

**ANALYSIS ON THE PREVALENCE OF MALARIA PARASITE AMONG  
CHILDREN UNDER THE AGE OF 10 IN IGUEBEN LOCAL GOVERNMENT  
AREA, EDO STATE**



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**UNIVERSITY OF BENIN**

**BENIN CITY**

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**A PROJECT SUBMITTED TO THE DEPARTMENT OF SCIENCE LABORATORY  
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## CERTIFICATION

This is to certify that this research work titled “**ANALYSIS ON THE PREVALENCE OF MALARIA PARASITE AMONG CHILDREN UNDER THE AGE OF 10 IN IGUEBEN LOCAL GOVERNMENT AREA**” was carried out by **IRHIA DAVID OSARETIN** with matriculation number LSC2007311, under the supervision of **DR. A.E. OMOREGIE** in the Department of Science Laboratory Technology, Faculty of Life Sciences, University of Benin as part of the requirements for the award of Bachelor of Science (B.Sc.) degree in Science Laboratory Technology.

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## **DEDICATION**

This project is dedicated to my late parents, whose memory continues to inspire and strengthen me. Their sacrifices and love laid the foundation for everything I have achieved today. I also dedicate this work to my family members, my supporters, and all my loved ones who have stood by me with constant encouragement and prayers.

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## ABSTRACT

Malaria remains a major public health challenge in Nigeria, particularly among children under ten years of age who are highly susceptible to infection. This study analyzed secondary malaria testing data from two primary health centres which are Ebelle Primary Healthcare Centre and Eguare Primary Healthcare Centre in Igueben Local Government Area (LGA), Edo State, covering the period January 2024 to April 2025. The objectives were to determine the total number of children under ten recorded as tested, the total number recorded positive, the monthly prevalence rates, and to identify seasonal trends in malaria transmission. Data were extracted from facility registers and analyzed using descriptive statistics, with prevalence computed as  $(\text{number positive} \div \text{number tested}) \times 100$ . Across both health centres, a total of 647 children under ten were recorded as tested, of which 517 (79.9%) tested positive for malaria parasites. At the facility level, Ebelle PHC recorded a prevalence of 73.3%, while Eguare PHC recorded 85.6%. Monthly prevalence varied between 56% and 100%, with the highest values recorded in March and April 2024 (Ebelle PHC) and June 2024 and March 2025 (Eguare PHC), corresponding to periods of intense rainfall and increased mosquito breeding. Both facilities showed sustained high transmission during the rainy and dry seasons, indicating year-round endemicity. The findings demonstrate that malaria remains highly prevalent among children under ten in Igueben LGA. Strengthening preventive strategies such as consistent use of insecticide-treated nets, improved community awareness, environmental management to eliminate mosquito breeding sites, and continuous surveillance at health facilities are recommended to reduce malaria burden in the area.

## **CHAPTER ONE**

### **INTRODUCTION**

#### **1.1 BACKGROUND OF STUDY**

Malaria stands as one of the most persistent and devastating public health challenges globally, particularly across the WHO African Region (WHO, 2024). This parasitic disease, transmitted through the bite of an infected female *Anopheles* mosquito, is largely preventable and curable, yet it continues to inflict catastrophic levels of morbidity and mortality (WHO, 2024). Globally, the disease burden remains profound, with the World Health Organization (WHO) estimating 263 million cases and 597,000 deaths worldwide in 2023 (WHO, 2024). The distribution of this burden is highly concentrated, with the WHO African Region accounting for approximately 94% of global cases and 95% of deaths in 2023 (WHO, 2024). Within this African context, the Federal Republic of Nigeria carries the single highest global malaria burden. It accounts for an estimated 27% of the total global case count and contributes roughly 31% of all malaria deaths reported in the African Region (FMOH, 2020; WHO, 2024). Transmission is highly endemic and perennial throughout the country, posing an unceasing health threat to its population of over 225 million (FMOH, 2020). The vulnerability of the paediatric population provides a critical focal point for intervention. Children under the age of five are disproportionately affected, accounting for nearly 76% of all malaria deaths in the WHO African Region (WHO, 2024). This elevated risk is due to their developing immune systems and the rapid progression of *Plasmodium falciparum* malaria, the deadliest species, which is highly prevalent across Africa, from uncomplicated febrile illness to severe disease, potentially resulting in death within 24 hours if untreated (WHO, 2024). Considering the significant burden placed on children, this study focuses on the 0-10 age bracket to capture the

entire spectrum of pediatric and early school-age risk. Edo State, situated in Nigeria's South South geopolitical zone, is characterized by a tropical rainforest climate that supports year-round, intensive vector breeding (Edo State Gov, 2020; Okunlola and Oyeyemi, 2019). Igueben Local Government Area (LGA), located in Edo Central Senatorial District, is one of the administrative units of Edo State. Demographic estimates indicate that Igueben LGA has the lowest estimated population within the state (approximately 99,926 people based on 2017 projections) (Edo State Gov, 2020). Despite Nigeria's recognition of the need for data-informed strategies tailored sub-nationally, the focus often remains on larger, more densely populated urban centres, leading to an epidemiological information gap in smaller, rural LGAs like Igueben (FMOH, 2020). The critical importance of addressing localized data deficits stems from the observation that the sheer concentration of global malaria deaths within Nigerian children means that targeted data generation in specific high-burden areas, even seemingly marginal ones, can yield substantial overall public health benefits. This necessity provides the immediate impetus for conducting a primary prevalence study in this specific local government area.

## **1.2 AIMS AND OBJECTIVE**

The main aim of this study is to determine the prevalence of malaria parasite infection among children under ten years of age attending Primary Healthcare Centres in Igueben local Government Area, Edo State, Nigeria.

The specific objectives of this study are:

1. To determine the total number of children under the age of 10 tested for malaria in Igueben LGA from January 2024 to April 2025.
2. To determine the total number of children under the age of 10 who tested positive for malaria during the same period.
3. To calculate the monthly prevalence of malaria parasite infection among children under the age of 10.

4. To identify seasonal trends and patterns in malaria prevalence based on monthly data, thereby informing targeted intervention scheduling.

### **1.3 RESEARCH QUESTIONS**

To guide the study, the following research questions are proposed:

1. What is the total number of children under the age of 10 tested for malaria in Igueben LGA between January 2024 and April 2025?
2. What is the prevalence of malaria parasite infection among children under the age of 10 in Igueben during the study period?
3. What are the monthly and seasonal trends in malaria prevalence among children under the age of 10?
4. How can the findings contribute to improve malaria prevention and control strategies in Igueben LGA?

#### **1.4 SIGNIFICANCE OF THE STUDY**

This study is highly significant as its findings will move beyond descriptive analysis to provide actionable empirical data essential for public health planning in a previously underserved area. The quantitative data generated, specifically the prevalence rates stratified by age and sex, will serve as a foundational epidemiological baseline for the Igueben LGA Primary Health Care (PHC) Board and the state-level malaria control office. This data enables health authorities to accurately align local intervention efforts with the national "High Burden to High Impact" (HBHI) framework implemented by Nigeria (Malaria Consortium, 2021; WHO, 2022). By identifying specific environmental and socio-demographic risk factors unique to Igueben (e.g., correlations between infection and specific sanitation practices or low LLIN utilization), the research directly facilitates resource prioritization. Public health expenditures, which are often scarce in rural LGAs, can be optimized by targeting resources precisely toward the most effective countermeasures, such as community education programs aimed at improving LLIN usage or environmental cleanup campaigns focused on identified larval sources (Tijjani *et al.*, 2016). Furthermore, documenting the contemporary burden in the 0-10 age group carries profound implications for child welfare. High parasite prevalence in this age group indicates widespread exposure, which risks not only acute mortality but also long-term developmental compromise. The findings underscore the critical need for robust preventive measures, highlighting that malaria control is an investment in the future human capital of the community, mitigating the risks of severe anemia and neurocognitive impairment associated with repeated or severe infection (Ssemata *et al.*, 2023). Therefore, this research serves as a catalyst for data-driven advocacy and equitable resource distribution within Edo State.

#### **1.5 JUSTIFICATION OF THE STUDY**

The justification for conducting this highly localized research in Igueben LGA rests on both empirical necessity and strategic public health imperatives. Empirically, the most compelling

justification is the evidence of persistently high malaria risk in geographically proximal areas. The finding of 44.7% Plasmodium prevalence among children aged 3-12 years in Edo-North (Braithair *et al.*, 2024) strongly indicates that children in Igueben LGA are likely subject to similar, high-intensity transmission dynamics, characteristic of the South-South region (Edo State Gov, 2020). The lack of direct prevalence data for Igueben LGA, therefore, represents an unacceptable gap in the current epidemiological map, given the known severe risk to this vulnerable age cohort. Strategically, Nigeria's commitment to its NMSP (2021-2025) requires success at the lowest administrative tiers (FMOH, 2020; Malaria Consortium, 2021). If Igueben LGA is to contribute effectively to the national goal of reducing prevalence below 10%, its unique epidemiological landscape must first be mapped. Studies have repeatedly shown that malaria risk is not homogenous; prevalence differs significantly even between neighboring LGAs based on minute variations in age structure, sanitation, and housing quality (Braithair *et al.*, 2024). Igueben, being the least populous LGA in Edo State (Edo State Gov, 2020), is particularly susceptible to being overlooked in generalized surveillance systems. This study acts as a crucial piece of operational research, validating the feasibility and impact of data-driven strategies at the micro-level, consistent with WHO recommendations for subnational tailoring of control measures (WHO, 2025). Quantifying the burden in this low-population setting ensures that resource allocation guided by the HBHI principle is directed precisely where the burden is highest, correcting potential resource-disease mismatches resulting from reliance on state averages.

## **1.6 DEFINITION OF TERMS**

- i. Malaria Fever: A febrile illness caused by infection with Plasmodium species, typically presenting with body temperatures above 37.5°C.
- ii. Prevalence: The proportion of a population found to have a condition at a specific time.
- iii. Children Under the age of 10: Refers to individuals between the ages of 0 and 10 years.

- iv. Secondary Data: Data collected by someone else for another purpose, but used for the current research.
- v. Microscopy: A diagnostic method involving the use of a microscope to examine stained blood films.
- vi. Rapid Diagnostic Tests (RDTs): Immunochromatographic tests used for the quick detection of malaria antigens.
- vii. Caregiver: A parent, guardian, or any adult responsible for the care of a child.

## **1.7 LIST OF ABBREVIATIONS**

- I. WHO: World Health Organization
- II. PHC: Primary Healthcare Centres
- III. RDTs: Rapid Diagnostic Tests
- IV. ICT: Immunochromatographic Test
- V. ACT: Artemisinin-Based Combination Therapy
- VI. LGA: Local Government Area
- VII. WBC: White Blood Cell
- VIII. ITN: Insecticide-Treated Net
- IX. IRS: Indoor Residual Spraying
- X. PCR: Polymerase Chain Reaction
- XI. PCV: Packed Cell Volume

## CHAPTER TWO

### LITERATURE REVIEW

#### 2.1 DEFINITION OF MALARIA PARASITE INFECTION

Malaria is fundamentally an acute febrile illness caused by protozoan parasites belonging to the genus *Plasmodium*, transmitted to humans via the bite of infected female *Anopheles* mosquitoes (WHO, 2024). Five species of *Plasmodium* are known to infect humans: *P. falciparum*, *P. vivax*, *P. ovale*, *P. malariae*, and *P. knowlesi* (WHO, 2024). Among these, *P. falciparum* poses the gravest threat, being responsible for the vast majority of malaria deaths globally and being the most prevalent species across the African continent (WHO, 2024). In non-immune individuals, symptoms typically manifest 10 to 15 days following the infective bite. The initial symptoms are often non-specific including fever, headache, and chills making early diagnosis challenging, especially in infants (WHO, 2024). The clinical presentation of malaria is highly age-dependent (Ekwere and Ibekwe, 2012). Infants and toddlers often display non-classical symptoms such as irritability, poor feeding, lethargy, vomiting, and non-paroxysmal fever, alongside signs like anemia, jaundice, and splenomegaly (Ekwere and Ibekwe, 2012). Older children (aged five to ten) are more likely to exhibit the classic symptoms of intermittent fever, chills, backache, headache, and myalgia (Ekwere and Ibekwe, 2012). If *P. falciparum* infection is not treated promptly, typically within 24 hours of symptom onset, it can progress rapidly to severe malaria, which is characterized by one or more severe syndromes (WHO, 2024; WHO, 2015). The primary manifestations in children include severe anemia (hemoglobin concentration less than 7 g/dL, resulting from high parasite burden and hemolysis of infected red blood cells), respiratory distress linked to metabolic acidosis, and cerebral malaria, which involves altered mental status, seizures, and coma (WHO, 2024; WHO, 2015). Moreover, in highly endemic areas such as Nigeria, repeated exposure leads to the development

of partial immunity, which complicates diagnosis by allowing for the occurrence of asymptomatic infections. These asymptomatic carriers, though outwardly healthy, constitute a hidden reservoir of parasites, crucial for sustaining transmission within the community (WHO, 2024). Therefore, accurate epidemiological studies, such as the proposed research in Igueben LGA, must employ diagnostic methods capable of detecting both symptomatic and asymptomatic parasitemia to quantify the full scope of the local disease burden.

## **2.2 EPIDEMIOLOGY OF MALARIA**

The global epidemiology of malaria reflects a critical concentration of disease burden, largely stagnant or slightly increasing since 2017 (WHO, 2024). While coordinated global efforts have averted an estimated 2.2 billion cases since 2000, 263 million cases were still recorded in 2023, with approximately 95% of the associated 597,000 deaths occurring in the WHO African Region (WHO, 2024). Nigeria's epidemiological context is defined by hyper-endemicity, contributing the largest national share to the global burden (FMOH, 2020). In 2021, the country estimated 68 million cases, accounting for nearly 27% of the global malaria burden (FMOH, 2020). The disease is present throughout the country year-round, although incidence tends to be higher in the northern regions (FMOH, 2020). For the WHO African Region, malaria case incidence decreased significantly between 2000 and 2019 but experienced disruption during the COVID-19 pandemic, leading to a rise in 2020. However, incidence slightly declined again to 223 per 1000 population at risk by 2022 (WHO, 2022). Edo State lies within the South-South geopolitical zone, which, like other southern zones, demonstrated substantial progress between 2010 and 2018, showing a prevalence ratio reduction of 0.51 (Ahmad *et al.*, 2020). However, this regional improvement often obscures high localized endemicity driven by specific environmental and socio-economic determinants. Epidemiological research across Nigeria identifies that localized risk is strongly associated with residing in rural areas, low family income, poor housing quality (e.g., lack of window screening), and suboptimal sanitation

practices (such as the use of pit latrines) (Braimah *et al.*, 2024; Tijjani *et al.*, 2016; Okunlola and Oyeyemi, 2019). The fact that studies from contiguous areas in Edo State still report child prevalence rates nearing 45% (Braimah *et al.*, 2024) underscores that the gains made at the zonal level are often fragile and unevenly distributed, requiring continuous, micro-level surveillance. The non-uniformity of malaria risk necessitates that the investigation in Igueben LGA determine which combination of these environmental and socio-economic risk factors are the dominant drivers of transmission within its unique environment, moving beyond generalized knowledge of endemicity.

Several factors increase the risk of malaria infection among children under the age of 10

<b>RISK FACTOR</b>	<b>DESCRIPTION</b>
AGE	Younger children (0-5 years) have weaker immune systems and are more susceptible.
Lack of ITN Use	Children who do not sleep under insecticide-treated nets are at higher risk.
Poor Housing	Mud walls, thatched roofs, and open windows allow mosquito entry.
Stagnant Water	Pools of water near homes serve as mosquito breeding sites.
Seasonal Variation	Malaria transmission peaks during the rainy season.
Low Socioeconomic Status	Poor families may not afford preventive tools or prompt treatment.

**Table 2.1: Risk Factors for Malaria infection in Children**

### 2.3 TRANSMISSION DYNAMICS OF MALARIA PARASITES

Malaria transmission involves a complex lifecycle requiring both the human host and the female *Anopheles* mosquito vector. The mosquito serves as the definitive host where the sexual stage of the parasite lifecycle occurs. When an infected human is bitten, the mosquito ingests gametocytes (the sexual stage of the parasite) circulating in the human blood. These gametocytes fuse in the mosquito gut to form a zygote, which develops into an ookinete. The ookinete migrates through the midgut wall, forms an oocyst, and subsequently ruptures, releasing numerous sporozoites that migrate to the mosquito's salivary glands, making the mosquito infective (CDC, 2020). When the infected mosquito bites another human, it injects sporozoites, initiating the human liver stage. Following liver maturation, merozoites are released into the bloodstream, where they infect red blood cells, beginning the asexual replication cycle (CDC, 2020). This erythrocytic stage is clinically significant because the rapid, cyclic multiplication of merozoites and the subsequent lysis of red blood cells are responsible for the clinical symptoms and pathologies associated with malaria, including fever, chills, and anemia (WHO, 2024; CDC, 2020). The severity of the disease, including conditions like hyper parasitemia (infection of greater than 5% of circulating red blood cells), is directly correlated with the density of these asexual parasites in the blood (WHO, 2015). In ecological settings like Igueben LGA, situated in the tropical South-South zone of Nigeria, transmission intensity is high and perennial, heavily influenced by local environmental conditions. Poor community sanitation, the presence of standing water bodies or poorly managed drainage (which serve as breeding sites), and inadequate housing structures that lack protective measures such as window nets directly increase the Entomological Inoculation Rate (EIR) the frequency of infective mosquito bites (Braithwaite *et al.*, 2024). Understanding these local transmission dynamics and environmental modifiers is crucial for designing effective, community-specific vector control and source reduction strategies.

## 2.4 IMPACT OF MALARIA ON CHILD HEALTH AND DEVELOPMENT

The impact of malaria on child health extends far beyond acute mortality, creating a severe long-term burden on development and future societal productivity. Acute infections, particularly with *P. falciparum*, remain a leading cause of death for children globally, accounting for an estimated 76% of all malaria deaths in the African Region for children under five (WHO, 2024). Immediate threats include severe manifestations such as cerebral malaria and profound anemia, which necessitate urgent clinical care (WHO, 2024; WHO, 2015). Beyond the immediate life-threatening conditions, malaria is recognized as a major contributing risk factor for poor developmental outcomes in children residing in low- and middle-income countries (LMICs) (Ssemata *et al.*, 2023; Holding and Snow, 2011). Severe malaria, especially cerebral malaria, is linked to permanent neurological injury and sustained impairment in cognitive and behavioral domains (Ssemata *et al.*, 2023). This developmental compromise is often exacerbated by associated factors like chronic or recurrent infection and severe anemia (Ssemata *et al.*, 2023; Holding and Snow, 2011). Recent rigorous systematic reviews and meta-analyses provide quantitative evidence of these developmental deficits (Ssemata *et al.*, 2023). Children who survive severe malaria infection have been found to experience significantly worse neuropsychological outcomes compared to uninfected children (Ssemata *et al.*, 2023). Specifically, three key areas of development are consistently affected: attention, memory, and externalizing behavioral problems (Ssemata *et al.*, 2023). The magnitude of these developmental impairments is substantial, as shown by meta-analysis metrics:

<b>Domain of Impairment</b>	<b>Observed Effect in Severe Malaria Survivors</b>	<b>Standardized Mean Difference (SMD)</b>
Attention	Significantly impaired performance	-0.68
Memory	Significantly reduced capacity for recall and learning	-0.52
Externalizing Behavior	Significantly increased disruptive or difficult behavior	0.45

Source: (Ssemata *et al.*, 2023)

**Table 2.2: Neuropsychological Domains Significantly Impaired by Severe Malaria in Children**

Note: For behavioural scores, a higher SMD indicates worse behavior.

These findings establish that high parasite prevalence in a community like Igueben LGA, particularly among the 0-10 age group, poses a long-term threat to the educational attainment and future productivity of the populace. Chronic exposure risks repeated infection and anemia, leading to developmental setbacks that diminish human capital. Consequently, quantifying and controlling the prevalence in Igueben LGA is an essential developmental and economic priority, not solely a clinical one.

## **2.5 PREVENTION AND CONTROL STRATEGIES**

Malaria control efforts globally are primarily anchored on two pillars: vector control and effective case management (WHO, 2025). Vector control strategies emphasize maximizing the distribution and utilization of Long-Lasting Insecticidal Nets (LLINs), which provide a physical and chemical barrier against the nocturnal feeding habits of *Anopheles* mosquitoes (Abegaz *et al.*, 2017). Studies consistently demonstrate that LLIN usage is a significant protective factor against *Plasmodium* infection (Abegaz *et al.*, 2017).

Nigeria's response is guided by the National Malaria Strategic Plan (NMSP 2021-2025), which aims for drastic reductions in morbidity and mortality, specifically targeting a parasite prevalence below 10% and a mortality rate in children under five below 50 deaths per 1,000 live births by 2025 (FMOH, 2020; Malaria Consortium, 2021). This strategy rests upon the "High Burden to High Impact" (HBHI) approach, prioritizing high political will, the use of strategic information, and coordinated national response (FMOH, 2020; WHO, 2022). Key interventions include universal access to diagnosis and prompt treatment with Artemisinin-based Combination Therapies (ACTs), chemoprevention strategies like Intermittent Preventive Treatment in Pregnancy (IPTp), and targeted deployment of vector control tools (Malaria

Consortium, 2021). However, the efficacy of these strategies is severely challenged by implementation gaps. While awareness regarding malaria transmission, symptoms, and prevention methods is generally high across Nigerian communities (often exceeding 90%), the actual utilization of preventive tools often lags significantly (Tijjani *et al.*, 2016). For instance, despite high rates of LLIN ownership, utilization rates can be as low as 49.5% in rural areas (Tijjani *et al.*, 2016). This disparity between knowledge/attitude and practice/utilization (KAP) indicates that success is not merely achieved through resource distribution but hinges on addressing socio-cultural, economic, and environmental barriers specific to each community. Thus, any high prevalence identified in Igueben LGA would signify a failure not of the national strategy itself, but of its localized implementation, requiring the identification of specific, community-level bottlenecks.

## **2.6 PREVIOUS STUDIES ON MALARIA PREVALENCE IN NIGERIA**

Nigeria, due to its high endemicity, has been the subject of numerous malaria prevalence studies, though these often highlight significant regional and administrative disparities. While the South-South geopolitical zone, where Edo State is situated, showed commendable reductions in prevalence between 2010 and 2018 (Ahmad *et al.*, 2020), localized prevalence remains critically high, particularly among children.

Studies conducted within Edo State confirm the persistent risk faced by the pediatric population:

- i. An analysis of children aged 6 to 24 months in parts of Edo State revealed a malaria parasitaemia prevalence of 28.7% (Ugwu *et al.*, 2023).
- ii. A separate hospital-based study in Benin City (Edo Specialist Hospital) found that children aged 1 to 12 years had an overall prevalence rate of 29.8% (Ugwu *et al.*, 2022).

The most compelling proximal evidence, however, comes from a recent cross-sectional study conducted in the Edo-North senatorial district, geographically adjacent to Igueben LGA. Although the overall prevalence across the study area was 15.54%, the researchers found that prevalence among children (aged 3-12 years) was alarmingly high at 44.7% (Braitham *et al.*, 2024). These studies collectively emphasize that relying on broad state- or zonal-level averages grossly underestimates the actual burden concentrated within the younger age groups. Furthermore, the localized research identified that prevalence varies significantly by specific local government area, age group, and risk factors such as sanitation facilities (e.g., pit latrine use). (Braitham *et al.*, 2024). This context of documented high, yet highly variable, pediatric risk in contiguous areas strongly frames the epidemiological threat potentially faced by children in Igueben LGA.

## **2.7 GAPS IN RESEARCH THAT JUSTIFY THE STUDY**

Despite the extensive literature documenting Nigeria's heavy malaria burden and the critical risk faced by children in Edo State, a fundamental research gap persists regarding specific, micro-level epidemiology. Specifically, there is a distinct absence of contemporary, published, community-based data quantifying Plasmodium parasite prevalence and its associated socio-environmental risk factors among children under the age of 10 residing in Igueben Local Government Area (Braitham *et al.*, 2024; Tijjani *et al.*, 2016). Existing epidemiological assessments typically aggregate data at the state or senatorial district level, which masks the true localized burden within smaller administrative units like Igueben LGA (Braitham *et al.*, 2024). This lack of specific data undermines the operational effectiveness of the NMEP's policy mandating the use of strategic information for subnational tailoring of interventions (FMOH, 2020; WHO, 2025). Without current, accurate data from Igueben, local health officials cannot efficiently allocate limited resources, select appropriate intervention mixes

(e.g., vector control versus chemoprevention), or accurately monitor local progress toward the NMSP targets. The urgent nature of this gap is amplified by the high prevalence (44.7%) observed in the contiguous Edo-North region (Braithair *et al.*, 2024). This proximate evidence strongly suggests that the information void in Igueben is not merely a scientific oversight but represents an unquantified, immediate public health risk to a vulnerable pediatric cohort. The research is justified by the strategic imperative to close this information gap, ensuring that intervention coverage and resource allocation in this specific, low-population LGA are guided by empirically derived prevalence rates rather than generalized assumptions, thereby safeguarding the health and developmental trajectory of Igueben's children.

## **CHAPTER THREE**

### **METHODOLOGY**

#### **3.1 STUDY AREA**

The study was conducted in Igueben Local Government Area (LGA), Edo State, Nigeria. Igueben LGA is located in southern Nigeria and falls within the tropical rainforest zone, characterized by high humidity and a bimodal rainfall pattern. The area is predominantly rural, with many communities lacking basic amenities such as piped water and electricity, which may influence malaria transmission dynamics.

Primary healthcare centres in Igueben LGA serve as the primary healthcare facilities for residents, including children under the age of 10 years old. These centers maintain records of malaria testing and diagnosis using either microscopy or Rapid Diagnostic Tests (RDTs), which will form the basis of this secondary data analysis.



**Plate 1: Eguare Primary Healthcare Centre in Igueben LGA**



**Plate 2: Ebelle Primary Healthcare Centre in Igueben LGA**

### **3.1.1 PARTICIPANT SELECTION**

Participants were selected based on the availability of their children’s malaria test records in the selected health facilities. Parents or guardians whose children met the inclusion criteria and were willing to provide informed consent were invited to participate in the survey.

### **3.1.2 INCLUSION CRITERIA**

- i. Children aged 0–9 years who reside in Igueben LGA.
- ii. Children whose malaria test results were recorded in selected health facilities between January 2024 and April 2025.
- iii. Parents or guardians who are willing to participate and provide informed consent.
- iv. Malaria testing performed using microscopy or Rapid Diagnostic Test (RDT).

### **3.1.3 EXCLUSION CRITERIA**

- i. Children age 10 and above.
- ii. Records with incomplete or missing data (e.g., missing age, test result, or date).
- iii. Children whose parents or guardians decline to participate in the questionnaire.
- iv. Records from private hospitals or clinics (if access is not granted).

## **3.2 STUDY DESIGN**

This study employs a retrospective descriptive design, utilizing secondary data analysis of existing laboratory and clinic records from selected primary healthcare centers in Igueben LGA. The focus is on analyzing monthly trends in malaria testing and positivity rates among children under the age of 10 years old between January 2024 and April 2025.

### **3.3 STUDY POPULATION**

The study population consists of children aged 0–9 years who accessed malaria diagnostic services at selected primary health centers in Igueben LGA during the study period. Since this is a retrospective analysis of secondary data, no direct interaction with participants will occur. Data was extracted from patient registers and laboratory books without collecting personal identifiers such as names, gender, or exact ages.

### **3.4 DATA COLLECTION TOOLS**

The data for this study were collected using a structured data table specifically designed by the researcher. The table contained columns for each month (January 2024 to April 2025), the number of children under 10 years tested for malaria, and the number of confirmed positive cases.

The table served as a data extraction sheet used to obtain monthly malaria test record for the selected Primary Healthcare Centres. The design of the table was guided by the format used in health facility malaria registers, but it was simplified for the purpose of the research.

### **3.5 DATA MANAGEMENT/ANALYSIS**

All extracted data were entered into Microsoft Excel for cleaning and analysis. Descriptive statistics were used to calculate the monthly prevalence rate of malaria parasite infection among children under the age of 10.

#### **3.5.1 PREVALENCE CALCULATION**

The monthly prevalence rate was calculated using the formula:

$$Prevalence (\%) = \frac{Number\ of\ positive\ cases \times 100}{Total\ number\ tested}$$

### **3.5.2 TREND ANALYSIS**

Monthly prevalence rates were plotted on a line graph to identify seasonal trends and patterns. Comparisons were made between rainy months (April–July, Sept–Oct) and dry months (December–March, August, November) to assess the impact of seasonality on malaria transmission.

### **3.6 ETHICAL CONSIDERATIONS**

Ethical approval was obtained from the Edo State Ministry of Health Research Ethics Committee and Edo State Primary Healthcare Development Agency before data collection begins. Permission will also be sought from the management of each health facility.

- i. Confidentiality: No personal identifiers (name, gender, exact age, address) was recorded or analyzed.
- ii. Data Security: All data were stored securely and used only for research purposes.
- iii. Informed Consent: An Informed Consent Letter was provided to the heads of health facilities, explaining the purpose of the study and ensuring they are aware of how their records were used.



# EDO STATE MINISTRY OF HEALTH HEALTH RESEARCH ETHICS COMMITTEE



**PROTOCOL NUMBER** HA/737/25/D/08050867 (PLEASE QUOTE IN ALL ENQUIRIES)

**APPROVAL NUMBER** HA/737/25/D/09080867

**TITLE OF RESEARCH PROPOSAL** ANALYSIS ON THE PREVALENCE OF MALARIA PARASITE AMONG CHILDREN UNDER THE AGE OF 10 IN IGUEBEN LOCAL GOVERNMENT AREA

**PRINCIPAL INVESTIGATOR (S)** IRHIA DAVID OSARETIN

**DATE CONSIDERED** 8<sup>TH</sup> SEPTEMBER, 2025.

**DECISION OF THE COMMITTEE** APPROVED

*THIS APPROVAL DATES 08/09/2025 TO 08/09/2026. IF THERE IS A DELAY IN STARTING THE RESEARCH, PLEASE INFORM THE HREC EDO SMoH SO THAT THE DATES OF APPROVAL CAN BE ADJUSTED ACCORDINGLY*

**REMARK:** Please kindly note that the HREC Edo SMoH seal authenticates this approval

**DR (MRS) Omonyemen B. BELLO**  
(MBBS, MPH, FPHCM) (CHAIRMAN)

SIGNATURE & DATE.....

*Bello*  
19/9/25

SUPERVISOR(S) .....

**ATTESTATION BY INVESTIGATOR(S)**

No participant accrual or activity related to this research may be conducted outside of the approval dates. All informed consent forms used in this study must carry the Edo SMoH HREC-assigned number and duration of your research. No changes are permitted in the research without prior approval of the Edo SMoH HREC except in circumstances outlined in the Code. The Edo SMoH HREC reserves the right to conduct compliance visits to your research site without previous notification.



Signature & Date.....



edohrec@edostate.gov.ng



Room 16, Block D, 2nd floor, State secretariat building.

**Plate 3: Edo State Health Research Ethics Committee (HREC) Approval**



UNIVERSITY OF BENIN  
P.M.B 1154,  
Benin City, Edo State.  
10<sup>th</sup> of October, 2025.

The Executive Secretary,  
Edo State Primary Healthcare Development Agency  
EDSPHCDA,  
Benin City, Edo State.



Dear Sir,

### REQUEST FOR APPROVAL OF DATA COLLECTION

I, **IRHIA DAVID OSARETIN** with Matriculation number **LSC2007311**, a final-year student of the Department of Science Laboratory Technology, Faculty of Life Sciences, University of Benin, currently undertaking my research project titled: **"ANALYSIS ON THE PREVALENCE OF MALARIA PARASITE AMONG CHILDREN UNDER THE AGE OF 10 IN IGUEBEN LOCAL GOVERNMENT AREA."**


As part of this study, I intend to collect secondary data on malaria test results from selected health centers and hospitals in Igueben LGA. The data will cover the period from **January 2024 to April 2025** and will include:

- Number of children under 10 tested for malaria
- Number of confirmed positive cases of the children tested for malaria.

I hereby kindly request for Approval for this study and support access to relevant health facilities for data collection.

Attached is the HREC approval from the Edo State Ministry of Health for my research project work. Thank you for your kind consideration.

Yours faithfully,

  
.....  
**IRHIA DAVID OSARETIN**  
Matric Number: LSC2007311  
Department of Science Laboratory Technology  
University of Benin  
Phone: 07017695019/09139233524  
Email: irhia2003@gmail.com

**Plate 4: Administrative Permission/Request Letter**

### **3.7 LIMITATIONS OF THE STUDY**

1. **Data Quality:** The accuracy of the study depends on the completeness and reliability of existing health facility records. Missing or incomplete data could introduce bias.
2. **Seasonal Bias:** The study covers only a 16-month period, which may not fully capture long-term trends or variations across multiple years.
3. **Diagnostic Method Variability:** Different health facilities may use varying diagnostic methods (microscopy vs. RDT), potentially affecting comparability.
4. **No Demographic Data:** Due to the nature of secondary data analysis, variables such as gender, exact age, and socioeconomic status cannot be included.

## CHAPTER FOUR

### RESULT AND DATA ANALYSIS

#### 4.1 OVERVIEW

This chapter presents the results obtained from the analysis of malaria prevalence among children under the age of ten in Igueben Local Government Area (LGA), Edo State. The data were collected from two selected Primary Healthcare Centres (PHCs) which are Ebelle and Eguare, covering the period from January 2024 to April 2025.

The data include the number of children tested for malaria, the number that tested positive, and the number that tested negative during each month. The prevalence of malaria was calculated using the formula:

$$\text{Prevalence (\%)} = \frac{\text{Number of positive cases} \times 100}{\text{Total number tested}}$$

The results are presented in tables and figures, followed by a detailed interpretation and scientific discussion.

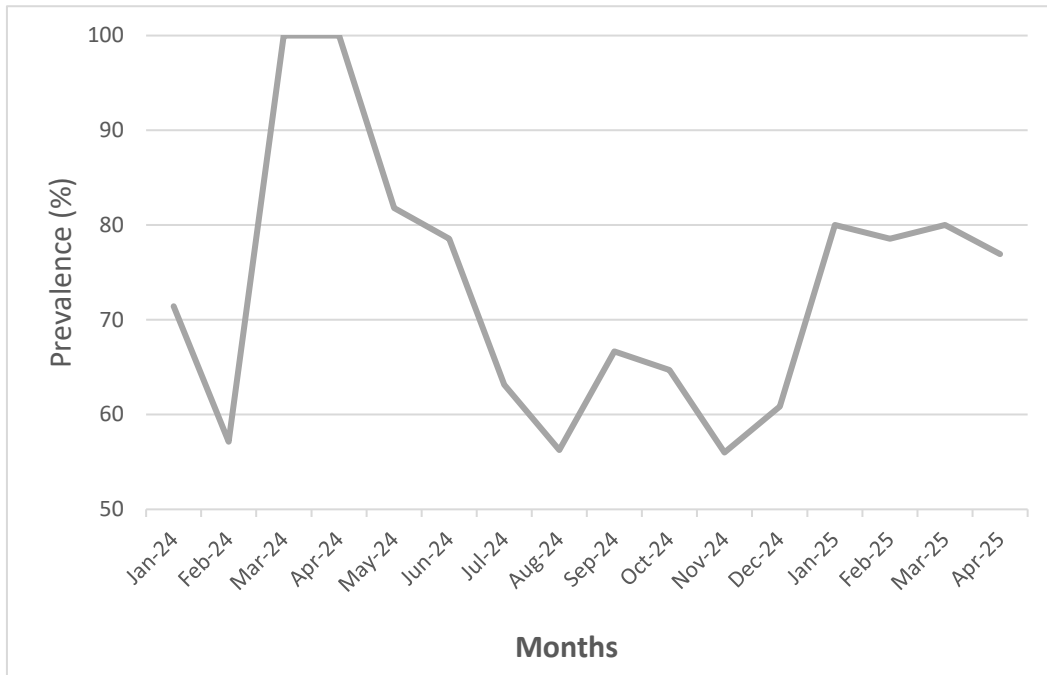
## 4.2 Summary of Findings

<b>Month</b>	<b>Number of Children (&lt;10) Tested for Malaria</b>	<b>Number Tested Positive</b>	<b>Number Tested Negative</b>
<b>Jan-24</b>	7	5	2
<b>Feb-24</b>	14	8	6
<b>Mar-24</b>	9	9	0
<b>Apr-24</b>	11	11	0
<b>May-24</b>	11	9	2
<b>Jun-24</b>	14	11	3
<b>Jul-24</b>	19	12	7
<b>Aug-24</b>	16	9	7
<b>Sep-24</b>	15	10	5
<b>Oct-24</b>	17	11	6
<b>Nov-24</b>	25	14	11
<b>Dec-24</b>	23	14	9
<b>Jan-25</b>	10	8	2
<b>Feb-25</b>	14	11	3
<b>Mar-25</b>	15	12	3
<b>Apr-25</b>	13	10	3
<b>TOTAL</b>	<b>233</b>	<b>164</b>	<b>69</b>

**Table 4.1: Monthly Malaria test results of children under the age of 10 at Ebelle Primary Healthcare Centre, Igueben LGA (January 2024 to April 2025)**

<b>Month</b>	<b>Number of Children (&lt;10) Tested for Malaria</b>	<b>Number Tested Positive</b>	<b>Prevalence (%)</b>
<b>Jan-24</b>	7	5	71.4
<b>Feb-24</b>	14	8	57.1
<b>Mar-24</b>	9	9	100
<b>Apr-24</b>	11	11	100
<b>May-24</b>	11	9	81.8
<b>Jun-24</b>	14	11	78.6
<b>Jul-24</b>	19	12	63.2
<b>Aug-24</b>	16	9	56.3
<b>Sep-24</b>	15	10	66.7
<b>Oct-24</b>	17	11	64.7
<b>Nov-24</b>	25	14	56
<b>Dec-24</b>	23	14	60.9
<b>Jan-25</b>	10	8	80
<b>Feb-25</b>	14	11	78.6
<b>Mar-25</b>	15	12	80
<b>Apr-25</b>	13	10	76.9
<b>Average Prevalence</b>			<b>73.3</b>

**Table 4.2: Monthly Prevalence of Malaria for Children Under 10 Years at Ebelle Primary Healthcare Centre at Igueben LGA (January 2024 - April 2025)**



**Figure 4.1: Monthly Trend of Malaria Prevalence among Children Under the age of 10 at Ebelle PHC (Jan 2024 – April 2025).**

The analysis of the data from Ebelle PHC revealed fluctuations in malaria prevalence across the 16-month period. The highest prevalence (100%) was observed in March and April 2024, indicating that all children tested during those months were positive for malaria. This may reflect the onset of the rainy season, when mosquito breeding activities begin to increase. The lowest prevalence (56%) was recorded in November 2024, corresponding to the early dry season when mosquito breeding sites are reduced. Although prevalence varied month to month, overall transmission remained high throughout the study period.

The total number of children tested also varied per month, which may reflect attendance patterns and health-seeking behaviors within the community.

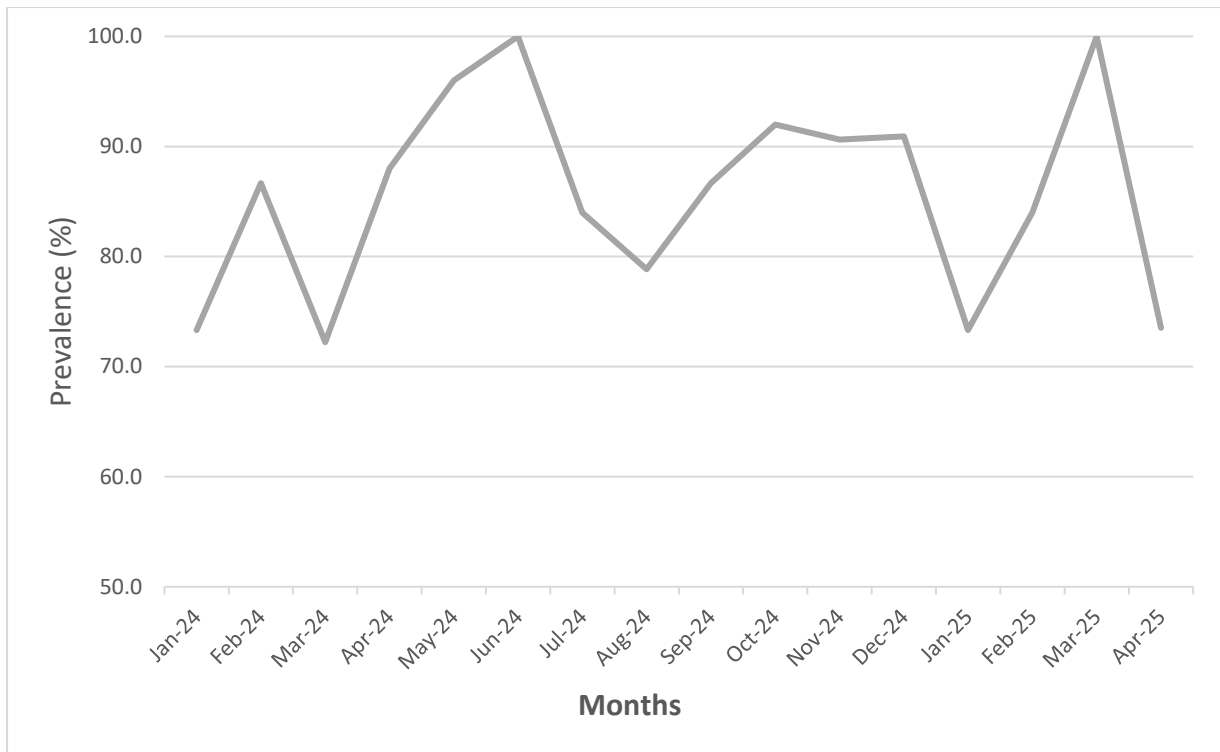
Overall, the average prevalence at Ebelle PHC during the study period was approximately 73.3%. This suggests that more than half of the children under the age of 10 tested were infected with malaria parasites, indicating a high malaria burden in the area.

<b>Month</b>	<b>Number of Children (&lt;10) Tested for Malaria</b>	<b>Number Tested Positive</b>	<b>Number Tested Negative</b>
<b>Jan-24</b>	15	11	4
<b>Feb-24</b>	30	26	4
<b>Mar-24</b>	18	13	5
<b>Apr-24</b>	25	22	3
<b>May-24</b>	25	24	1
<b>Jun-24</b>	12	12	0
<b>Jul-24</b>	25	21	4
<b>Aug-24</b>	52	41	11
<b>Sep-24</b>	30	26	4
<b>Oct-24</b>	50	46	4
<b>Nov-24</b>	32	29	3
<b>Dec-24</b>	11	10	1
<b>Jan-25</b>	15	11	4
<b>Feb-25</b>	25	21	4
<b>Mar-25</b>	15	15	0
<b>Apr-25</b>	34	25	9
<b>TOTAL</b>	<b>414</b>	<b>353</b>	<b>61</b>

**Table 4.3: Monthly Malaria test results of children under the age of 10 years at Eguare Primary Healthcare Centre, Igueben LGA (January 2024 – April 2025).**

<b>Month</b>	<b>Number of Children (&lt;10) Tested for Malaria</b>	<b>Number Tested Positive</b>	<b>Prevalence (%)</b>
<b>Jan-24</b>	15	11	73.3
<b>Feb-24</b>	30	26	86.7
<b>Mar-24</b>	18	13	72.2
<b>Apr-24</b>	25	22	88
<b>May-24</b>	25	24	96
<b>Jun-24</b>	12	12	100
<b>Jul-24</b>	25	21	84
<b>Aug-24</b>	52	41	78.8
<b>Sep-24</b>	30	26	86.7
<b>Oct-24</b>	50	46	92
<b>Nov-24</b>	32	29	90.6
<b>Dec-24</b>	11	10	90.9
<b>Jan-25</b>	15	11	73.3
<b>Feb-25</b>	25	21	84
<b>Mar-25</b>	15	15	100
<b>Apr-25</b>	34	25	73.5
<b>Average Prevalence</b>			<b>85.6</b>

**Table 4.4: Monthly Prevalence of Malaria for Children Under 10 Years at Eguare Primary Healthcare Centre at Igueben LGA (January 2024 - April 2025)**



**Figure 4.2: Monthly Trend of Malaria Prevalence among Children Under 10 years at Eguare PHC (Jan 2024 - April 2025).**

The data collected from Eguare PHC showed a consistently severe malaria burden throughout the study period, with an overall average prevalence of **85.6%**. Unlike Ebelle PHC, the trend at Eguare does not exhibit a sharp seasonal decline.

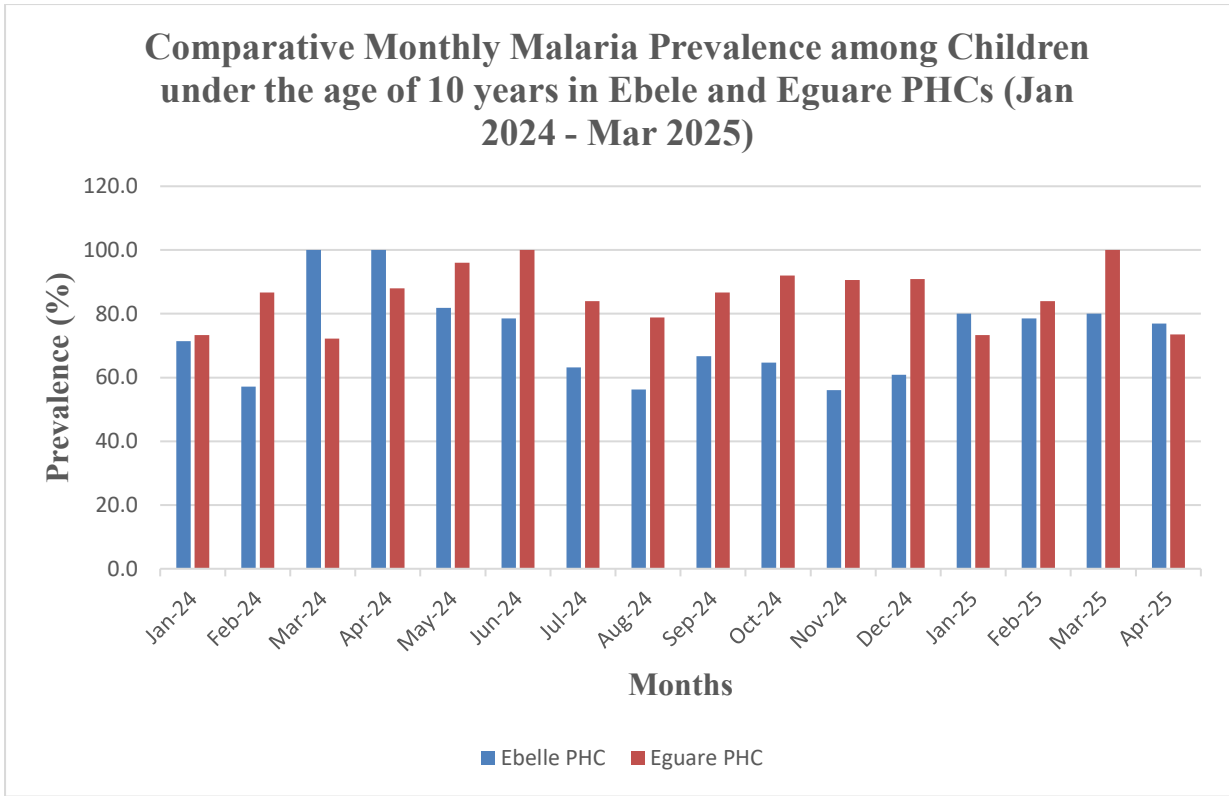
As shown in Table 4.4 and Figure 4.2, the monthly prevalence remained exceptionally high:

- i. Prevalence peaked at **100%** in June 2024 and March 2025.
- ii. Crucially, during the typical dry season months (November and December 2024), the prevalence remained at **90.6%** and **90.9%**, respectively.
- iii. This trend indicates a pattern of intense, perennial (year-round) transmission in the Eguare community. While there is a slight dip in the total number of tested cases later in the year, the percentage of positive cases remain high regardless of the season, suggesting the persistence of effective vector breeding sites (like domestic water storage or poor drainage) that are not solely dependent on rainfall.

### 4.3 Comparative Analysis Between Ebelle and Eguare PHCs

Months	Ebelle PHC (%)	Eguare PHC
Jan-24	71.4	73.3
Feb-24	57.1	86.7
Mar-24	100	72.2
Apr-24	100	88
May-24	81.8	96
Jun-24	78.6	100
Jul-24	63.2	84
Aug-24	56.3	78.8
Sep-24	66.7	86.7
Oct-24	64.7	92
Nov-24	56	90.6
Dec-24	60.9	90.9
Jan-25	80	73.3
Feb-25	78.6	84
Mar-25	80	100
Apr-25	76.9	73.5
<b>Average Prevalence</b>	<b>73.3</b>	<b>85.6</b>

**Table 4.5: Comparative Monthly malaria prevalence among children under the age of 10 at Ebelle and Eguare Primary Healthcare Centres.**



**Figure 4.3: Comparative malaria prevalence trend between Ebele and Eguare PHCs**

The comparative analysis between the two healthcare centres shows that both locations experience seasonal malaria transmission patterns, but with varying intensities.

Eguare PHC recorded slightly higher prevalence rates across most months, which may be linked to differences in environmental factors such as proximity to stagnant water bodies, waste management practices, or housing conditions that favor mosquito breeding.

Ebelle PHC, on the other hand, showed a more moderate prevalence trend, possibly reflecting better community sensitization or malaria control interventions such as insecticide-treated nets (ITNs) usage and environmental sanitation.

The overall average prevalence across both PHCs during the study period was 73.3% and 85.6%, indicating that malaria remains a major public health concern among children under the age of ten in Igueben LGA.

## CHAPTER FIVE

### DISCUSSION, CONCLUSION AND RECOMMENDATION

#### 5.1 DISCUSSION

This study determined the malaria parasite prevalence and transmission dynamics among children under ten attending two Primary Healthcare Centres (PHCs) Ebelle and Eguare in Igueben Local Government Area (LGA), Edo State. The analysis of the facility-based secondary data (January 2024 to April 2025) yielded critical evidence that redefines the known malaria burden in this area.

##### 1. Severity of Malaria Burden and Contextualization

The most significant finding is the **alarmingly high overall malaria prevalence of 79.9%** (517 positive cases out of 647 tested children). This figure establishes malaria in Igueben LGA as severely **hyper-endemic**, signifying a near-universal exposure and high risk of infection among children under ten seeking care at these centres.

When contextualized against official data, this figure is highly concerning:

- i. It is approximately **four times the 2021 Nigeria Malaria Indicator Survey (NMIS) state average of 18%** for all of Edo State (NMEP, 2022).
- ii. The overall prevalence rate confirms that malaria is the predominant disease among the pediatric population in Igueben LGA, aligning with studies that show rural settings in Nigeria often bear a disproportionately higher burden compared to urban centres (Ugwu *et al.*, 2022; Tijjani *et al.*, 2016).

## 2. Spatial Heterogeneity and Transmission Patterns

The study's critical contribution lies in identifying significant **spatial heterogeneity** in transmission, confirming that the two communities face different epidemiological risks:

### a. Eguare PHC: The Perennial Hyper-Endemic Hotspot

Eguare PHC recorded the highest average prevalence at **85.6%**. The monthly trend revealed a pattern of **intense, perennial (year-round) transmission**. Prevalence peaked at 100% in June 2024 and March 2025, but crucially, it remained exceptionally high during the typical dry season months, dropping only slightly to **90.6% and 90.9% in November and December 2024**, respectively. This finding is interpreted as follows:

- i. **Persistence:** Transmission is sustained by factors independent of seasonal rainfall, likely including poor domestic drainage, inadequate waste management, or perennial human-made breeding sites (stagnant wells, water storage containers) that maintain high vector populations regardless of the climate.
- ii **Intervention Implication:** The risk in this community is constant, demanding continuous, high-intensity public health interventions and environmental management programs 365 days a year.

### b. Ebelle PHC: High-Endemic Seasonal Pattern

Ebelle PHC recorded a lower, yet still severely high, average prevalence of **73.3%**. The data here exhibited a more classical **seasonal transmission pattern**:

- Prevalence peaked at **100%** in March and April 2024, corresponding perfectly to the beginning of the rainy season when initial rainfall creates abundant mosquito breeding habitats.
- The lowest prevalence of **56%** was recorded in November 2024, marking a distinct seasonal dip associated with the dry season and reduced breeding opportunities.
- **Intervention Implication:** While the overall burden is high, the seasonal fluctuation suggests that targeted, high-impact interventions focused on the period just before and during the rainy season (March to October) would yield the most significant reduction in incidence.

The comparative analysis confirms the initial hypothesis: a single, uniform malaria control strategy applied across Igueben LGA will be inefficient and ineffective.

## 5.2 CONCLUSION

This research project has successfully analyzed the prevalence of malaria among children under ten years attending Primary Health Care Centres in Igueben LGA, Edo State, leading to three major conclusions:

1. **High Burden Confirmation:** Malaria is a persistent, hyper-endemic public health crisis in Igueben LGA, with an overall prevalence of **79.9%** among children tested at the PHCs. This burden is significantly higher than the state average, justifying the urgent need for localized control efforts.
2. **Epidemiological Heterogeneity:** The LGA exhibits two distinct and contrasting transmission patterns. **Eguare PHC (85.6% average)** serves as a **perennial hotspot**, requiring year-round interventions due to non-seasonal transmission drivers. **Ebelle PHC (73.3% average)** exhibits a **seasonal pattern**, where transmission risk is highest during the rainy season.
3. **Need for Tailored Strategy:** The existence of these two distinct patterns confirms that malaria control programs in Igueben LGA must be **micro-stratified**. A single approach targeting only the rainy season will fail to address the critical, year-round risk in communities like Eguare.

The findings validate the importance of community-level surveillance in refining state and national malaria elimination strategies.

### 5.3 RECOMMENDATIONS

Based on the evidence and conclusions of this study, the following recommendations are forwarded to the Igueben Local Government Area Primary Health Care Department and the National Malaria Elimination Programme (NMEP):

1. **Adopt a Differentiated Intervention Strategy:**
  - i. **For Eguare PHC Community (Perennial Hotspot):** Implement continuous, year-round environmental management and larval source management, alongside sustained community distribution of Insecticide-Treated Nets (ITNs).
  - ii. **For Ebelle PHC Community (Seasonal Pattern):** Intensify ITN distribution, community education, and seasonal malaria chemoprevention (if applicable to the age group) specifically between **February and October**, just before and during the high-transmission period.
2. **Improve Facility-Level Data Quality:** Mandate the meticulous recording of patient data, including age, address, and ITN usage, in facility registers to enable future studies to analyze specific risk factors and track intervention effectiveness more accurately.
3. **Conduct Further Entomological and Risk Factor Studies:** Future research should focus on entomological surveys to identify the specific vector species and their breeding habitats (permanent versus temporary) that sustain the perennial transmission in Eguare. This is essential for effective, targeted vector control.

## **5.4 CONTRIBUTION TO KNOWLEDGE**

This study contributes to existing knowledge by:

- i. Providing up-to-date local data on malaria prevalence trends among children under ten in Igueben LGA.
- ii. Demonstrating the seasonal relationship between rainfall and malaria infection rates.
- iii. Highlighting the need for area-specific interventions to reduce malaria burden in rural communities.

These insights can serve as a reference for public health authorities and researchers involved in malaria control and epidemiological surveillance.

## REFERENCES

- Abegaz, F.E., Gebretinsae, H. and Woldemichael, K. (2017). Asymptomatic malaria and associated risk factors among school children in Sanja town, northwest Ethiopia. *International Scholarly Research Notices*. 2017: 303269.
- Ahmad, A.S., Olorukooba, A.A., Gani, K.A. and Sambo, N.A. (2020). Changes in malaria prevalence across states of Nigeria: a spatio-temporal modeling of three national malaria indicator surveys. *Malar J*. 19:445.
- Braimah, J.O., Edike, N., Okhaiomoje, A.I. and Correa, F.M. (2024). The fight against malaria in Edo-North, Edo State, Nigeria: identifying risk factors for effective control. *PeerJ*, 12:18301.
- CDC (Centers for Disease Control and Prevention). (2020). *Malaria Parasite Life Cycle*. Atlanta: CDC.
- Edo State Government (2020). Edo State Atlas. Benin City: Edo State Ministry of Physical Planning and Urban Development. (Official Government Document)
- Ekwere, T.A. and Ibekwe, C.R. (2012). Age-specific clinical manifestations of malaria in children. *Annals of Clinical Pediatrics*. 2(1):1-7.
- Federal Ministry of Health, Nigeria (FMOH) (2020). National Malaria Strategic Plan, 2021 - 2025. Abuja: National Malaria Elimination Programme.
- Malaria Consortium (2021). Malaria Consortium to support Nigeria's National Malaria Elimination Programme to reduce malaria burden to pre-elimination by 2025.
- Okonko, P.O., Ogu, E.N., Onyedobe, O.B., Olokpa, N.E. (2024). Prevalence of Malaria Parasitaemia and Anaemia in Children 6-24 Months of Age in Selected Communities in

- Oredo Local Government Area of Edo State, Nigeria. *Asian Journal Research Biosciences*. **6**(1):110-120.
- Okunlola, M.A. and Oyeyemi, A.Y. (2019). Environmental predictors of malaria incidence in Nigeria using spatio-temporal analysis. *Geospatial Health*. **14**(1):865.
- Ssemata, A.S., Nakitende, A.J., Kizito, S., Thomas, M.R., Islam, S., Bangirana, P. (2023). Association of severe malaria with cognitive and behavioural outcomes in low- and middle-income countries: a meta-analysis and systematic review. *Malaria Journal*. **22**:227.
- Tijjani, B., Muhammad, A.N., Abubakar, M., Aliyu, M. and Bello, F.H. (2016). Community-based study on the prevalence and risk factors of malaria and its control measures in rural Hausa communities, Kano State, Nigeria. *Infect Dis Poverty*. **5**(1): 69.
- Ugwu, C.I., Ezeagwuna, D.A., Ikekpeazu, E.J., Eze, K.I. and Emesowum, I.O. (2022). Prevalence and associated risk factors of malaria in children attending Edo Specialist Hospital, Benin Cit, Nigeria. *Saudi J Biomed Res*. **7**(6): 269-275.
- A.U., Ugwu, C.I., Ezeagwuna, D.A., and Ugwu, M.U. (2023). Prevalence of malaria parasitaemia and associated anaemia among children 6-24 months in parts of Edo State, Nigeria. *International Journal Health Sciences and Research*. **13**(10): 291-299.
- World Health Organization (WHO) (2024). *Malaria Fact Sheet*. Geneva: WHO.
- World Health Organization (WHO) (2024). *World malaria report 2024: Addressing inequity in the global malaria response*. Geneva: WHO.

World Health Organization (WHO) (2022). *Report on malaria in Nigeria 2022*. Geneva: WHO.

World Health Organization (WHO) (2015). *Guidelines for the treatment of malaria, 3rd edition*. Geneva: WHO

World Health Organization (WHO) (2025). *Subnational tailoring of malaria strategies and interventions: reference manual (forthcoming guidance)*. Geneva: WHO.