



# Malaria Control Measures Among Caregivers of Under-five Children in Ahoada East LGA, River State

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## Abstract

## Original Research Article

Malaria remains a leading cause of morbidity and mortality among children under five in Nigeria. This study assessed malaria prevention, ownership and utilization of control tools, and environmental practices among caregivers of under-five children in Ahoada East Local Government Area (LGA), Rivers State, to identify gaps between access and effective use of preventive measures. A community-based cross-sectional survey was conducted across three randomly selected communities in Ahoada East LGA. A total of 381 caregivers were recruited using systematic sampling. Data were collected using a structured, interviewer-administered questionnaire and analyzed using descriptive. Descriptive statistics was used to summarize socio-demographic characteristics and malaria control practice. Most respondents were female (54.8%) with a mean age of 37.8 ( $\pm 10.0$ ) years. While 64.2% of households owned at least one mosquito net and 59.0% reported possessing insecticide-treated nets (ITNs), only 30.9% of under-five children had slept under a net in the prior three months. Frequency of regular ITN use was low (16.4% always), and common barriers to ITN use included breathing difficulties (14.5%), perceived discomfort/laziness (10.1%), child disinterest (8.8%) and cost (7.3%). Environmental practices were inconsistent: 43.6% always burned refuse, 23.6% always cleaned gutters, and 46.2% lived near stagnant water bodies. High ownership of nets in Ahoada East LGA has not translated into consistent protection of under-five children. Closing this gap requires targeted behavior-change communication, context-appropriate ITN designs for hot climates, integrated community environmental management, and empowerment of local health workers and caregivers to sustain proper use of preventive measures.

**Keywords:** Malaria, insecticide-treated nets, caregivers, under-five children, ITN utilization, vector control, behavior change.

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## 1. Introduction

Malaria remains a major global public health challenge, particularly among children under five

years of age, who bear the greatest burden of malaria-related morbidity and mortality. Despite substantial progress in malaria control over the past two decades, the disease continues to cause preventable



illness and death, especially in low- and middle-income countries. According to the World Health Organization (WHO), an estimated 249 million malaria cases and 608,000 malaria-related deaths occurred globally in 2022, with children under five accounting for approximately two-thirds of all malaria deaths worldwide (WHO, 2023). This disproportionate impact underscores the vulnerability of young children and the critical role of effective malaria prevention strategies at the household and community levels.

Globally, malaria control efforts have focused on a combination of vector control, chemoprevention, prompt diagnosis, and effective treatment. Key interventions include the widespread distribution of insecticide-treated nets (ITNs), indoor residual spraying (IRS), environmental management to reduce mosquito breeding sites, and health education to promote preventive behaviors (Greenwood et al., 2025; Sach et al., 2002). Evidence from several endemic regions demonstrates that sustained and correct use of ITNs alone can reduce malaria incidence and child mortality by up to 50% (Greenwood et al., 2005). However, gaps persist between access to malaria control tools and their consistent utilization, limiting the effectiveness of these interventions.

In sub-Saharan Africa, which accounts for over 95% of global malaria cases and deaths, malaria control remains particularly challenging due to a complex interplay of environmental, socio-economic, and health system factors (Ahorlu et al., 2019). High temperatures, seasonal rainfall, poor housing conditions, inadequate waste management, and weak drainage systems create favorable conditions for mosquito breeding (Carter et al., 2025; Kleinschidt et al., 2024). Although large-scale malaria control programs have increased ownership of ITNs across many African countries, several studies have reported inconsistent use, particularly among households with young children, often due to discomfort, misconceptions, cultural beliefs, and perceived side effects (Muller et al., 2006; Akello et al., 2022; Ahorlu et al., 2019).

Nigeria bears the highest malaria burden globally, contributing approximately 27% of global malaria

cases and 31% of malaria deaths (WHO, 2023). Malaria remains endemic throughout the country and is a leading cause of outpatient visits, hospital admissions, and under-five mortality. In response, the National Malaria Elimination Programme (NMEP) has implemented multiple control strategies, including mass ITN distribution campaigns, seasonal malaria chemoprevention, IRS in selected areas, and community-based health education (NMEP, 2020). Despite these efforts, malaria transmission remains persistent, particularly in rural and semi-urban communities, suggesting gaps in the effectiveness and sustainability of existing interventions.

In Rivers State, malaria continues to pose a significant public health concern due to its humid tropical climate, extensive river networks, and frequent flooding, all of which favor mosquito breeding. Studies conducted in the Niger Delta region have reported high malaria prevalence among under-five children, driven by environmental exposure, poor sanitation, and inconsistent use of preventive measures (Iwara et al., 2024). Ahoada East Local Government Area (LGA), characterized by mixed rural settlements, stagnant water bodies, and varying socio-economic conditions, exemplifies these challenges. Although malaria control tools are available in many households, anecdotal evidence suggests that their utilization remains suboptimal, particularly among caregivers of young children.

Caregivers play a pivotal role in the prevention of malaria among under-five children, as their knowledge, attitudes, and practices directly influence the adoption and sustained use of malaria control measures. Understanding caregivers' behaviors, perceived barriers, and environmental practices is therefore essential for designing effective, context-specific malaria control interventions. However, there is limited empirical evidence focusing specifically on malaria control practices among caregivers in Ahoada East LGA.

This study therefore assessed malaria control measures among caregivers of under-five children in Ahoada East Local Government Area, Rivers State, Nigeria. Specifically, it examined ownership and utilization of malaria preventive tools,

environmental control practices, and challenges affecting effective malaria prevention. Findings from this study are expected to inform policymakers, public health practitioners, and community stakeholders on targeted strategies to improve malaria control and reduce malaria-related morbidity and mortality among under-five children in the study area.

## 2. Methods

The study is conducted in Ahoada East Local Government Area (LGA), located in Rivers State, Nigeria. Ahoada East comprises of 3 Clans, namely; Akoh, Ehuda and Upata. It has 13 Wards which are in two (2) Constituencies. Constituency 1 has 31 Communities and Constituency 2 has 21 Communities. Within Ahoada East LGA, the study focuses three randomly selected communities in Ahoada east. These communities represent environmental contexts within the LGA.

### 2.1 Study Design and Study Population

The study utilized a cross-sectional research design to examine malaria incidence and control strategies in Ahoada East Local Government Area (LGA) in Rivers State, Nigeria. The study population comprised caregivers of under-five children in Ahoada East Local Government Area, Rivers State, Nigeria.

### 2.2 Sample Size and Sampling Techniques

The sample size was determined using Fisher's formula for single population proportion, assuming a 95% confidence level, a 5% margin of error, and a malaria prevalence of 44.1% among under-five children based on previous studies (Iwara et al., 2024). This yielded a minimum sample size of 381 caregivers. A systematic sampling technique was employed to select respondents across three randomly selected communities in Ahoada East LGA, with proportional allocation based on community size to ensure adequate representation.

### 2.3 Data Collection Procedure and instrument

The questionnaire is designed to gather information on malaria prevention and control in Ahoada East

LGA. It includes a series of closed-ended questions with predefined response options, with sections providing information on demographic information, malaria control measures practiced, and access to healthcare. Specific questions were tailored to the research objectives and population under study.

### 2.4 Validity and Reliability of Instrument

Content validity of the questionnaire was ensured through careful alignment of items with the study objectives and a review of relevant literature on malaria prevention and control. The instrument was reviewed by public health experts to ensure clarity, relevance, and cultural appropriateness. Reliability was assessed through a pilot test conducted among caregivers in a similar population outside the study area. Feed-back from the pretest informed minor revisions to improve clarity and consistency, and internal consistency of the instrument was confirmed to be acceptable.

### 2.5 Method of Data Analysis

Data collected from the survey were coded entered into the Stata Version 16, for analysis. Descriptive statistics were used to summarize respondents' socio-demographic characteristics and malaria control practices.

## 3. Results

### 3.1 Socio-demographic characteristics of respondents

The demographic and socio-economic characteristics of the studied population provide a comprehensive overview of the sample. The majority of participants were female (54.8%), with males comprising 45.2% of the sample. The age distribution was nearly equal between the 18–35 and 36–53 age groups (46.5% each), while the 54–71 age group represented a smaller proportion (7.0%). The mean age of participants was 37.8 years ( $\pm 10.0$ ), indicating a relatively young to middle-aged population.

Education levels varied, with the majority having secondary (46.2%) or tertiary (42.9%) education, while a small proportion had no formal (6.0%) or

primary (4.9%) education. Occupation-wise, traders constituted the largest group (36.6%), followed by civil servants (20.3%), students (17.4%), artisans (13.8%), and farmers (11.9%). Marital status data showed that 63.4% of participants were married, while 36.6% were unmarried. A significant proportion of households (71.7%) had under-five children, high-lighting the presence of young families in the population.

Household income distribution revealed that 62.6% earned between 30,000 and 100,000, while 20.3%

earned below 30,000 and 17.1% earned above 100,000. Housing types were predominantly modern (62.9%), with traditional houses making up 37.1%. The majority of households (90.6%) had access to improved water sources, while 9.4% relied on unimproved sources. These findings illustrate the socio-economic diversity of the population and provide a foundation for understanding the context in which ma-laria prevalence and other health outcomes are studied.

**Table 1 Distribution of socio-demographic characteristics of respondents**

Variable	Frequency	Percentage
<b>Sex</b>		
Female		54.8
Male		45.2
<b>Age (Year)</b>		
18 – 35		46.5
36 – 53		46.5
54 – 71		7.0
<b>Mean (<math>\pm</math>SD)</b>		

**Level of Education**

**No formal** 6.0

**Primary** 4.9

**Secondary** 46.2

**Tertiary** 42.9

**Occupation**

**Civil servant** 20.3

**Artisan** 13.8

**Farmer** 11.9

**Trader** 36.6

**Student** 17.4

**Marital Status**

**Married** 63.4

**Unmarried** 36.6

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<b>Presence of under-five child(ren)</b>	
<b>Yes</b>	<b>71.7</b>
<b>No</b>	<b>28.3</b>
<b>Household monthly income</b>	
<b>&lt; 30,000</b>	<b>20.3</b>
<b>30,000 - 100,000</b>	<b>62.6</b>
<b>100,000 - Above</b>	<b>17.1</b>
<b>Type of House</b>	
<b>Modern</b>	<b>62.9</b>
<b>Traditional</b>	<b>37.1</b>
<b>Source of water</b>	
<b>Improved</b>	<b>90.6</b>
<b>Unimproved</b>	<b>9.4</b>

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### 3.2: Malaria control measures practiced among respondents

The analysis of malaria control measures revealed key insights into mosquito net ownership, usage, and environmental practices in Table 1- 2

**Table 2: Respondents' malaria control measures**

<b>Variable</b>	<b>Frequency</b>	<b>Percentage</b>
<b>Owned a mosquito net used during sleep</b>		
Yes		64.2
No		35.8
<b>Number of mosquito nets owned</b>		
1 - 3		50.4
4 - 6		13.8
No		35.8
<b>Under-five ever slept under the mosquito net for the last three months</b>		
Yes		30.9

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<b>No</b>	<b>40.8</b>
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**Owned an insecticide-  
treated net**

<b>Yes</b>	<b>59.0</b>
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<b>No</b>	<b>41.0</b>
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**Frequency of insecticide-  
treated net use**

<b>Always</b>	<b>16.4</b>
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<b>Never</b>	<b>15.6</b>
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<b>Often</b>	<b>8.6</b>
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<b>Rarely</b>	<b>26.2</b>
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<b>Sometimes</b>	<b>33.2</b>
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**Reported  
challenges with**

**insecticide  
spray/ mosquito**

**coil use**

<b>Health problems</b>	<b>28.1</b>
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<b>Non-target effects</b>	<b>28.3</b>
<b>None</b>	<b>13.5</b>
<b>Burning of refuse</b>	
<b>Always</b>	<b>43.6</b>
<b>Often</b>	<b>22.1</b>
<b>Rarely</b>	<b>4.2</b>
<b>Sometimes</b>	<b>30.1</b>
<b>Frequency of gutter cleaning</b>	
<b>Always</b>	<b>23.6</b>
<b>Often</b>	<b>17.4</b>
<b>Rarely</b>	<b>13.0</b>
<b>Sometimes</b>	<b>46.0</b>
<b>Living near stagnant water bodies</b>	
<b>Yes</b>	<b>46.2</b>

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**No**

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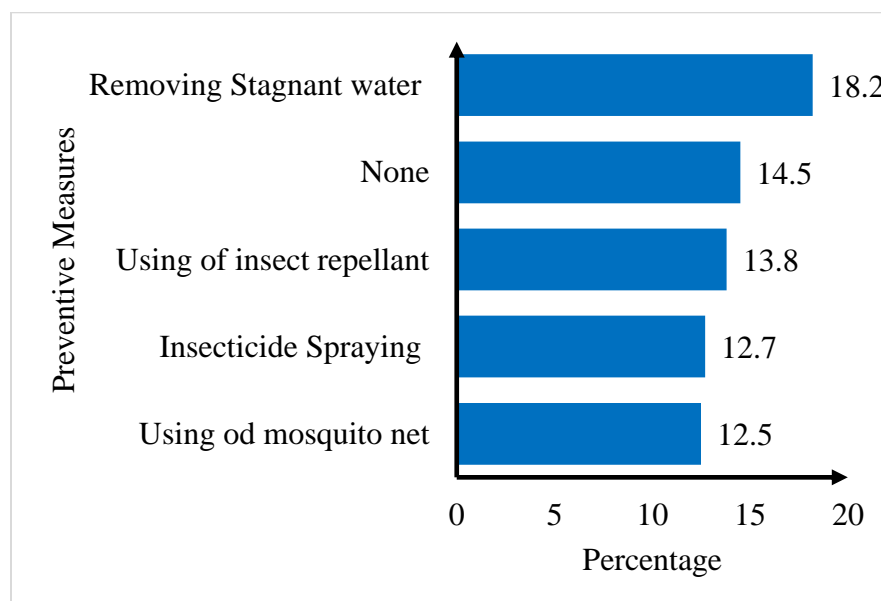
**53.8**

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A majority of respondents (64.2%) owned mosquito nets used during sleep, with 50.4% owning 1–3 nets and 13.8% owning 4–6 nets. However, 35.8% did not own any nets. Regarding usage, 30.9% reported that under-five children slept under mosquito nets in the last three months, while 40.8% did not. Ownership of insecticide-treated nets (ITNs) was reported by 59.0% of households, with 41.0% lacking ITNs. Frequency of ITN use varied, with 16.4% always using ITNs, 15.6% never using them, 8.6% often using them, 26.2% rarely using them, and 33.2% sometimes using them.

Respondents reported challenges with insecticide sprays or mosquito coils, including health problems (28.1%) and non-target effects (28.3%), while 13.5% reported no challenges. Burning of refuse was a common practice, with 43.6% always burning refuse,

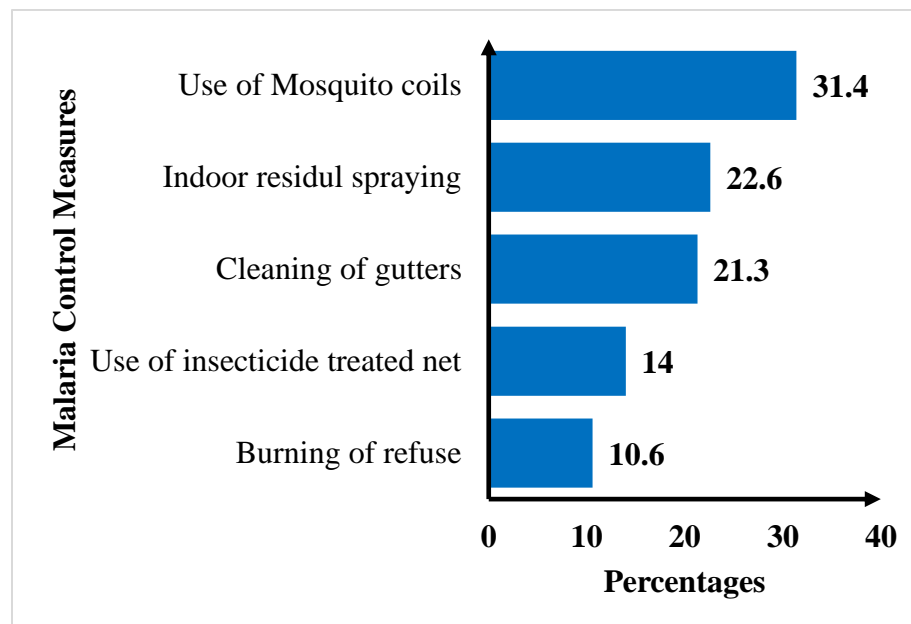
22.1% often, 30.1% sometimes, and 4.2% rarely. Gutter cleaning practices varied, with 23.6% always cleaning gutters, 17.4% often, 13.0% rarely, and 46.0% sometimes. Additionally, 46.2% of respondents lived near stagnant water bodies, while 53.8% did not. Figure 1 illustrated the distribution of practiced malaria control measures. The most common measures included the use of mosquito nets (31.4%), indoor residual spraying (22.6%), cleaning of gutters (21.3%), use of insecticide-treated nets (14%), and burning of refuse (10.6%). These findings emphasize the importance of combining environmental management with preventive measures like ITNs and spraying to effectively control malaria transmission. The primary reasons for not using ITNs included breathing difficulties (14.5%), laziness (10.1%), child's disinterest (8.8%), and financial problems (7.3%) in Figure 3.2



**Figure 1. Distribution of practice malaria control measure**

Figure 1 further explores the frequency of practicing malaria preventive measures. A majority of respondents indicated that they always use control measure such as re-moving stagnant water (18.2%), use insect repellent (13.8%), insecticide spraying (12.7%) and use of mosquito net (12.5%), while

others reported none. This variation in consistency shows that while awareness may be high, actual adherence to preventive practices is not uniform. Health promotion strategies should thus focus not only on awareness but also on encouraging sustained behavioral change.



**Figure 2: Control measures practiced**

Figure 2 summarizes the various malaria control measures practiced. It shows use of Mosquito coils (31.4%), indoor residual spraying (22.6%), and cleaning of gutters (21.3%) as the leading control strategies. Other measures used includes use of insecticide treated net (14%) and Burning of refuse (10.6%). This suggests that these practices are well-known among the population. However, the continued presence of less effective methods like mosquito coils indicates a need for ongoing community education to phase out suboptimal practices in Ahoada East Local Government Area.

#### 4. Discussion

This study assessed malaria control measures among caregivers of under-five children in Ahoada East

Local Government Area, Rivers State, and revealed important gaps between ownership of malaria preventive tools and their consistent utilization. Although a substantial proportion of households reported owning mosquito nets and insecticide-treated nets (ITNs), regular use of these preventive measures by under-five children remained low. This finding supports the working hypothesis that access to malaria control tools alone is insufficient to ensure effective protection against malaria without sustained and correct utilization.

The observed high level of mosquito net and ITN ownership aligns with global and national malaria control efforts that prioritize mass distribution campaigns as a core intervention strategy (WHO, 2023; NMEP, 2023). Similar levels of ownership

have been reported in other malaria-endemic settings across sub-Saharan Africa, reflecting the success of do-not-supported and government-led distribution programs (Akello et al., 2022; Ahorlu et al., 2019). However, the low proportion of under-five children who consistently slept under mosquito nets in this study highlights a persistent “ownership-use gap,” which has been widely document-ed in malaria-endemic regions (Ahorlu et al., 2019; Pulford et al., 2011; Koenker et al., 2018). This gap undermines the potential impact of ITNs on malaria morbidity and mortality among vulnerable populations.

In line with previous studies conducted in Nigeria and other African countries, care-givers in the present study reported discomfort, breathing difficulties, child resistance, and perceived inconvenience as major barriers to ITN use (Akello et al., 2022; Ahorlu et al., 2019; Yaya et al., 2018). Similar findings have been reported in Ghana, Uganda, and Ethiopia, where thermal discomfort and misconceptions about insecticide safety discouraged regular net use despite high awareness of malaria risks (Pulford et al., 2011; Koenker et al., 2018; Yaya et al., 2018; Deresaa et al., 2014). These barriers are particularly relevant in humid tropical environments such as Rivers State, where high nighttime temperatures may reduce tolerance for ITN use. This suggests that malaria control programs must move beyond distribution-focused strategies to address behavioral, cultural, and environ-mental determinants of utilization.

Environmental control practices observed in this study, including refuse burning, gut-ter cleaning, and proximity to stagnant water bodies, further contextualize malaria transmission risks in Ahoada East LGA. Although some caregivers reported engaging in environmental sanitation activities, these practices were inconsistently applied. Nearly half of the respondents lived near stagnant water bodies, which are well-established breeding sites for malaria vectors (Carter et al., 2025; Githeko et al., 2000). This finding is consistent with studies from the Niger Delta and other riverine communities in Nigeria, where poor drainage systems and frequent flooding limit the effectiveness of household-level malaria prevention efforts (Iwara et al., 2024; Onwujekwe et

al., 2014). The persistence of such environmental risk factors suggests that individual preventive behaviors may have limited impact in the absence of coordinated community-level environmental management.

The continued reliance on less effective malaria control methods, such as mosquito coils and indiscriminate insecticide spraying, observed in this study reflects patterns reported elsewhere in sub-Saharan Africa (Okafor et al., 2019; Liu et al., 2019). While these methods may offer short-term relief from mosquito nuisance, they provide limited protection against malaria transmission and may expose households to harmful chemicals. Their sustained use underscores the need for targeted health education that promotes evidence-based malaria control strategies while discouraging reliance on suboptimal practices.

From a broader public health perspective, the findings of this study reinforce the importance of integrated vector management (IVM) approaches that combine personal protective measures, environmental management, and sustained behavior-change communication. Previous research has demonstrated that malaria control interventions are most effective when household-level practices are supported by community-wide sanitation efforts, improved housing conditions, and active involvement of local health workers (Sachs & Malaney, 2002; WHO, 2021). In this context, empowering caregivers with practical knowledge, addressing misconceptions about ITNs, and promoting community ownership of malaria prevention initiatives may enhance long-term intervention sustainability.

This study has important policy and programmatic implications. Malaria control strategies in Ahoada East LGA and similar settings should prioritize behavior-change communication that addresses context-specific barriers to ITN use, including discomfort and child resistance. In addition, local governments should strengthen environ-mental sanitation policies and invest in drainage and waste management infrastructure to reduce mosquito breeding sites. Collaboration between health authorities, community leaders, and caregivers is

essential to ensuring that malaria control interventions translate into meaningful reductions in malaria burden among under-five children.

Future research should explore qualitative perspectives of caregivers to gain deeper insights into cultural beliefs, household decision-making processes, and gender dynamics that influence malaria prevention practices. Longitudinal studies assessing seasonal variations in ITN utilization and malaria incidence would also provide valuable evidence to guide targeted interventions. Additionally, operational research on climate-adapted ITN designs and community-led environmental control strategies could further enhance malaria prevention efforts in high-transmission settings such as the Niger Delta.

## 5. Conclusions

This study demonstrates that although ownership of malaria preventive tools, particularly insecticide-treated nets, is relatively high among caregivers of under-five children in Ahoada East Local Government Area, their consistent utilization remains inadequate. The persistent gap between access and effective use highlights behavioral, environmental, and contextual barriers that limit the impact of existing malaria control interventions. Inconsistent environmental sanitation practices and continued exposure to mosquito breeding sites

further compound malaria transmission risks within the community.

These findings underscore the need for malaria control strategies that extend beyond commodity distribution to address context-specific behavioral and environmental determinants. Strengthening behavior-change communication, promoting caregiver-centered education, and integrating community-led environmental management are essential for improving the effectiveness of malaria prevention efforts. Future interventions should prioritize sustained utilization of preventive tools and foster community ownership of malaria control initiatives to achieve meaningful reductions in malaria burden among under-five children in similar endemic settings.

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**Conflicts of Interest:** The author declare no conflicts of interest.

## Abbreviations

The following abbreviations are used in this manuscript:

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**Local Government  
Area**

**World Health  
Organization**

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**National Malaria  
Elimination Program**

**Insecticide-Treated  
Net(s)**

**Integrated Vector  
Management**

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