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PREVALENCE OF MALARIA AMONG CHILDREN UNDER FIVE(5) YEARS IN A NIGERIA PRIMARY HEALTHCARE CENTER, IN COVID-19 ERA

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ABSTRACT

Background: Malaria is a life-threatening disease and remains an overwhelming cause of morbidity and mortality among children under five years of age, especially in sub-Saharan African region. The estimated number of malaria death was 627,000 in 2020, an increase of 69,000 deaths compared to the previous year. About two-thirds of these deaths (47,000) were due to disruptions during the COVID19 pandemic, the remaining one-third (22,000) reflected a recent change in WHO test methodology using rapid diagnostic test (RDT) for malaria. **Methodology:** A retrospective study of prevalence of malaria was carried out between January and July 2022 among children under five years of age who attended the Ogwashi-uku Primary Healthcare center, in Delta State, Nigeria to provide epidemiological data on the status of malaria infection in the community. A sample size was calculated, otained and used. The instrument of data collection was through information register of patients. Data analysis were performed using the statistical software SPSS. Confidence interval of 95% and a p-value > 0.05 was regarded as statistically significant. **Results: A** total of 1365 under-5 children attended the health care center within the study period. A sample size of 300 was obtained from the calculation. There were 152(50.7%) male children and 148(49.3%) female children. The result showed a total of 224(74.7%) of the children tested positive for malaria parasite *(P. falciparum*). Female116(38.7%), were more infected when compared to male 108(36%), but statis tical significance is >0.05. Meanwhile, for age classifications, children aged 3>4yrs were most infected (93)(31%) followed in decending order 0 >1yr (75)(25%); 1> 2yrs 63(21%) with 4>5yrs (13)(4.3%) being the least infected age group, with p-value <0001. The result also showed that children above 2 years but less than 5years were more infected than those below 2years of age. **Conclusion:** Malaria has high prevalence rate in the communities and under five children are most vulnerable. This study confimed the wide distribution of malaria among under five children with a high prevalence rate]'of 74.7% which further indicates the endemicity of the infection in the community.

KEYWORDS: Malaria, Prevalence, Under-five, Primary Health Care, Nigeria.

INTRODUCTION

Malaria is an acute febrile illness caused by parasites of the genus *Plasmodium* and is exclusively transmitted by the bite of an infected female *Anopheles* mosquito. Malaria continues to be a major public health problem in 97 countries and territories in the tropical and sub-tropical regions. In 2019, malaria caused about 409,000 deaths of which 67% were children under five years. Globally, approximately 214 million cases of malaria occur each year and 3.2 billion people are at risk of infection.[1] Approximately 438,000 deaths were attributed to malaria in 2015, especially in sub-Saharan Africa, where there's an estimated 90% of all malaria deaths.[1] As a key goal of the Millennium Development Goals, in 2005, the World Health Assembly set a target to reduce malaria cases and deaths by 75% between 2005 and 2015.[2] Consequently, over the past decade, there has been a renewed interest in the research and innovation of diagnostic methods, drugs and vaccines, and in the development of control measures to eradicate malaria.[3] As a result, between 2000 and 2013, the incidence of malaria fell by 30% worldwide and by 34% in Africa.[4] Nigeria has the highest malaria burden in the world, with approximately 51million cases and 207,000 deaths reported each year (about 30% of the total malaria burden in Africa), while 97% of the total population number (about 173 million people) are at risk of infection.[5] In addition, malaria accounts for 60% of outpatient hospital visits and causes about 11% of maternal mortality and 30% of infant mortality,

particularly in children under 5 years of age.[5],[6] The burden of malaria disproportionately affects population groups. Studies),[7][8] have shown that the burden of malaria is more common in children, pregnant women, and travelers from areas free of the disease. For example, children under the age of five account for approximately 67% (272,000) of malaria deaths worldwide.[7] This crude statistical value is due to infants and young children under five years at high risk of clinical episodes due to their weak or non-existent immunity against malaria infection.[7],[9],[10] The negative impact of malaria in children under 5 years of age is very severe. In some cases, the harmful effects of malaria in children lead to low level of cognitive development, serious diseases such as anemia and malnutrition.[11],[12],[13],[14] In Nigeria, childhood malaria accounts for 25% and 30% of infant and child mortality.[15][16] Malaria caused by *Plasmodium falciparum* and the mosquito species *Anopheles gambiae*, *Anopheles funestus*, *Anopheles arabiensis* and *Anopheles moucheti* are the main vectors of the disease throughout the year.

Artemether-lumefantrine (AL) or Artesunate-amodiaquine (AS + AQ) was the treatment regimen introduced in 2004.[1],[17] This devastating disease affects the economic productivity of the country, resulting in an estimated 132 billion naira (~$700 million USD) in monetary losses, treatment, prevention and other indirect costs.[18] Since 2008, the National Malaria Control Program (NMCP) in Nigeria has adopted a specific plan with the goal of reducing the burden of malaria by 50% by 2013 by achieving at least 80% coverage with insecticide treated mosquito nets, as well as other measures, such as 20% of homes in target areas being sprayed with indoor residual insecticides (IRS) and treated with two doses of intermittent prophylaxis for 100% of pregnant women presenting for antenatal care.[19] Thanks to these measures, the proportion of households with at least one insecticide-treated mosquito net increased to more than 70% in 2010, compared with just 5% in 2008. Although previous studies have documented high rates of malaria throughout Nigeria,[20] there is still very little research on the population's knowledge, attitudes and practices (KAP) about malaria in most Federal states to enable sustaintenace of efforts made. The information is essential to identify and implement effective control measures and to plan for the participation of target communities in control, which is one of the fundamental tools for success and sustainability of disease control programs.[21] The aim of this study is to evaluate the prevalence of malaria among children below 5 years who attended the Primary Healthcare center, Ogwashi-ukwu in Delta State within the study period, and ascertain the frequency of prevalence distribution, as well as to provide raw statistical data that can be used for further study; and to compare the current prevalence to previous year's report on prevalence.

METHOD

Research design and setting

The study was a retrospective study design carried out at Ogwashi-uku Primary Health Care center in the year, 2022, during the era of Covid-19, to determine the prevalence of malaria among children below 5 years. The Ogwashi-uku Primary Health Care center is located in Ogwashi-uku town in Aniocha South local government area, Delta State. It is situated beside the old post office. Ogwashi-uku is in the tropical rain forest region. The rainy season stretches from March to October and dry season from November to February. The temperature in Ogwashi-uku during raining season ranges between 22 to 36.5 degree celsius and in dry season between 27 to 36.5 degree celsius. The climate, poor sanitary conditions and the vegetation at certain periods of the year created a favorable breeding site for Anopheles mosquitoes which are vectors of *Plasmodium* parasites.

Study Population All children below five 5 years who attended the Primary Health Care center for a period of seven (7) months, from January to July, 2022 were included.

Sample Size and sampling technigue: The sample size was calculated using sample size determination formula[22] and random sampling technique was used to obtain the sample size from the total population. A total population of 1365 patients was recorded for the seven (7) months, from January to July who visited the Primary Health Care center, from which a sample size of n=300 was obtained from the calculation.

Sample Size Determination: Sample size determination is a means for easy identification of an ideal subset which represents the population and produces strong statistically significant results. That is, it is used to make inference to a particular population size because it enables one choose the number of replicate in a research work. Sample size can be calculated using this formula: Sample size(n) here n = sample size Z= confidence level 95%=1.96); P= standard deviation(0.5) N= population size; e= margin of error (5%=0.05).

Record shows that as at January to July 2022, the clinic had 1365 patients who visited the clinic for treatment. The figure was used as the population size, and a sample size of 300 was obtained when substituted into the formula below

$$n = \frac{z^2 \text{ X } p\,(1-p) / e^2}{1 + \{z^2 \text{ X } p\,\{1-p\}/\, e^2 N\};\{z = 1.96;\ p = 0{,}5;\ N = 1365;\ e = 0.05\}}$$

$n = 1.962 \text{ X } 0.5\,(1 - 0.05) / 0.5^2 \text{ X } 1365$

$= 384.16/1 + (0.2814) = 284.16/1.2814$

$n = 299.8$ approx. $= 300$

Data collection: Data were collected from the clinic's patients information folder with consent and approval from the Head of Department.

Data Analysis: Data analysis was performed using the statistical software, SPSS, Chi-square and Frequency percentages was used to interpret data. A p-value less than 0.05 was regarded as statistically significant.

Ethical approval: The Ministry of Health and the Head of Department (HOD) of Ogwashi-uku primary Healthcare center approved the study

RESULTS

A total of three hundred (300) children under five years of age were included in the study; from January to July. Table 1 shows the demographic data of the studied population. There were 152(50.7%) males and 148(49.3%) females that were screened for malaria infection.

Table 1: Demographic data of the studied group. (n= 300).

Gender	**Frequency**	**Valid (%)**	**p-value**
Male	**152**	**50.7**	**0.817**
Female	**148**	**49.3**	
Total	300	100%	

The total number of female was 148 with a percentage of 49.3%, while the total number of male was 152 with a percentage of 50.7%. There is no significant difference between the number of male and female under -5 years (p>0.05)

Table 2 shows prevalence of malaria among children under 5years accordig to gender (n=300).

			Gender			**Total**	**p-value**
			Male	**Female**			
RDT result	Negative (-ve)	Frequency	44	32		76	0.145
		% of Total	14.66%	10.66%		25.3%	
	Positve (+ve)	Frequency	108	116		224	
		% of Total	36.0%	38.7%		74.7%	
Total		Frequency	152	148		300	
		% of Total	50.7%	49.3%		100%	

The result showed that a total of 224(74.7%) children were found positive for *P.*; *falciparum* 108(36.0%) males and 116(38.7%) females. Females showed 38.7% positive and 10.7%, negative for the rapid diagnostic test (RDT) while male showed 36.0% positive and negative of 14.7%. The total of 74.7% malaria positive agrees with the WHO data and previous study reports of the high prevalence among children under 5years. The gender prevalence of the infection showed more female children under five years being infected than male but there is no significant difference (p>0.05)

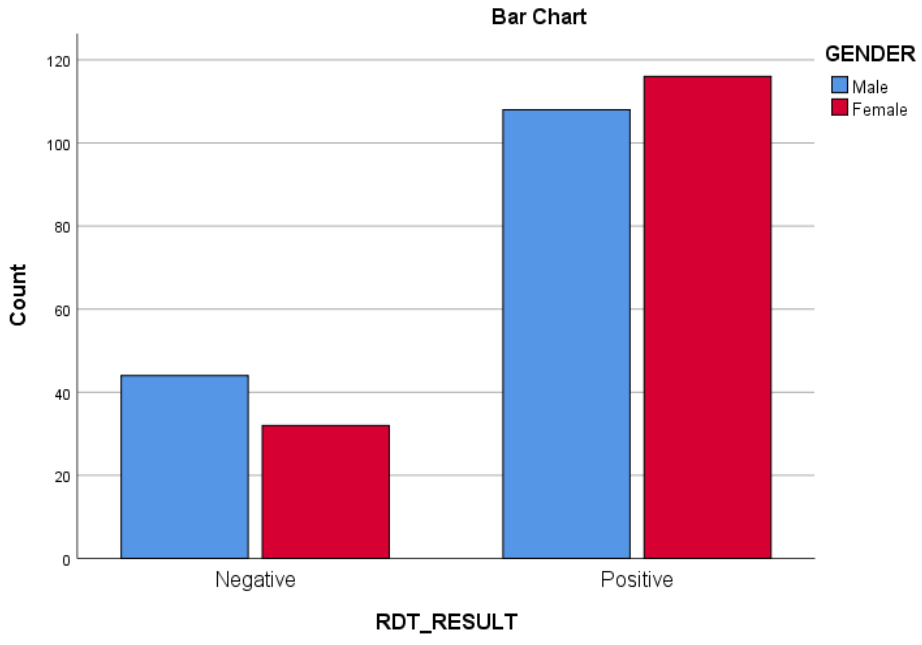

Fig. 1: Prevalence rate of malaria among under -5 years children according to gender (p> 0.05)

Fig. 1 shows a Bar chart illustrating the different distribution of the malaria prevalence among the male and female children under five years with the blue column representing the males and the red column representing the females.

Table 3: Malaria prevalence among children (below 5 years) according to individual age (n=300).

Age	Frequency	Valid percentage	p-value
0 >1yr	75	25.0%	>0.0001
1yr >2yrs	63	21.0%	
2yrs >3yrs	56	18.7%	
3yrs >4yrs	93	31.0%	
4yrs >5yrs	13	4.3%	
Total	300	100%	

Table 4: Malaria prevalence among children (below 5years) according to Two major age classification of <2years and >2years to <5 years. (n =300).

			Age Classification		Total	p-value
			>2yrs	<2yr to ≤ 5yrs		
RDT result	Negative (-ve)	Frequency	54	22	76	<0.0001
		% of Total	18.0%	7.3%	25.3%	
	Positive (+ve)	Frequency	83	141	224	
		% of Total	27.7%	47.0%	74.7%	
TOTAL		Frequency	137	163	300	
		% Total	45.7%	54.3%	100%	

Table 4 shows the malaria prevalence among under-5yrs according to two major age stratifications. Dividing the age groups into two sections, showing those below 2 years (<2yrs) and those above two years (>2yrs) but less than five years, it was observed that the group of >2yrs showed 83(27.67%) positive to RDT and 54(18.0%) negative. While those above 2years but less than 5yrs (<2yrs to >5yrs) showed 141(47.0%) positive and 22(7.3%) negative. This shows those above 2 years being more infected than those below 2 years and this differed significantly ($p<0.05$).

However, there was significant difference in prevalence among individual age groups ($p<0.05$), with those aged 3>4yrs having the highest prevalence, followed by 0>1year. The least prevalence was recorded among those 4 > 5yrs, Table 3.

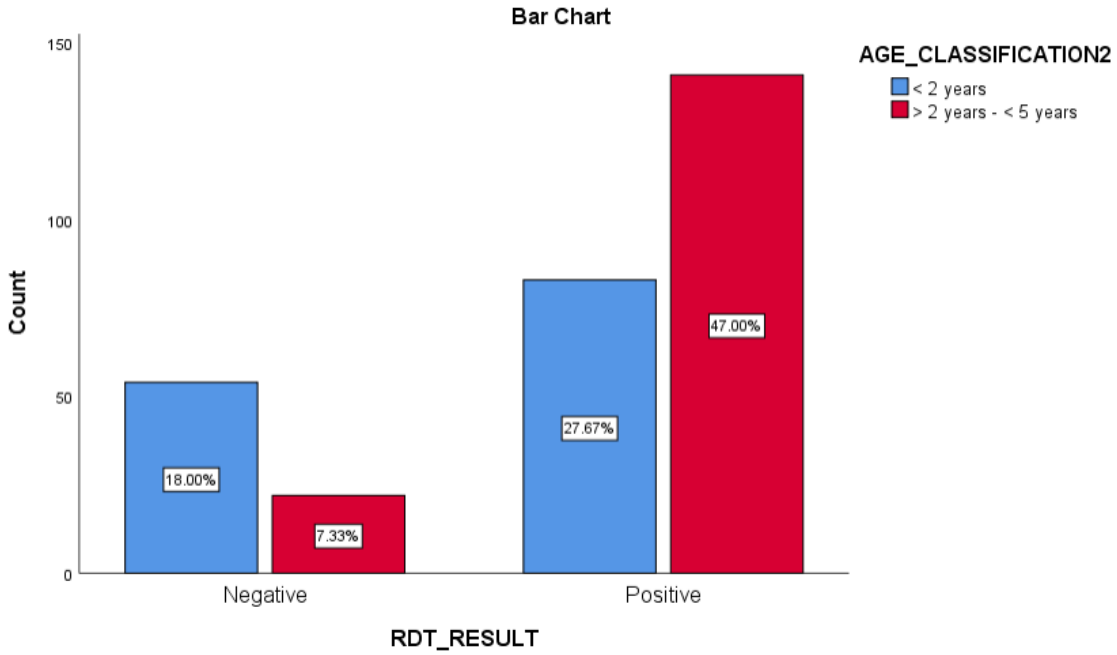

Fig. 2: Bar Chart above shows the malaria prevalence distribution among ages of >2yrs and <2yrs to <5yrs, with the blue column representing those below 2yrs and the red column representing those above 2yrs to below 5yrs.

DISCUSSION

The study showed unequal distribution of the male and female subjects as the numbers were slightly higher for male than for female. This may be as a result of more male children visiting the health clinic than the female during the period in which the data was collected. Children who were 3 >4 years old formed the largest percentage in the study group followed by those who are 1>2years, while the least are those below 1year of age. This is a typical representation of the children below 5years who visited the clinic and had a malaria Rapid Diagnostic Test to confirm if their illness was due to malaria before the commencement of treatment. The findings of this study is alarming as it shows a very high malaria prevalence rate among the under-5yr children. Out of the 300 children tested, 224(74.7%) showed positive, result to rapid diagnostic test (RDT). The present study agrees with the findings of the WHO on the prevalence of malaria in Africa which states that children are particularly vulnerable to malaria, unlike adults that have grown in the endemic regions, they are yet to develop the immunity to defend themselves against the disease[18]; and another finding which observed that children under-5yrs are particularly vulnerable, accounting for 80% of malaria deaths in African continent and that about 481,500 under-5yrs lost their lives to the deadly disease in Africa in 2020.[23] The study also agreed with the findings of Edelu et al[24] and United States Embassy in Nigeria,[25] which stated that the most vulnerable Nigerians are under-5yrs children, who experience an average of 2-4 episodes per year and account for as much as 90% of national malaria mortality. Previous local studies have reported higher values such as 81.9% in a 2012 study in Edo State[26]; 63.3% in a 2015[27] study in Bayelsa State; 66.3% in Cross Rivers[28] and 63% in a 2019 study in Ekiti State.[29] The reason for the high prevalence among children could be due to the fact that children have not developed the required immunity like adults to help fight the malaria infection. Geographic, region, climatic conditions which includes temperature and rainfall could be another determining factor as Ogwashi-uku community is located in Delta State in the Niger Delta region which have favorable weather and environment for breeding the malaria parasite. The region is also malaria endemic. Another reason can also be attributed to poverty, poor level of sanitary control, and lack of finance. Nigeria's high under-five malaria mortality is largely attributable to a health financing system that leaves many individuals uninsured, resulting in high out-of-pocket (OOP) medical expenditure that discourages care-seeking behaviour, especially among the poor.[7][30] Another reason, could be cost of the malaria drugs. Even when care is sought, the most effective malaria treatments are prohibitively costly and used by few Nigerians.[31][32] According to the study, more female children were observed to be infected with malaria compared to the male children. Though the difference in infection rate among gender line is small. There are no prior data showing susceptibility to malaria infection due to gender among children under-5yrs. Futher studies may help to understand if malaria prevalence in children is dependent on gender. Though in adults, some studies tried to prove that males are more susceptible to malaria than females with the theory that females are able to clear asymptomatic malaria infection at faster rate than males. While some argued that its due to the nature of work that men do which exposes them much to the parasite.

Classifying the study into two age groups: <2years and >2years-<5years; there is high positive frequency among the children at the age of >2years to <5years than in children below 2years(<2years). It gives a wide margin in the prevalence frequency. The low prevalence in children below 2 years may be due to the fact that they are well protected in some ways such as proper clothing and always kept indoors. They could also have some immunity gotten from the mother's breast milk especially for those under 1 year. The higher prevalence among those above 2 years could signal higher exposure as they could walk around by themselves, staying out longer and may lack proper protection from mosquitoes. There's the possibility of care givers not putting much attention on older children as they could walk around by themselves and play with their mates, leading to higher exposure. In general, poor hygiene, unclean and unkept surroundings could lead to higher malaria infections. Lack of health education and health awareness is also a contributing factor to higher prevalence. Previous studies has shown some fluctuations in the prevalence rate, sometimes high and sometimes lower, but have been within range of the World Health Organization prevalence report showing very high prevalence in children in Africa and the result of this study is in line with the study as it shows high prevalence rate among children under 5yrs.

CONCLUSION

This study showed a high malaria prevalence of 74.7% among children under 5 years, who attended the primary health care center in Ogwashi-uku, which indicates the endemicity of the infection in the community. This value compared favorably with previous study which obtained over 70% of malaria prevalence.

AUTHORS' CONTRIBUTIONS: The first author developed the idea. The second author reviewed the literature, collected the data and wrote the manucript. The first author reviewed the write up and input corrections and submitted the manuscript.

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CONFLICT OF INTEREST: There is no conflict of interest in this study.

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