of malaria and some arboviral infections among suspected febrile patients visiting a health centre in Simawa, Ogun State, Nigeria. *Journal of Infection and Public Health*, 9(1), 52–59.
<https://doi.org/10.1016/j.jiph.2015.06.009>
- Chanda-Kapata, P., Chanda, E., Masaninga, F., Habluetzel, A., Masiye, F., & Fall, I. S. (2014). A retrospective evaluation of the quality of malaria case management at twelve health facilities in four districts in Zambia. *Asian Pacific Journal of Tropical Biomedicine*, 4(6), 498–504.
<https://doi.org/10.12980/APJTB.4.2014C153>
- Edosomwan, E. U., Evbuomwan, I. O., Agbalalah, C., Dahunsi, S. O., & Abhulimhen-Iyoha, B. I. (2020). Malaria coinfection with Neglected Tropical Diseases (NTDs) in children at Internally Displaced Persons (IDP) camp in Benin City, Nigeria. *Heliyon*, 6(8), e04604.
<https://doi.org/10.1016/j.heliyon.2020.e04604>
- Hassen, J., & Dinka, H. (2020). Retrospective analysis of urban malaria cases due to Plasmodium falciparum and Plasmodium vivax: the case of Batu town, Oromia, Ethiopia. *Heliyon*, 6(3), e03616.
<https://doi.org/10.1016/j.heliyon.2020.e03616>
- Merrick, B., Lambert, J., & Schmid, M. L. (2019). A UK single-centre retrospective analysis of malaria diagnostics. *Clinical Infection in Practice*, 1, 100005.
<https://doi.org/10.1016/j.clinpr.2019.100005>
- Oboh, M. A., Singh, U. S., Antony, H. A., Ndiaye, D., Badiane, A. S., Ali, N. A., Bharti, P. K., & Das, A. (2018). Molecular epidemiology and evolution of drug-resistant genes in the malaria parasite Plasmodium falciparum in southwestern Nigeria. *Infection, Genetics and Evolution*, 66, 222–228.
<https://doi.org/10.1016/j.meegid.2018.10.007>
- Okechukwu, C. E., Abdullahi, I. N., Aliyu, D., Kabiru, M., Adekola, H. A., & Ikeh, E. I. (2020). Prevalence and risk factors of malaria and human

immunodeficiency virus co-infection among pregnant women at Sokoto, Nigeria. *Rwanda Medical Journal*, 77(2), 1-5.

Orevaoghene, Onosakponome, E., Ugochukwu, Nyenke, C., Edache, Abah, A., & Adah, O. R. (2022). Prevalence of Plasmodium falciparum Malaria among Children Residing in Urban and Peri-urban Settlements in Rivers State. *Journal of Advances in Microbiology*, 1-7. <https://doi.org/10.9734/jamb/2022/v22i430450>

Sankineni, S., Chauhan, S., Shegokar, R., & Pathak, Y. (2023). Global Health and Malaria: Past and Present. In *Malarial Drug Delivery Systems: Advances in Treatment of Infectious Diseases* (pp. 1-16). Springer

Hafeez Aderinsayo Adekola *et.al.*,