

**PREVALENCE OF MALARIA IN TODDLERS IN THE PAEDIATRICS
DEPARTMENT OF A TERTIARY TEACHING HOSPITAL OF A DEVELOPING
COUNTRY: A RETROSPECTIVE STUDY**

ABSTRACT

BACKGROUND: Malaria is one of the most important public health and life-threatening parasitic infections caused by the protozoan parasite- Plasmodium. The WHO [Global technical strategy for malaria 2016–2030](#), updated in 2021, provides a technical framework for all malaria-endemic countries. It is intended to guide and support regional and country program as they work towards malaria control and elimination.

OBJECTIVES: This study assessed the prevalence of malaria in toddlers in a tertiary health facility in developing countries between January and December 2021.

METHODOLOGY: The study involved the use of patient's case notes, A total of 104 case notes were selected using simple random technique. A checklist was generated from the collection of data. Data was analyzed using the statistical package for scientific solution (SPSS) software version 21.0. for descriptive statistics. The Chi square test was used to test for associations. The level of significance was set as $P < 0.05$.

RESULTS: It was discovered that Half (50%) of the toddlers were 2years old, a little above half (52.9%) were male and the mean age was 2.31 with a standard deviation of 3.02. studies. On the financial implication of malaria treatment study revealed that 76.9% spent between ₦1500 - ₦1900 and artesunate was the most common antimalarial used and most children spent up to 3 days on admission

CONCLUSION: Findings from this study reveals that the prevalence is common among toddlers especially in 2years old. The average amount spent on antimalarial purchase is relatively fair based on the drugs the patients can afford. The highest prevalence was seen in July (62%) and the least prevalence was seen in January (30%)

KEYWORD: Malaria, toddlers, anti-malaria, income.

1.0 INTRODUCTION

1.1 Background

Malaria is one of the most important public health and life-threatening parasitic infections caused by the protozoan parasite- Plasmodium. It is a major concern in tropical and subtropical parts of the world. Plasmodium organisms implicated are: *Plasmodium falciparum*, *P. vivax*, *P. ovale*, *P. knowlesi*, and *P. malariae*. These are the five *Plasmodium* species that cause malaria in humans[1].

In 2018, the World Health Organization (WHO) report indicates that globally an estimated 228 million new cases of malaria were documented. The WHO African region accounted for 93% of all cases followed by the Southeast Asia region (3.4%) and Eastern Mediterranean region (2%). Likewise, there were an estimated 405,000 deaths due to malaria in the globe. Children under the age of five-year were accounted for two-thirds (67%) of the world's malaria deaths in 2018. [2]

The mode of transmission of malaria as already established by infected female anopheles mosquito which feed from infected person and then feed on non-infected person thereby leading to spread of the condition. However, other mode of transmission include mother to unborn child, through blood transfusions and by sharing needles used to inject drugs. [3]

Categories of people at risk of having malaria are people who live in the malaria endemic zones which include Sub-Saharan Africa, South and Southeast Asia, Pacific Islands, Central America and Northern South America.[4]

Symptoms of malarial infection are nonspecific and may manifest as a flulike illness with fever, headache, malaise, fatigue, and muscle aches. Some patients with malaria present with diarrhea

and other gastrointestinal (GI) symptoms. Immune individuals may be completely asymptomatic or may present with mild anemia [5].

However, symptoms of malaria have been found to be severe in some young children and infants, older adults, travelers coming from areas with no malaria and pregnant women and their unborn children

They go as far presenting with loss of consciousness, acute kidney injury, loss of developmental milestones and severe anemia.

It has been observed that in many countries with high malaria, may owe it to poor environmental conditions[6]

Appropriate history taking, examination, blood investigations and test using the rapid diagnostic test kit for malaria and microscopic view of peripheral blood film of suspected cases is key to effective treatment. Generally, the World health Organization (WHO) advocates the control of malaria through three major ways: effective vector control, use of prophylactic drugs and vaccination.

- 1. Effective vector control**
- 2. Use of drugs and prophylactic drugs**
- 3. Vaccination**

1.2 Statement of the Problem

Nigeria suffers the world's greatest malaria burden, with approximately 51 million cases and 207,000 deaths reported annually (approximately 30 % of the total malaria burden in Africa),

while 97 % of the total population (approximately 173 million) is at risk of infection with children constituting about 53% of such [21].

It is also worthy of note and alarming that the WHO reported that four African countries accounted for just over half of all malaria deaths worldwide: Nigeria (31.9%), the Democratic Republic of the Congo (13.2%), United Republic of Tanzania (4.1%) and Mozambique (3.8%)[9]. This statistics clearly place Nigeria among the highest with under five children leading the number of death and common presentation to the hospitals.

1.3 Justification of the Study

Although numerous studies and research have been done on malaria that of a prevalence study especially to determine the prevalence among toddlers in the paediatrics department of a tertiary teaching hospital such as Specialist Teaching Hospital Irrua has not been fully exhausted. The fact the study is done in a malaria endemic zone which has received cases and managed malaria complications in children since inception further backs the need for the study to be appreciated and carried out.

1.4 Objectives of the Study

The General Objective of the study was to determine Prevalence of malaria in toddlers in the paediatrics department of a tertiary health facility - Specialist Teaching Hospital Irrua. (ISTH) with special consideration to the cost and common drugs used.

2.0 LITERATURE REVIEW

2.1 Prevalence of Malaria Among Toddlers

In a national cross sectional study done in Guinea. A total of 1984 children aged 6 months to 9 years were enrolled. The mean age was 50 months (SD, 27). The rapid diagnostic test showed a high malaria prevalence (44%) countrywide along with regional variation ranging from 38% to 61%. A multivariate analysis showed that living in Forest Guinea (AOR: 2.48; 95% CI: 1.78–3.46), in rural areas (AOR: 1.91; 95% IC: 1.45–2.5) and having a splenomegaly (AOR: 2.66; 95% CI: 1.75–4.04) were highly associated with malaria. This study shows that malaria is still prevalent in Guinea among children aged 6 months to 9 years of age. [12]. The researcher sets to find out if similar conditions observed in this study will be reproduced in the ongoing study.

In a cohort study done for over 18months among 553 children in the republic of Benin. It was observed that in three cross-sectional surveys, malaria incidence showed a marked seasonal distribution with two peaks: the first corresponding to the long rainy season, and the second corresponding to the overflowing of Lake Nokoue. The overall *Plasmodium falciparum* incidence rate was estimated at 84/1,000 person-months, and its prevalence was estimated at over 40% in the two first surveys and 68.9% in the third survey.[13] This study was restricted to two seasons which doesn't give an over view of an adequate result in the course of the year.

2.2 Cost Implication of Treating Malaria

In a study to determine the cost implication of treating malaria in Zambia, it was observed that severe malaria in children has been shown to account for over 45% of the total monthly curative

healthcare costs incurred by households compared to the mean per capita monthly income. The cost of treating severe malaria depleted 7.67% of the monthly average household income. [15]

In a study done on three sub-Saharan countries (Ghana, Tanzania and Kenya) to estimate the economic cost of malaria among under 5 using several models, it was observed that household and health system costs per malaria episode ranged from approximately US\$ 5 for non-complicated malaria in Tanzania to US\$ 288 for cerebral malaria with neurological sequelae in Kenya. On average, up to 55% of these costs in Ghana and Tanzania and 70% in Kenya were assumed by the household, and of these costs 46% in Ghana and 85% in Tanzania and Kenya were indirect costs. Expected values of potential future earnings (in thousands) lost due to premature death of children aged 0–1 and 1–4 years were US\$ 11.8 and US\$ 13.8 in Ghana, US\$ 6.9 and US\$ 8.1 in Tanzania, and US\$ 7.6 and US\$ 8.9 in Kenya, respectively. The expected treatment costs per episode per child ranged from a minimum of US\$ 1.29 for children aged 2–11 months in Tanzania to a maximum of US\$ 22.9 for children aged 0–24 months in Kenya. The total annual costs (in millions) were estimated at US\$ 37.8, US\$ 131.9 and US\$ 109.0 nationwide in Ghana, Tanzania and Kenya and included average treatment costs per case of US\$ 11.99, US\$ 6.79 and US\$ 20.54, respectively. [16]

2.3 Drug Used in Treating Malaria

In an interviewer's based study in Ethiopia, of 447 children with malaria-like symptoms, only 30% took the recommended first-line treatment (ACT) (all of whom were cured), and 47% took chloroquine (93.4% cured) [19].

In a retrospective study done in Nigeria to assess the treatment of under 5 in tertiary hospitals, analysis of the data revealed that more male (213) than female (169) children were admitted for

malaria treatment: Fever with convulsion (55.8%) was the commonest presenting symptoms, and anemia was the most frequent complications of malaria recorded. Chloroquine was found to be the most prescribed antimalarial agent and overall artesunate-based drug was prescribed either as a first or second line treatment in only 18.2% of the cases. The death rate recorded was 16%. [20].

3.0 METHODOLOGY

3.1 Study Area

The study area was at Irrua Specialist Teaching Hospital (ISTH) which was established in 1993. It is involved in all round healthcare especially the pediatric department made up of special baby care unit, pediatric ward, and children emergency ward.

3.2 Study Design

A descriptive cross sectional retrospective study was employed for this study.

3.3 Study Population

The study population were toddlers admitted in ISTH paediatrics department

3.4 Study Duration

The study was carried out for a period 6 months.

3.5 Selection Criteria

Inclusion criteria

- All cases of malaria in toddlers diagnosed between January and December 2022.
- All cases of toddlers between January and December 2021

Exclusion criteria

- All case-notes of toddlers who were not admitted

3.6 Sample Size Estimation

Sample size will be estimated using Cochran's formula for cross sectional surveys

$$\text{Sample size } n = \frac{Z^2 P q}{d^2} = \dots\dots\dots^{34}$$

For this study;

$$Z = 1.96$$

P = 93.4% i.e 0.934 (using a prevalence rate of 93.4% in an interviewer's based study in Ethiopia)

[23]

$$d = 0.05$$

From the formula above

$$\text{Sample size } n = \frac{Z^2 P q}{d^2}$$

or
$$n = \frac{Z^2 P(1-P)}{d^2}$$

$$n = \frac{(1.96)^2 \times 0.934 \times (1-0.934)}{(0.05)^2}$$

$$n = \frac{3.8416 \times 0.934 \times 0.066}{0.0025} = \frac{0.235110216}{0.0025}$$

n = 94.04 approximately 95. With a 10% attrition making up to 104 case notes

3.7 Sampling Technique

Case notes that suites the selection criteria were selected randomly per month until the sample size was completed.

3.8 Method of Collection Of Data

The data was collected from case notes.

3.9 Study Instrument

Checklist: a checklist was employed for the study to fit criteria needed for the study, having obtained approval from Department of Community Medicine, Ambrose Alli University, Ekpoma

3.10 Data Analysis

The data was analyzed using the statistical package for scientific solution (SPSS) software version 21.0(SPSS Inc, Chicago, USA). The chi square test was used to test for statistical associations. P value of less than 0,05 was regarded as significant

3.11 Ethical Consideration

An exempt was obtained from the Ethical review board Irrua Specialist Teaching Hospital. Data was anonymously collected and used only for academic purpose.

4.0 RESULTS

104 case notes that met the inclusion criteria were selected from the pool of case notes in the record office and the following findings were observed and represented in charts and table below:

Table 1: Sociodemographic Characteristics for Children

VARIABLE	FREQUENCY	PERCENT
AGE IN YEARS	n=104	%
1	25	24.0
2	52	50.0
3	28	26.0
SEX		
Male	55	52.9
Female	49	47.1
MEAN±S.D	2.31±3.02	

Half (50%) of the toddlers were 2years old and a little above half (52.9%) were male and the mean age was 2.31 with a standard deviation of 3.02.

Table 2: Sociodemographic Characteristics for Father

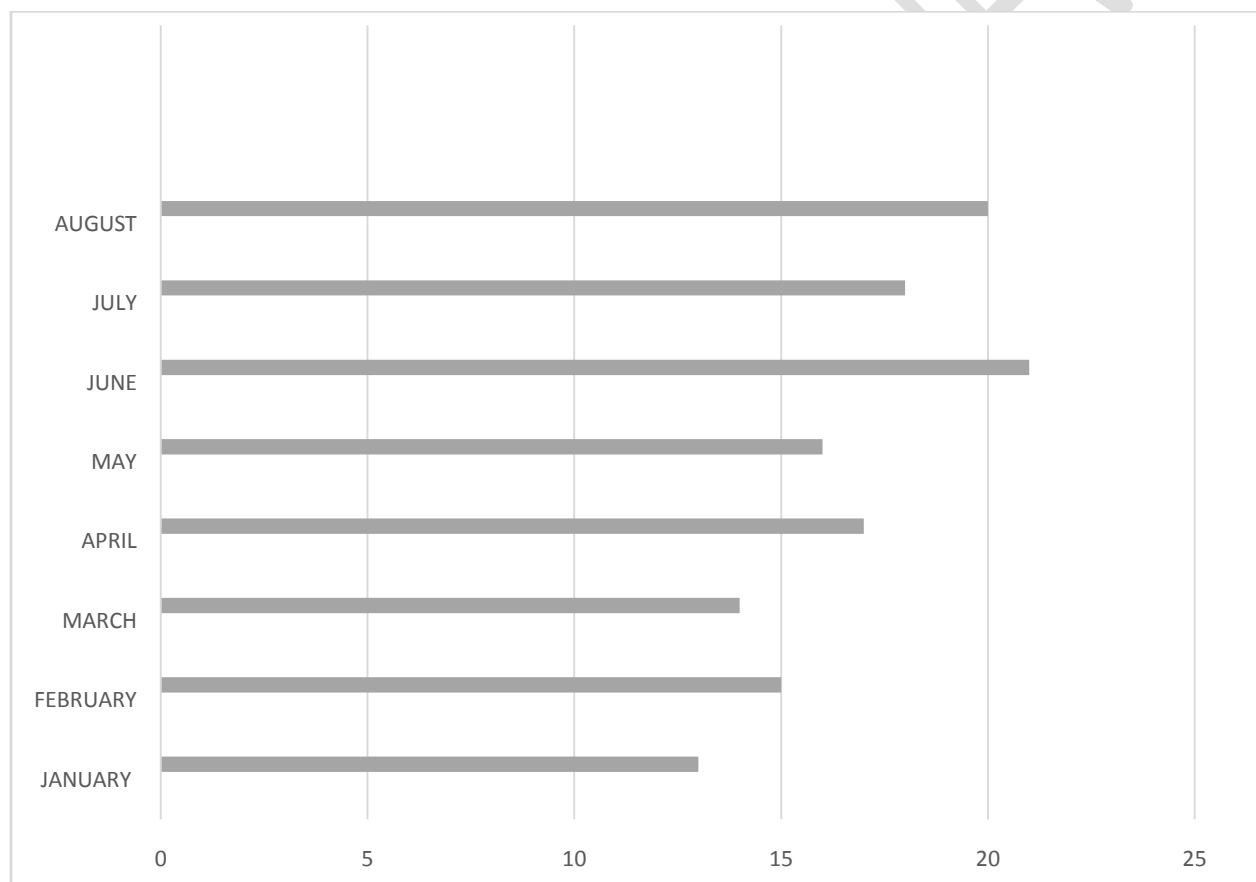
VARIABLE	FREQUENCY	
AGE IN YEARS	n=104	%
21-30	15	14.4
31-40	67	64.4
41-50	21	20.2
51-60	1	0.9
MEAN±S.D	36.78±5.24	
LEVEL OF EDUCATION		
No formal Education	8	7.7
Primary	12	11.5
Secondary	36	34.6
Tertiary	48	46.2
RELIGION		
Christian	94	90.4
Muslim	10	9.6
OCCUPATION³⁵		
Managerial and Technical	47	45.2
Entrepreneur	26	25.0
Skilled	17	16.3
Professional	14	13.5
ETHNICITY		
Esan	72	69.2
Etsako	11	10.6
Bini	7	6.7
Igbo	5	4.8
Yoruba	4	3.8

Ora	4	3.8
Afemai	1	0.9

Table 3: Sociodemographic Characteristics For Mother

VARIABLE	FREQUENCY	PERCENTAGE
AGE IN YEARS	n=104	%
21-30	67	64.4
31-40	29	27.9
41-50	6	5.8
51-60	2	1.9
MEAN±S.D	29.58±5.87	
LEVEL OF EDUCATION		
No formal education	9	8.7
Primary	12	28.8
Secondary	53	50.9
Tertiary	30	11.5
RELIGION		
Christian	92	88.5
Muslim	12	11.5
OCCUPATION ³⁵		
Entrepreneur	62	59.6
Managerial and Technical	24	23.1
Professional	13	12.5
Unemployed	5	4.8
ETHNICITY		
Esan	72	69.2
Etsako	12	10.6
Bini	7	6.7
Igbo	4	4.8

Yoruba	4	4.8
Ora	3	2.8
Afemai	1	0.9
PARITY		
1-2	51	49.0
3-4	37	35.6
5-6	16	15.4



Graph 1.;Prevalence the malaria disease among the different months

The highest prevalence was seen in July (62%) and the least was seen in January (30%)

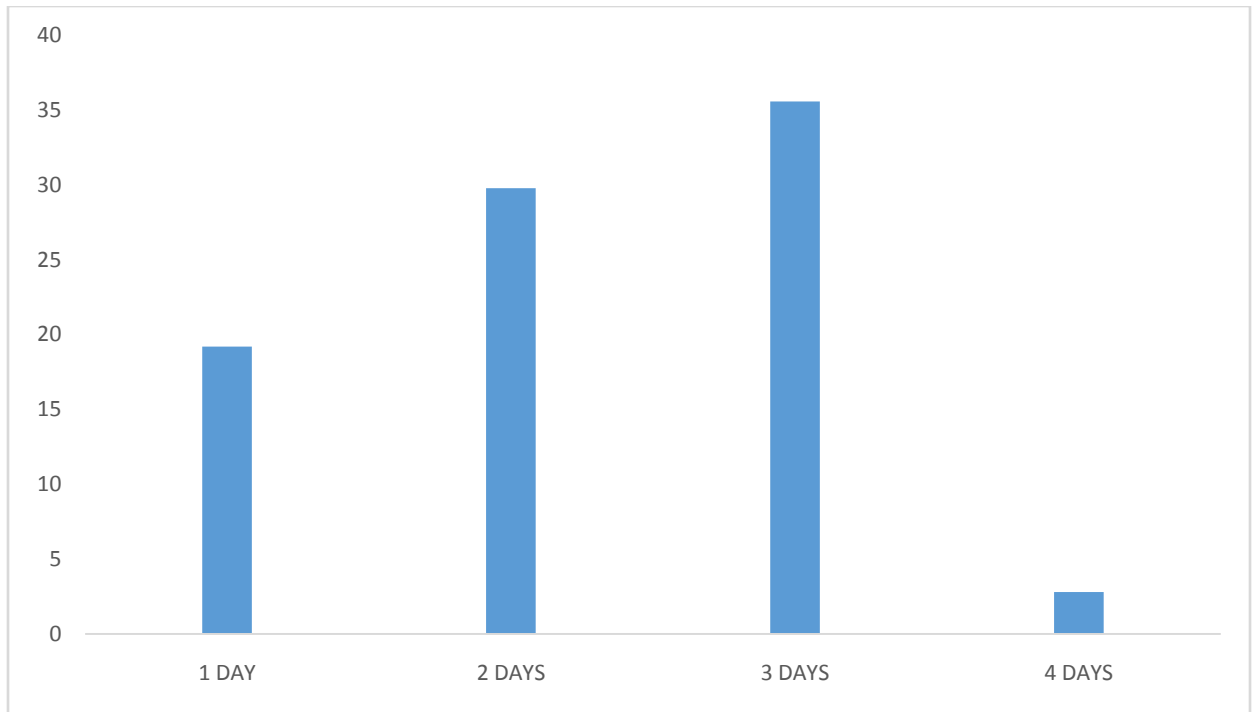


Figure 1: Number of Days on Admission

Table 4: Cost of Treatment

VARIABLE	FREQUENCY	PERCENTAGE
COST (₦)		
1500-1900	80	76.9
2000-2500	14	13.5
2600-3000	10	9.6

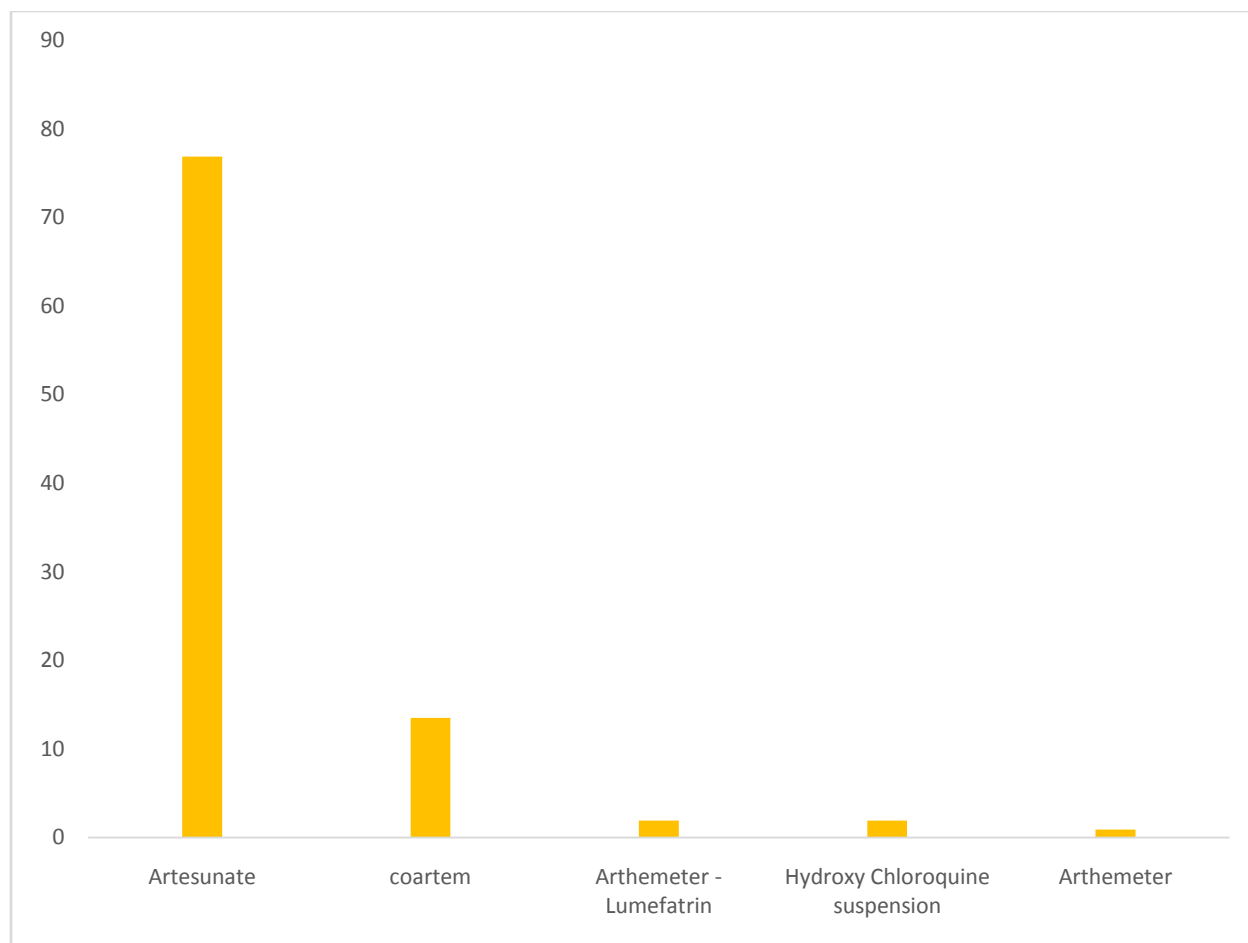


Figure 2: Frequency Of Antimalaria Used

Table 5: Antimalaria Used and Selected Social Demographic Factors

VARIABLE ANTIMALARIA	SEX		TOTAL	F-EXACT	P-VALUE
	MALE	FEMALE			
Artesunate	40	40	80	10.28	0.53
Coatem	12	2	14		
Amodiaquine	2	3	5		
Athermeter-lumefatrin	1	2	3		
Hydroxy-chloroquine suspension	0	1	1		

	AGE IN YEARS					
ANTIMALARIA	1	2	3		31.70	0.03*
Artesunate	17	42	21	80		
Coatem	4	6	4	14		
Amodiaquine	2	3	2	7		
Athermeter-lumefatrin	0	0	1	1		
Hydroxy-chloroquine suspension	1	1	0	2		

Table 6: Antimalaria and Number Days on Admission

	NUMBER OF DAYS ON ADMISSION					F-exact	p-value
ANTIMALARIA	1	2	3	4	Total	21.80	0.04*
Artesunate	10	29	31	10	80		
Coatem	5	4	3	2	14		
Amodiaquine	0	3	2	0	5		
Athermeter-lumefatrin	0	0	2	0	2		
Hydroxy-chloroquine suspension	0	0	1	0	2		

Table 7: Antimalaria and Cost of Antimalaria

VARIABLE	COST		OF	F-exact	p-value
	ANTIMALRIA (₦)				
ANTIMALARIA	1500-2000	>2000	Total(104)	24.1	0.001*
Artesunate	68	12	80		
Coatem	4	10	14		
Amodiaquine	2	3	5		
Athermeter-lumefatrin	2	2	2		
Hydroxy-chloroquine suspension	0	2	2		

5.0 DISCUSSION

It was observed that the number of days spent on admission in this study ranged between 1-4 with the highest- 3 days similar to studies done among countries in Sub-Sahara Africa[16] and in a study in a non-endemic zone (Spain).[26]

In addition, artesunate was found to be the most commonly prescribed antimalarial among the healthcare professionals in this study artesunate with a rate of 79.2%. In other places like Ibadan, it was discovered that the most commonly used drug was chloroquine[24]. In a study in Ghana, it was discovered that the artesunate-amodiaquine combination was preferred[30]. In this study artesunate was the most prescribed drug across sex and age. This was found to be significant as $p=0.03$ for age; $p=0.04$ for number of days spent on admission and $p=0.001$ based on the number of days spent on admission. This therefore reveals that the most prescribed antimalarial drug is largely dependent on availability and response to treatment in the area of prevalence.

There was no adverse or side effect of using antimalarial in this study as reported in other climes in the journal of travel medicine where by most children that received medication like chloroquine, mefloquine came with symptoms like itching, nausea, vomiting, hallucination, changes in sleep pattern after medication which led to stoppage of such medications[23]. It has been advocated that antimalarial combination therapies should be used.

Recommendations

To effectively reduce, control and manage the prevalence of malaria among toddlers in our society today, all hands must be on deck. The Government is advised to make strategic policies on effective prevention of malaria should be made and implementation effected. Health workers should undergo training and retraining on prompt diagnosis and treatment for malaria where ever they find themselves especially in rural areas. Good health seeking behavior should be encouraged and cultivated amongst the people in the society

5.3 General Health Implication of The Study

Children are at highest risk for severe disease and death between six months and five years of age: during this period children are most vulnerable as they have lost maternal immunity and they haven't yet developed specific immunity to infection.

Hence, children must be given critical attention during their early formative years until their immune systems have significantly improved.

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LIST OF ABBREVIATIONS

WHO: World Health Organization

ACT: Artemisinin-based Combination Treatment

OOP: Out Of Pocket expenditure

SMC: Seasonal Malaria Chemoprevention

MDA: Mass Drug Administration