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Research Article

Factors Influencing Malaria Recurrence Rate Among Patients Using Selected Primary Healthcare Centres in Sagamu, Ogun State- Nigeria

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Abstract

Malaria continues to pose a significant public health challenge, impacting millions of lives and burdening the healthcare system. In Nigeria various attempts to contain and one day, eradicate malaria, have followed a complex model which has undergone various changes over the years to suit the various development needs of different countries: prevention, early identification, and appropriate treatment. The study examined the factors influencing malaria recurrence rate amongst patients using selected Primary Healthcare Centres in Sagamu, Ogun State. The study adopted a cluster sampling technique to select 202 clients who have experienced recurrent malaria at specified primary health care facilities in Sagamu Ogun state within the period January 2023 to December 2023. The study was done in Makun and Agura Primary Healthcare Centres in Sagamu, Ogun State. Results reveal that a significant majority (65.0%) strongly agree with the idea that malaria can recur post-treatment, indicating high awareness of malaria's potential for recurrence. A majority of respondents (55.6%) strongly agree that completing the full course of malaria medication helps prevent recurrence. The majority (62.5%) strongly agree that mosquito nets help reduce malaria risk. A significant majority (70.6%) take preventive anti-malaria medications and only 26.3% of respondents always complete their medication. A significant portion either rarely (26.3%) or never (8.1%) complete their treatment. Only 14.4% always seek medical treatment, while 35.0% never do. Based on these findings, it

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was recommended among others that strategies to increase access to repellents, insecticide-treated nets, and anti-malaria medications could help bridge the gap in prevention efforts.

Keywords: Factors, Malaria, Recurrence rate, Patients.

Introduction

The eradication of malaria from Nigeria is a much-desired need in the healthcare sector. Malaria continues to pose a significant public health challenge, impacting millions of lives and burdening the healthcare system (Babamale, et al., 2022). In Nigeria various attempts to contain and one day, eradicate malaria, have followed a complex model which has undergone various changes over the years to suit the various development needs of different countries: prevention, early identification, and appropriate treatment (Omole, et al., 2024).

Globally, the World Health Organisation (WHO) recorded 249 million malaria cases, which led to 608,000 deaths in 2023 (WHO 2023). The World Health Organization (WHO) African region accounted for 96% of the deaths in 2023 (WHO, Africa 2023). The staggering statistics of malaria prevalence and the deaths it causes, despite having a cure, bring about studies into its recurrence and factors influencing it (Mahittikorn, et al., 2023). Mustapha, (2022) pointed out that Sub-Saharan Africa accounts for the highest malaria burden, of which Nigeria is among the three countries contributing over 50% of the global cases and the most of the malaria-related deaths and eventually eliminate malaria have taken a multifaceted approach modified multiple times over the years to suit the needs of various regions, integrating prevention, timely diagnosis, and effective treatment strategies.

The warm and humid weather conditions of Sagamu encourage the hatching of Anopheles mosquitoes, which is essential to malaria transmission. Poor solid, liquid, human, and animal waste management, along with stagnant water around homes or healthcare centers, leads to increased breeding of mosquitoes and, consequently, higher transmission rates (Kokori, Olatunji, & Akinboade, 2024).

It is well-established that non-compliance to prescribed antimalarial regimens, either due to side effects, costs, or lack of understanding of instructions, is a significant reason for recurrence (Hadiza, 2019). The uncontrolled application of self-medication among individuals results in incomplete treatment and consequent drug resistance. Many households in Sagamu do not use or do not use ITNs correctly despite their proven effectiveness. Malaria prevention initiatives are undermined by weak community participation in environmental sanitation and vector control efforts (Egwu, et al., 2023; Idris, et al., 2023).

The past decade has seen the emergence of several critical issues related to the management of malaria, such as drug resistance. Drug-resistant Plasmodium falciparum now constitutes a significant threat to malaria therapy in Nigeria, with treatment failures and high recurrence being reported (Falade, et al., 2023). Malaria is still a daunting public health challenge in Nigeria. It is necessary to tailor interventions to locally-specific factors associated with malaria recurrence is essential, and understanding these factors is vital in a specific geographical area such as Sagamu, Ogun State.

Research Method

The study adopted a retrospective cross sectional study design in order to collate data on factors influencing malaria recurrence rate in the period January, 2023 to December, 2023 among patients attending selected Primary Healthcare Centres in Sagamu, Ogun State. The study was conducted in Sagamu, Ogun State. The study was done in Makun and Agura Primary Healthcare Centres in Sagamu, Ogun State. Makun PHC is a free health facility for the community and recognized by Minster of Health, Nigeria. The study location is Sagamu, Ogun State. The researcher selected Sagamu because the town serves as the state's primary settlement with both urban and rural inhabitants yet diverse healthcare service levels. The primary healthcare facilities across Sagamu comprise a sufficient group to allow researchers to understand local malaria care strategies. A cluster sampling technique was adopted for the study to collect data from clients who have experienced recurrent malaria at specified primary health care facilities in Sagamu Ogun state within the period January 2023 to December 2023. The data was analysed using Statistical Package of Social Sciences v. 26.0. Informed Consent was gotten from every participant of the study before commencing the study. The researcher ensured that confidentiality was maintained.

Results and Discussion

Table 1. Socio-demographic Characteristics

Variable	Response	Frequency (n=160)	Percentage (%)
Age Range	15 - 20	20	12.5
(Mean = 31.4 ± 0.5)	21 - 35	87	54.4
	36 - 60	48	30.0
	60>	5	3.1
Current marital status	Divorced	6	3.8
	Married	100	62.5
	Single	50	31.3
	Widowed	4	2.5
Religion	Christianity	125	78.1
	Islam	35	21.9

Occupation	Civil Servant	24	15.0
	Private Employee	12	7.5
	Self-Employee	96	60.0
	Unemployed	28	17.5
Income	100 - 150,000	32	20.0
	150,000>	12	7.5
	30 - 50,000	55	34.4
	50 - 100,000	61	38.1
Education Level	High School Graduate	63	39.4
	Primary school graduate	15	9.4
	Tertiary Institute Graduate	82	51.3
Household Size	1	15	9.4
	2 - 5	102	63.8
	More than 5	43	26.9
Duration of Residency	1 - 3 years	59	36.9
	Less than 1 year	21	13.1
	More than 3 years	80	50.0

The largest age group is 21-35 years (54.4%), indicating that the majority of respondents are young adults. This is followed by 36-60 years (30.0%), suggesting a smaller but significant middle-aged group. The smallest groups are 15-20 years (12.5%) and over 60 years (3.1%). (Mean = 31.4 ± 0.5). The majority of respondents are married (62.5%), followed by single individuals (31.3%), with divorced (3.8%) and widowed (2.5%) respondents comprising the smallest portions.

Christianity is the predominant religion (78.1%), with Islam making up the remaining 21.9%. Cultural beliefs influenced by religion may affect attitudes towards healthcare practices and adherence to malaria preventive measures.

The majority of respondents are self-employed (60.0%), followed by unemployed (17.5%), civil servants (15.0%), and private employees (7.5%). Self-employed and unemployed individuals may have variable income levels and limited access to consistent healthcare, potentially impacting their ability to afford malaria treatment and preventive measures.

The income bracket distribution shows that 38.1% of respondents earn ₦50,000 - ₦100,000, while 34.4% earn ₦30,000 - ₦50,000. A smaller portion, 20.0%, earns ₦100,000 - ₦150,000, and 7.5% earn more than ₦150,000 Most respondents are tertiary institute graduates (51.3%), followed by high school graduates (39.4%), with a small group of primary school graduates (9.4%).

Most respondents have 2-5 members in their household (63.8%), with households of more than 5 members (26.9%) and single-member households (9.4%) being less common. Half of the respondents have lived in their area for more than 3 years (50.0%), followed by 1-3 years (36.9%) and less than 1 year (13.1%).

Table 2. Knowledge of Malaria Recurrence

	Strongly Agree	**Agree**	**Strongly Disagree**	**Disagree**
Malaria can recur after a person has been treated, recover from a previous infection	104 (65.0%)	40 (25.0%)	3 (1.9%)	13 (8.1%)
Completing my full course of malaria medication can prevent malaria recurrence	89 (55.6%)	43 (26.9%)	13 (8.1%)	15 (9.4%)
Living in an area with poor sanitation increases my risk of malaria infection.	105 (65.6%)	40 (25.0%)	1 (0.6%)	14 (8.8%)
Using mosquito nets consistently can reduce the risk of malaria recurrence	100 (62.5%)	45 (28.1%)	100 (62.5%)	11 (6.9%)
Staying near stagnant water increases my risk of getting malaria again	81 (50.6%)	17 (10.6%)	18 (11.3%)	44 (27.5%)

A significant majority (65.0%) strongly agree and 25.0% agree with the idea that malaria can recur post-treatment, indicating high awareness of malaria's potential for recurrence. Only a small portion disagrees (8.1%) or strongly disagrees (1.9%).

A majority of respondents (55.6%) strongly agree and 26.9% agree that completing the full course of malaria medication helps prevent recurrence, showing a strong understanding of treatment adherence's role in malaria prevention. Some remain skeptical, with 9.4% disagreeing and 8.1% strongly disagreeing. A high level of agreement is seen here, with 65.6% strongly agreeing and 25.0% agreeing that poor sanitation raises malaria risk. Few respondents (8.8%) disagree, and just 0.6% strongly disagree, which indicates widespread awareness of environmental conditions impacting malaria transmission.

The majority (62.5%) strongly agree and 28.1% agree that mosquito nets help reduce malaria risk. A small minority either disagrees (6.9%) or strongly disagrees (2.5%), showing that most participants recognize mosquito nets as a preventive measure.

Half (50.6%) of the respondents strongly agree and 10.6% agree with this statement, suggesting moderate awareness about stagnant water as a risk factor. However, 27.5% disagree and 11.3% strongly disagree, indicating that some participants may not fully understand the link between stagnant water and malaria risk.

How often do you take preventive anti-malaria medications?

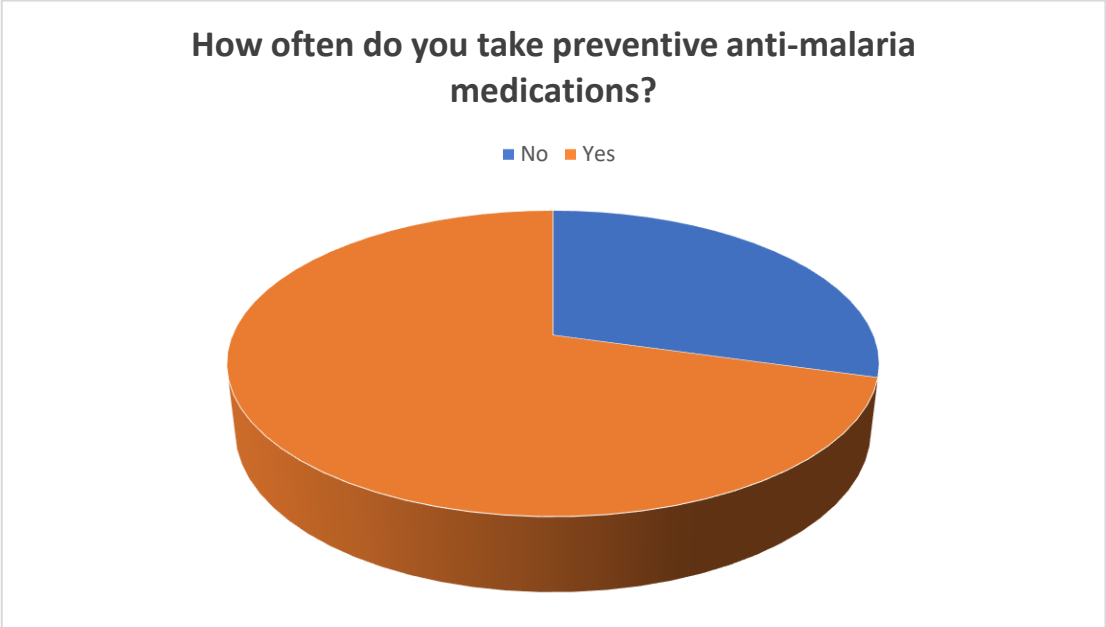

Figure 1. Responses on Intake of Preventive Anti-malaria Medications

A significant majority (70.6%) take preventive anti-malaria medications, while 29.4% do not.

Table 3. Factors Influencing Malaria Recurrence

	Always	**Never**	**Often**	**Rarely**
How often do you complete your prescribed malaria medication?	42 (26.3%)	13 (8.1%)	63 (39.4%)	42 (26.3%)
How often do you use mosquito nets when sleeping?	28 (17.5%)	33 (20.6%)	37 (23.1%)	62 (38.8%)
How often do you seek medical treatment when you feel malaria symptoms returning?	23 (14.4%)	56 (35.0%)	22 (13.8%)	59 (36.9%)
How often do you clear stagnant water around your house to reduce mosquito breathing?	43 (26.9%)	35 (21.9%)	39 (24.4%)	43 (26.9%)

The data in Section C explores behavioral factors influencing malaria recurrence among respondents, focusing on practices related to medication adherence, preventive measures, and healthcare-seeking behaviors.

Completion of Malaria Medication: Only 26.3% of respondents always complete their medication, while 39.4% do so often. A significant portion either rarely (26.3%) or never (8.1%) complete their treatment. Use of Mosquito Nets: Only 17.5% use mosquito nets always, while the largest group (38.8%) uses them rarely. A smaller portion uses them often (23.1%) or never (20.6%).

Seeking Medical Treatment for Returning Symptoms: Only 14.4% always seek medical treatment, while 35.0% never do. A significant portion either **rarely** (36.9%) or often (13.8%) seek treatment when symptoms reappear. A large number of respondents do not consistently seek medical treatment upon experiencing malaria symptoms, potentially leading to untreated or improperly managed malaria cases and increasing the likelihood of recurrence.

Clearing Stagnant Water: Responses are divided, with 26.9% always and 26.9% rarely clearing stagnant water, while others do so often (24.4%) or never (21.9%).

How often do you use insect repellents or sprays inside your home?

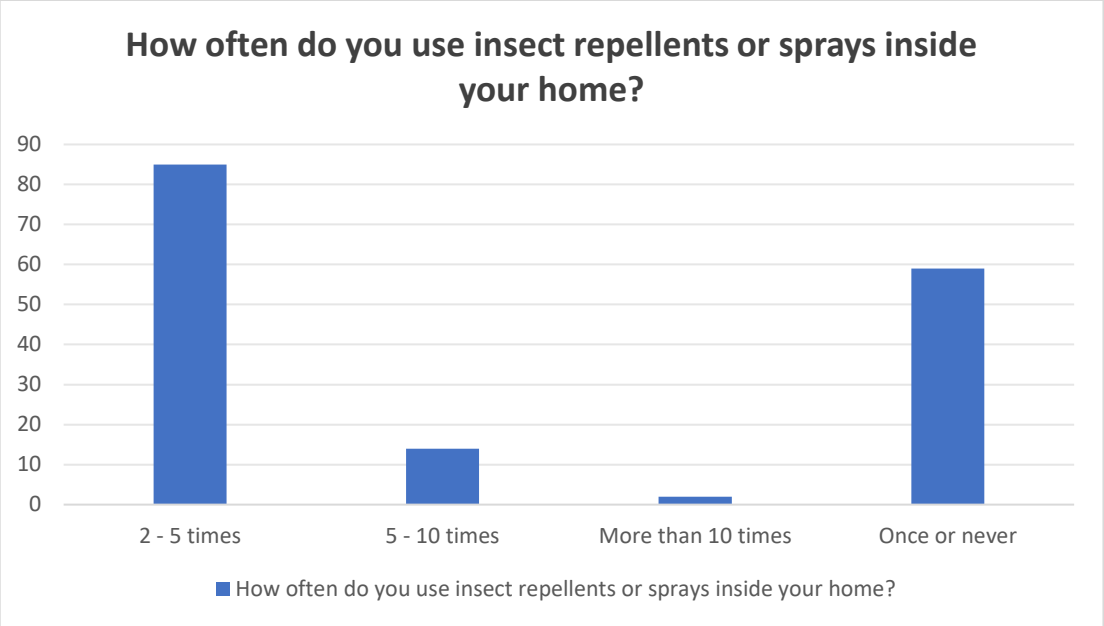

Figure 2. Responses on Use of Insects Repellents

Most respondents (53.1%) use sprays 2-5 times per month, while 36.9% use them only once or never. Only a small portion uses them more frequently (8.8% for 5-10 times and 1.3% for more than 10 times).

How often do you wear covered clothes to prevent mosquito bites?

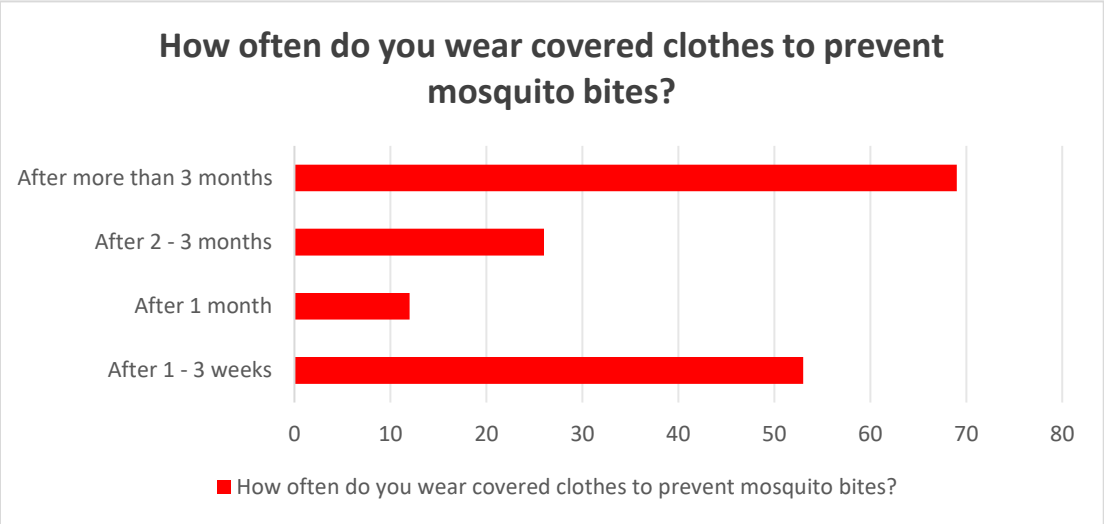

Figure 3. Responses on Malaria Preventing Clothing

The majority (43.1%) wear covered clothing after more than 3 months, while 33.2% do so after 1-3 weeks. Smaller portions wear them after 2-3 months (16.3%) or after 1 month (7.5%).

Discussion

The study revealed that the mean Age (31.4 ± 0.5) implying that most of the respondents were of mid-adulthood age bracket and had a standard deviation of 0.5. The largest number of participants belongs to the age range of 21-35 years (54.4%). This implies that malaria reinfection might be more prevalent in working-age population, who bear several risks associated with environmental and workplace exposures.

A significant majority of respondents understand that malaria can recur after treatment. This indicates a good level of awareness about the nature of malaria as a recurring disease, especially in areas with persistent mosquito populations. Malaria is caused by *Plasmodium* parasites, which can persist in the liver or red blood cells, leading to relapses even after treatment if not entirely eradicated. This knowledge is essential for patients to recognize the importance of preventive measures and continued vigilance after recovery. A small minority seems to have misconceptions about malaria, which may reflect a lack of education or awareness about the complex nature of the disease. It is essential to address these gaps in knowledge, as misunderstanding the recurrence potential of malaria can lead to complacency and inadequate prevention or treatment (Babamale, et al., 2022).

A majority of the respondents recognize the importance of completing the full course of malaria medication to prevent recurrence. This understanding is critical because incomplete treatment can lead to drug resistance and incomplete eradication of the parasite, increasing the risk of relapse. Full adherence to prescribed medication ensures that the parasite is completely eliminated from the body, reducing the chances of malaria coming back. Thus while most participants are aware of the importance of completing treatment, the fact that nearly 18% disagree indicates that there may be some misconceptions or barriers preventing full adherence. These barriers could include a lack of access to healthcare, inadequate counseling about medication, or a misunderstanding of the importance of completing the treatment even after feeling better (Babamale, et al., 2022).

A strong majority of respondents understand the link between poor sanitation and increased risk of malaria. Poor sanitation, including the presence of stagnant water, provides ideal breeding grounds for *Anopheles* mosquitoes, which transmit malaria. This understanding highlights the need for community-level interventions that focus on improving sanitation practices, such as proper waste disposal and eliminating stagnant water sources. A small proportion of respondents do not believe that sanitation is a risk factor for malaria, which may suggest a lack of awareness of the broader environmental and ecological factors that contribute to malaria transmission. This gap in knowledge underscores the importance of public health education that connects sanitation with disease prevention.

There is a significant proportion of participants (62.5%) who strongly disagree with the effectiveness of mosquito nets in preventing malaria recurrence. This could reflect a lack of understanding about the proper use of nets or the importance of consistent usage. In some cases, individuals may use mosquito nets

intermittently or may not recognize that the nets lose their effectiveness over time without re-treatment (Hadiza, 2019).

The majority of participants (53.1%) reported using insect repellents or sprays inside their homes 2 to 5 times per week, indicating that a significant portion of the population actively engages in mosquito control measures. This regular use of repellents may suggest an awareness of malaria risks and a proactive approach to minimizing exposure to mosquito bites. However, 36.9% of respondents either used repellents only once or never, which highlights a potential gap in preventive practices among a substantial portion of the population. This group may either lack access to repellents, be unaware of their effectiveness, or be non-compliant due to cultural beliefs or cost concerns.

The frequency of wearing covered clothes as a preventive measure against mosquito bites shows a considerable variation in adherence to this practice. A significant proportion (43.1%) reported wearing covered clothes only after more than 3 months, which suggests that protective clothing is not consistently prioritized, and other preventive measures (like using insect repellents or sleeping under treated nets) may take precedence.

A substantial majority (70.6%) of participants reported taking preventive anti-malaria medications, which is a positive finding in terms of adherence to malaria prevention strategies. This suggests that a significant portion of the population is aware of the importance of chemoprophylaxis in preventing malaria and is actively engaging in this practice (Hadiza, 2019).

A significant portion of the respondents (39.4%) indicated that they "often" complete their prescribed malaria medication, while 26.3% reported rarely completing the full course. Together, this accounts for a considerable number of patients who may not fully adhere to their malaria treatment regimen, which is critical for preventing drug resistance and ensuring that the parasite is fully cleared from the body. Malaria recurrence can often be linked to incomplete treatment, as patients may stop taking medication once they begin feeling better, even though the parasites may still be present. This highlights the need for improved education on the importance of completing the full course of malaria medication (Egwu, et al., 2023).

The 8.1% of respondents who "never" complete their prescribed medication could be due to various factors such as financial constraints, lack of understanding of the medication’s importance, or side effects of the drugs. This group may be at a higher risk of developing recurrent malaria, and they represent a population that may benefit from targeted interventions, such as reminders or counseling.

The study revealed that 38.8% of respondents use mosquito nets rarely, while 20.6% never use them. The low percentage of individuals who "always" use mosquito nets (17.5%) is concerning because ITNs (insecticide-treated nets) are one of the most effective tools for malaria prevention. Their consistent use can drastically reduce the risk of mosquito bites, especially for children and pregnant women who are more vulnerable to malaria. The low adherence to net use may be linked to factors such as discomfort, lack of access to mosquito nets, or insufficient education about their importance. Additionally, the cost or availability of insecticide-treated nets may be barriers in low-income settings. Given that mosquito nets are a primary preventative measure, the low usage rates in this survey suggest a gap in preventive practices,

which could contribute to higher malaria recurrence rates in the community. This issue requires interventions that focus on increasing net availability, education, and community outreach to encourage consistent net use (Falade, et al., 2023).

A large portion of respondents (35.0% "never" seek medical treatment when they feel malaria symptoms returning, and 36.9% do so "rarely") shows a concerning trend of delayed or non-existent medical intervention. Malaria symptoms can worsen rapidly, and without timely treatment, complications can occur, and the risk of recurrence increases. Several factors may contribute to the delay in seeking medical treatment, such as lack of financial resources, a perception that symptoms are mild and will resolve on their own, or lack of access to healthcare facilities (Falade, et al., 2023). Delaying or avoiding treatment when symptoms return increases the likelihood of malaria relapse and the risk of severe complications such as anemia, cerebral malaria, or even death. This highlights the need for community-based health education campaigns that emphasize the importance of seeking timely medical care at the first sign of symptoms (Egwu, et al., 2023).

Conclusion

A significant majority (65.0%) strongly agree with the idea that malaria can recur post-treatment, indicating high awareness of malaria's potential for recurrence. A majority of respondents (55.6%) strongly agree that completing the full course of malaria medication helps prevent recurrence. The majority (62.5%) strongly agree that mosquito nets help reduce malaria risk. A significant majority (70.6%) take preventive anti-malaria medications and only 26.3% of respondents always complete their medication. A significant portion either rarely (26.3%) or never (8.1%) complete their treatment. Only 14.4% always seek medical treatment, while 35.0% never do. Based on these findings, the study recommended among others that **s**trategies to increase access to repellents, insecticide-treated nets, and anti-malaria medications could help bridge the gap in prevention efforts. Additionally, public health campaigns should focus on educating communities about the importance of consistent use of insect repellents, wearing protective clothing, and taking preventive medications.

References

Babamale, A. O., Abdulkareem, A. O., Oyewole, J. Y., Kolawole, F., Babawale, O. O., Onitayo, F. A., Mohammad, M. U., & Ugbomoiko, U. S. (2022). High parasitaemia correlates with malaria episodes and the socioeconomic impact of recurrent malaria infection in high-transmission zone of Nigeria. *Bulletin of the National Research Centre, 46*(1), 147. https://doi.org/10.1186/s42269-022-00822-9

Egwu, C. O., Aloke, C., Chukwu, J., Nwankwo, J. C., Irem, C., Nwagu, K. E., Nwite, F., Agwu, A. O.,

Alum, E., Offor, C. E., & Obasi, N. A. (2023). Assessment of the antimalarial treatment failure in Ebonyi State, Southeast Nigeria. *Journal of Xenobiotics, 13*(1), 16–26. https://doi.org/xxxx (if applicable)

Falade, C. O., Orimadegun, A. E., Olusola, F. I., Michael, O. S., Anjorin, O. E., Funwei, R. I., Adedapo, A. D., Olusanya, A. L., Orimadegun, B. E., & Mokuolu, O. A. (2023). Efficacy and safety of pyronaridine–artesunate versus artemether–lumefantrine in the treatment of acute uncomplicated malaria in children in South-West Nigeria: An open-labelled randomized controlled trial. *Malaria Journal, 22*(1), 154. https://doi.org/10.xxxx/xxxxxx

Hadiza, I. O. (2019). *Molecular Surveillance of* Plasmodium Falciparum Chloroquine Resistant Transporter Genes Among Selected Secondary School Students in Ilorin East LGA, Kwara State (Master's thesis, Kwara State University (Nigeria)).

Idris, I. O., Ayeni, G. O., Iyamu, I. O., Sina-Odunsi, A. B., Adebisi, Y. A., & Obwoya, J. G. (2022). Factors influencing severity of recurrent malaria in a conflict-affected state of South Sudan: an unmatched case-control study. *Conflict and Health*, *16*(1), 34.

Kokori, E., Olatunji, G., & Akinboade, A. (2024). Triple artemisinin-based combination therapy (TACT): advancing malaria control and eradication efforts. Malaria Journal, 23, 25. https://doi.org/10.1186/s12936-024-04844-y

Mahittikorn, A., Masangkay, F. R., Kotepui, K. U., Milanez, G. D. J., & Kotepui, M. (2021). The high risk of malarial recurrence in patients with Plasmodium-mixed infection after treatment with antimalarial drugs: a systematic review and meta-analysis. *Parasites & vectors*, *14*(1), 280.

Mustapha, R. B. (2022). Comparative Assessment on the Use of Insecticide Treated Net and Environmental Sanitation as a Measure of Malaria Control in Selected Communities of Makarfi LGA, Kaduna State (Master's thesis, Kwara State University (Nigeria)).

Omole, O. R., Ezirim, E. O., Abali, I. O., Akwuruoha, E. M., Onyemereze, C. O., Onyekachi, O. I. N., Anele, D. O., & Airaodion, A. I. (2024). Prevalence, knowledge, and prevention of malaria among pregnant women attending antenatal care at a teaching hospital in southern Nigeria. *Journal of Gynecology and Reproductive Health, 2*(1), 1–11.

World Health Organization. (2023). *World malaria report 2023*. Geneva: World Health Organization. Retrieved from https://www.who.int/teams/global-malaria-programme/reports/world-malaria-report-2023 (Accessed June 8, 2024).

World Health Organization Regional Office for Africa. (2023). *Report on malaria in Nigeria 2022*. Brazzaville: World Health Organization Regional Office for Africa. Retrieved from https://www.afro.who.int/countries/nigeria/publication/report-malaria-nigeria-2022-0 (Accessed June 8, 2024).