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Prevalence of Malaria and Wiliness to Accept Malaria Vaccine amongst Parents, Guardians and Caregivers of Children under 5 Years

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The study investigated the prevalence of malaria and wiliness to accept malaria vaccine amongst parents, guardians and caregivers of children under 5years. Both survey and experimental design was adopted for the study. Blood samples were collected from children under years and analysed for the presence of malaria parasite. From the analysis, result showed that malaria parasite is prevalent among female gender than male gender. The result also showed that malaria parasite is more prevalent among age of 3-5years than those in age group of 1-2years. Therefore, the study recommended that Government ensure more awareness on malaria vaccination to sensitize the masses on it acceptance and more fund should be disbursed into malaria prevention programmed in other to enable all a sundry to receive free malaria vaccination.

Keywords: Malaria; prevalence; wiliness; malaria vaccine; parents; guardians; caregivers and children under 5 years.

1. INTRODUCTION

Malaria remains a public health problem in many countries of the world, It is transmitted through the bite of an infected female anopheles mosquito. It is recorded to affect almost 109 countries [1]. Almost half of the world population is at risk with nearly 243 million cases and 863,000 deaths due to malaria in 2008 [2]. In 2015 sub-Saharan Africa alone encountered for 90% of the malaria cases and 92% of malaria worldwide. Nigeria and republic of Congo are the two major African countries contributing to this high burden countries. Vast majorities of cases occurs in children under the age of five years and pregnant women [1,2]. According to the world report in 2013, there were 200 million malaria cases in 2012 [3]. An estimated 627,000 people

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died from malaria in 2012, 90% of them in sub-Saharan Africa. In recent years the number of new cases has declined by 25% globally and deaths fallen by 42% (WHO, 2015). Mortality rate fell by 48% in children under 5 years of age.

Malaria disease burden is not limited to only the health sector as it also takes its toll on economic development as well. In the education sector malaria leads to loss of productivity due to loss of man hours, as teachers who are down with malaria would not be able to teach due to work absenteeism, and this causes students to perform poorly in exams [4].

Malaria is responsible for about 30% of outpatient consultation and about 15% of hospital admission in children. Children of fewer than five years of age and pregnant women are the most vulnerable to this disease. One of every 5 children born in sub Saharan African die of the disease before the age of 5 leading to a total of 3000 deaths every day [5], and 285,000 deaths annually [6].

Different strategies ranging from insecticides treated bed net (ITNs) to long lasting insecticidal nets (LLINs) to indoor residual spraying to artemisinin based combination therapy to intermittent preventive treatment during pregnancy (IPTPp) even newer strategies like the rapid diagnostic test were used in eradicating malaria but all these efforts were met with limited success especially in sub Saharan Africa [5]. These problems was and is still compounded by weak health system, endemic corruption, politic instability and incessant conflict and tribute wars. Changes in the biting habit of the female mosquitoes, widespread resistance to insecticides and development of multi drug resistance to malaria parasite to chloroquine and other malarial drug have contributed amongst other factors to making the dream of malaria eradication of huge challenges.

In response to these drawbacks, the world bank, WHO, TDR, in collaboration with pharmaceuticals industries experts have explored other approaches to malaria control one of which is the use of vaccination. Vaccines are substances given to stimulate the body production of antibodies and provide immunity against a disease prepared from the agent that causes the disease or a synthetic substitute as defined by the English dictionary 2008. This is a public health strategy which has been found very effective in disease control and has been successfully exploited in eradicating an infectious disease.

The past 2 decades have witnessed tremendous advancement in development of malaria vaccines. The RTS,S is the only approved vaccine as of 2015 and it requires four injections and has a relatively low efficacy and thus is not recommended for babies between 6 an 12 weeks of age. Its commercial name is known as ‘mosquirix’ and was developed by PATH malaria vaccine initiative (MVI) and glaxosmithkline (GSK) with support from bill and Melinda gates foundation. It is necessary to determine caregivers perception and acceptability of malaria vaccines because Africans often lack behind in the uptake of new health interventions and technologies.

Resistance to malaria has been reported in most new chemotherapeutic measures given out of vaccines should be a requisite step that must be taken to eradicate the disease completely and it is important that these vaccines are given to children under age 5 as there are one of the most vulnerable group affected by the disease and their immune system is still developing and not so strong and these vaccines could protect them against the disease.

1.1 Aim and Objectives

The aim of the study is to ascertain the prevalence of malaria and wiliness to accept malaria vaccine amongst parents, guardians and caregivers of children under 5years. Specifically, the objective of the study is to;

1. To determine the prevalence of malaria parasite among under 5years children in Urban community
2. Determine the awareness of caregivers regarding malaria vaccines
3. Determine the perception of caregivers, parents and guardians
4. To identify factors that affect acceptability of malaria vaccines among caregivers.

2. LITERATURE REVIEW

Malaria is a human disease that is caused by sporozoan parasites of the genus *Plasmodium* in the red blood cells which is transmitted by the bite of anopheline mosquitoes, and is characterized by periodic attacks of chills and fever (Merriamwbster Dictionary, 2011). According to Caraballo [7] Malaria is a mosquito-

borne infectious disease affecting humans and other animals caused by parasitic protozoans belonging to the *Plasmodium* type [5]. Accoriding to Caraballo, [7] it causes symptoms that typically include fever, tiredness, vomiting, and headaches and in some other severe cases it can cause yellow skin, seizures, coma, or death.

As a fact, malaria still remains a significant public health problem in sub-Saharan Africa, including Nigeria, accounting for 10 % of the burden of disease [8]. Recent, technical innovations to control malaria have contributed to a decline in the malaria burden, but the disease remains a significant threat due to persistent enabling environments, poverty and fragile health systems [8]. Therefore, additional strategies are needed to ensure a combination of interventions that target the various phases of the malaria life cycle, including malaria vaccination [9].

2.1 Awareness of Caregivers Regarding Malaria Vaccines

Uchechukwu et al. [10] in their study showed that 100% caregivers are aware of malaria and identified mosquito as the possible cause of malaria. They are also aware of the signs and symptoms of malaria were identified as fever which include headache, cold, swollen eyes, bitter tongue and deep yellow urine. They also reported that half of the respondent (51.4%) used in his study are aware of any prospective malaria vaccine. Which implies that good people are not aware of malaria vaccines. Though the few other who are aware of the prospective malaria vaccine, got to know about it through the media such as television and radio.

Therefor creating more awareness and making malaria vaccine available for routine use will be a major achievement, but the level of its acceptability, especially in the developing countries like Nigeria could pose another considerable challenge that need to be addressed in order to achieve a successful implementation of the programme. Previous difficult experiences recorded in vaccination programmes in parts of sub-Saharan Africa, Nigeria inclusive have raised concerns about the successful implementation of malaria vaccinations in endemic areas when developed [11]. For instance, the highest number of polio cases was once recorded in Nigeria, and that was blamed on low coverage and compliance of the vaccine in the country [5].

While the focus is on malaria vaccine development, less attention has been paid on acceptance and readiness among caregivers to comply with malaria vaccinations. Compliance rates are influenced by the level of awareness as well as the perceptions of the population about the diseases in question [12]. Some cultural, social and religious circumstances in Nigeria have hindered previous vaccination programmes due to perceptions and beliefs in the causation of diseases and how they should be controlled [13, 14,15].

Beliretu & Ikeoluwapo [16] also reported that most people wants malaria vaccine to be introduced, to community and acknowledges the prospect of a malaria vaccine in the control of the disease. Their responses generally reflected the view that a malaria vaccine would bring added health benefits.

Health practioners also view the use of malaria vaccine as a good welcome idea. According to Beliretu & Ikeoluwapo [16] when malaria vaccines are brought into use it should be safe, readily available and easily accessible. As well, it should be able to work well; it should be free so that many of persons will be vaccinated. In his view malaria vaccine should be readily available and easily accessible at all the time when it is out for use. The safety of the vaccine should be guaranteed for use. Beliretu & Ikeoluwapo(2015) suggested that vaccine developers should target everyone, including pregnant women and the elderly, and that such a vaccine should be delivered orally.

2.2 Prevalence of Malaria and the Need for a Vaccine

Malaria represents one of the international community's most pressing public health problems. The parasitic, mosquito-borne disease is a leading cause of death and illness among young children, hitting hardest in resource-poor tropical and subtropical regions. Every year, malaria kills hundreds of thousands of people, most of them African children under age five [17].

Pregnant women and their unborn children are particularly vulnerable to the disease, which contributes to anemia, low birth weight, premature birth, and infant deaths. Children who survive bouts of malaria do not escape unharmed. Episodes of fever and anemia often affect their mental and physical development [18]. According to the report, by WHO [19] are

212 million new cases of malaria worldwide in 2015 (range 148–304 million). The WHO African Region accounted for most global cases of malaria (90%), followed by the South-East Asia Region (7%) and the Eastern Mediterranean Region (2%).

In 2015, there were an estimated 429 000 malaria deaths (range 235 000–639 000) worldwide. Most of these deaths occurred in the African Region (92%), followed by the South-East Asia Region (6%) and the Eastern Mediterranean Region (2%). Between 2010 and 2015, malaria incidence rates (new malaria cases) fell by 21% globally and in the African Region. During this same period, malaria mortality rates fell by an estimated 29% globally and by 31% in the African Region.

Children under 5 are particularly susceptible to malaria illness, infection and death. In 2015, malaria killed an estimated 303 000 under-fives globally, including 292 000 in the African Region [17]. Between 2010 and 2015, the malaria mortality rate among children under 5 fell by an estimated 35%. Nevertheless, malaria remains a major killer of under-fives, claiming the life of 1 child every 2 minutes.

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 [5]. Moreover, malaria accounts for 60 % of outpatient visits to hospitals and led to approximately 11 % maternal mortality and 30 % child mortality, especially among children less than 5 years (Nigeria Federal Ministry of Health, 2009; WHO, 2015). Malaria is caused by *Plasmodium falciparum*, and the mosquitoes *Anopheles gambiae*, *Anopheles funestus*, *Anopheles arabiensis*, and *Anopheles moucheti* are the major vectors that cause year-round transmission; artemether-lumefantrine (AL) or artesunate + amodiaquine (AS + AQ) is the treatment regime adopted in 2004 [19], (Kar, Kumar,Singh,Carlton &Nanda,2015). This devastating disease affects the country's economic productivity, resulting in an estimated monetary loss of approximately 132 billion Naira (700 million USD), in treatment costs, prevention, and other indirect costs (WHO, 2012. Federal Ministry of Health, 2012).

Since 2008, the National Malaria Control Programme (NMCP) in Nigeria has adopted a specific plan, the goal of which is to reduce 50 % of the malaria burden by 2013 by achieving at least 80 % coverage of long-lasting impregnated mosquito nets (LLINs), together with other measures, such as 20 % of houses in targeted areas receiving indoor residual spraying (IRS), and treatment with two doses of intermittent preventative therapy (IPT) for 100 % of pregnant women who visit antenatal care clinics (Ye, Patton, Kilian, Dovey & Eckert , 2012; USAID, 2013; Adigun et al. 2010). Because of these measures, the percentage of households with at least one LLIN increased to over 70 % by 2010, compared to only 5 % in 2008 (Oyeyemi, 2010). Although previous studies have documented a high prevalence of malaria throughout Nigeria [20]. There remains a paucity of research on people's knowledge, attitudes, and practices (KAP) towards malaria in the majority of the federation, particularly in Northern Nigeria, including Kano State. This information is imperative in order to identify and implement effective control measures, and plan for the participation of the targeted communities in the control, which is one of the cardinal tools for the success and sustainability of disease control programmes [21]. Malaria can have a debilitating effect on adults as well, often removing them from the workforce for days or weeks at a time. Malaria parasite is complex and adaptable, and it has survived for millennia. Therefore, we need many tools to defeat this disease—tools that save lives today and those with the potential to save lives in the future. A safe, effective, and affordable malaria vaccine would help close the gap left by other interventions.

2.3 Perception of Caregivers, Parents and Guardians on Malaria Vaccine

Majority of the of those who are aware of malaria vaccine strongly agreed that malaria vaccine would prevent malaria [10]. Uchechukwu et al. [10] in his study reported that About 61.4% of his respondent agreed that everyone should receive malaria vaccine. Therefore, it implies that those who are aware of the vaccination against malaria have positive perception about the vaccine. Their report further indicated that 80.0% of those studied strongly agreed that they would take the malaria vaccine when they get access to it, showing that caregivers, parents and guardians strongly have good perception toward the vaccine. Though his study indicated that the acceptance of malaria vaccines is not against the cultural believe of many and at the same time malaria vaccine will help save money spent on constant malaria treatment.

2.4 Decision-making and External Influences Related to Child Vaccination

Mothers tend to decide more frequently on childhood vaccination. Although mothers has primary responsibility for vaccination decision-making, though fathers' permission have to be acknowledged. Decision-making for child vaccination takes place within the family unit, generally by one or both parents [22]. Mothers are culturally accepted and expected to be key decision-makers for matters related to vaccination services [23]. Research on the 'Role of Women's Decision Autonomy in the Uptake of Childhood Immunization in Nigeria' showed that maternal decision-making autonomy is positively associated with the uptake of childhood immunisation services; children whose mothers participate in household decisions had twofold higher odds of being fully immunised compared with children whose mothers did not participate in any household decisions [24]. The positive influence of health workers on child vaccination uptake at the community level influence other health services provided such as provision of treatment services and health education at the community level (Ajayi, Browne, Garshong & Bateganya, 2016). This positive influence on vaccination uptake could be explained by their major involvement in the NIDs and campaigns for polio vaccine immunisation.

This suggests that health workers might have to be provided with incentives to further the course of introducing a malaria vaccine in the community and the media stands to be a good complement to the advocacy activities of the health workers on creating awareness on malaria vaccine.

The recognition of the religious leaders as trusted influencers of vaccine uptake is very important for the acceptance of any vaccine.

2.5 Willingness to Accept Malaria Vaccine

Study conducted by Michael (2017) shows that there is a high level of public interest in a malaria vaccine, despite an overall low awareness of it. In accordance to the willingness of people who are aware malaria vaccine to accept it Daniels et al. [25] observed that caregivers who take decisions regarding vaccination of their children and those who reported that health workers at the community level have influenced their decision were those who at a point in time had their children vaccinated. Involvement of these two key (community health worker and government) stakeholders influences that willingness to accept a malaria vaccine in Nigeria. Abdulraheem (2018) revealed that a high level of education in mothers has a strong association with vaccine uptake and increases vaccination chances of a child.

2.6 Malaria Vaccination

Vaccines are considered cost-effective interventions to reduce and eliminate burden of infectious diseases [26]. Efforts are being made to deliver malaria vaccines as a means to achieving elimination of malaria. Malaria vaccine RTS,S is the most advanced candidate to undergo large scale Phase III evaluation in Africa. It has been tested in eight countries with varying degrees of prevention of malaria transmission. The study sites included: Nanoro in Burkina Faso; Kintampo and Agogo in Ghana; Lambarene in Gabon; Manhica in Mozambique; Lilongwe in Malawi; Kilifi, Siaya, Kombewa in Kenya; Bagamoyo and Korogwe in Tanzania [26]. Furthermore, phase II and III clinical trials of RTS,S showed that the vaccine reduced the episodes of malaria among young children and infants in malaria endemic areas by half (Ojaka, Ofware, Machira, Yamo, Collymore & Ba-Nguz, 2011). Upon completion of the clinical trials, policy makers will need to make evidence-based decision on the best ways to engage communities to facilitate introduction of malaria vaccine in the national health systems. The availability of RTS,S contributes to a multi-intervention approach to controlling malaria that currently uses long-lasting insecticide- treated nets (LLITNs), insecticide-treated nets (ITNs), indoor residual spraying (IRS), and other means of disease reduction and effective drug treatment [27].

Studies on vaccine adherence interventions and acceptance of vaccines recommended use of strategies that will enhance positive community knowledge and perceptions on vaccine effectiveness are also made to enable help evaluate the level to which malaria vaccine are being utilized and how effective it for malaria treatment [28].

Effectiveness of vaccines rely on both clinical efficacy and on a community's perceptions [29]. During vaccine promotion lack of community support due to poor knowledge and perceptions resulted into poor community uptake while others

reject vaccines [30] In such contexts aligning stakeholders is an important input as suggested in the network analysis to examine decision-making space in Nigeria [31].

According to Malaria vaccine initiative, [17], malaria vaccine scientists evaluate different vaccine candidates and formulations that are designed to stimulate the immune system to destroy or arrest the malaria parasite. A malaria vaccine's desired actions can take place at several points during the life cycle of the parasite. The most significant challenge that malaria vaccine scientists face is a lack of understanding of the specific immune responses associated with protection against the parasitic disease. Because malaria parasite is so complex, scientists pursue a diversity of vaccine development approaches. Many believe that a malaria vaccine will need to encompass more than a single approach to reach a high degree of efficacy. Early malaria vaccine development efforts focused on the parasite's pre-erythrocytic stage—the period during which the organism, in the form of a sporozoite, enters a person's blood stream and heads for the liver, where it matures and begins a prolific multiplication process. Today, malaria vaccinologists are also trying to develop different types of vaccines [17].

2.7 Types of Malaria Vaccine

2.7.1 Pre-erythrocytic vaccine

Pre-erythrocytic vaccine is aimed to protect against the early stage of malaria infection at the stage at which the parasite enters or matures in an infected person's liver cells. These vaccines would elicit an immune response that would either prevent infection or attack the infected liver cell if infection does occur. These candidates include:

- Recombinant or genetically engineered proteins or antigens from the surface of the parasite or from the infected liver cell.
- DNA vaccines that contain the genetic information for producing the vaccine antigen in the vaccine recipient.
- Live, attenuated vaccines that consist of a weakened form of the whole parasite (the sporozoite) as the vaccine's main component.

2.7.2 Blood-stage vaccine

Blood-stage vaccine target the malaria parasite at its most destructive stage—the rapid replication of the organism in human red blood cells. Blood-stage vaccines do not aim to block all infection. They are expected to decrease the number of parasites in the blood, and in so doing, reduce the severity of disease. Evidence suggests that people who have survived regular exposure to malaria develop natural immunity over time. The goal of a vaccine that contains antigens or proteins from the surface of the blood-stage parasite (the merozoite) would be to allow the body to develop that natural immunity with much less risk of getting ill.

2.7.3 Transmission-blocking vaccine

Transmission-blocking vaccine (TBV) seek to interrupt the life cycle of the parasite by inducing antibodies that prevent the parasite from maturing in the mosquito after it takes a blood meal from a vaccinated person. Transmission-blocking vaccine (TBV) candidates aim to prevent mosquitoes from becoming infected by malaria-causing parasites when they feed on infected people.

While the TBV approach would not necessarily prevent malaria infection in the immunized person, such a vaccine would reduce the number of mosquitoes carrying the parasite and thus the number of people in a community who are infected. A successful transmission-blocking vaccine would be expected to reduce deaths and illness related to malaria in at-risk communities [17].

2.8 Types of Malaria Parasite

Fiver major species parasite of malaria cause malaria in humans and 2 of these species-*P. falciparum* and *P. vivax*-pose the greatest threat. *P. falciparum* is the most prevalent malaria parasite on the African continent. It is responsible for most malaria-related deaths globally. *P. vivax* is the dominant malaria parasite in most countries of sub-Saharan Africa [6]. In high transmission areas, partial immunity is acquired during childhood in such settings, the majority of malarial disease and particularly severe disease with rapid progression to death, occurs in young children without acquired immunity. Severe anaemia, hypoglycemia and cerebral malaria are features of severe malaria more commonly seen in children than in adults (WHO, 2015). In areas of low edemicity where the immunity is low, severe infection occurs in all age groups including adults.

2.9 Factors that Affect Acceptability of Malaria Vaccines and the Wiliness to Accept Malaria Vaccines among Caregivers

The perception of people regarding a malaria vaccine showed that even the person who had never vaccinated their children are eagerly willing to accept a malaria vaccine (Beliretu & Ikeoluwapo, 2015). On the other hand, there are reasons why people might not accept malaria vaccine; one major concern was fear of injection and others were safety of the vaccine and cost [16].

According to Onyekachi (2018), some of the reasons why the vaccine may not be accepted by people is due to fear of injection. Therefore, he suggested that malaria vaccine be given alongside with other childhood vaccines and should be given once in a year or probably once in a life time. He further listed the following reasons to be responsible for the rejection of malaria vaccine as

1. **Ignorance**: Due to the level of unawareness which might lead to ignorance on the part of the public makes people fail to see the good benefit of accepting malaria vaccine.
2. **Believes**: Some religious believe or culture makes people to reject malaria vaccine viewing it as against the Christian believe of not taking drug rather have faith in God to heal them.
3. **Lack of information**: Most people living in most Nigeria community are not aware of malaria vaccine which can be used to prevent malaria.

Onyekachi (2018) further highlighted some reasons which may also make some people in Nigeria community to accept malaria vaccinations as follows.

1. **Free vaccination**: when malaria vaccines are given freely to people it serve as a motivating factor for those who knows about malaria vaccine to accept it.
2. **Awareness and sensitisation**: Awareness and sensitization of the masses on the health benefit of malaria vaccine also encourages the people to accept the vaccine.
3. **Influence of community health workers:** influence of community workers who are well experiences on malaria vaccine also encourage caregivers, parent and guardian to allow their children to accept malaria.
4. **Endorsement by the Government:** government endorsement of malaria vaccine and health officials, encourage the people to accept the vaccine since they are sure that government and health officers can only endorse and make sure the vaccination are safe for the masses.
5. **Religious leaders assurance:** assurance of people from religious leaders also encourages the acceptance of malaria vaccine since they are sure that their leaders especially spiritual leaders will always have their best interest at heart.

2.10 Diagnosis and Treatment

Early diagnosis and treatment of malaria reduces disease and prevents deaths. It also contributes to reduce malaria transmission. The best available treatment, particularly for *P. falciparum* malaria, is artemisinin- based combination therapy (ACT) (Musa, 2013). WHO recommends that all cases of suspected malaria be confirmed using parasite-based diagnostic testing (either microscopy or rapid diagnostic test) before administering treatment. Results of parasitological confirmation can be available in 30 minutes or less. Treatment, solely on the basis of symptoms should only be considered when a parasitological diagnosis is not possible.

2.11 Prevention

Vector control is the main way to prevent and reduce malaria transmission. If coverage of vector control interventions within a specific area is high enough, then a measure of protection will be conferred across the community (WHO, 2015). World Health Organization recommends protection for all people at risk of malaria with effective malaria vector control. Two forms of vector control – insecticide-treated mosquito nets and indoor residual spraying – are effective in a wide range of circumstances.

3. MATERIALS AND METHODS

3.1 Study Area

The study was conducted in urban community of Nnewi. Nnewi is the second largest city in Anambra State in southeastern Nigeria. Nnewi as a metropolitan city in co-ordinate of 6.02 latitude and 6.92 longitude encompasses 2 local government areas, Nnewi North, Nnewi South; Nnewi North is commonly referred to as Nnewi

central, and comprises four autonomous quarters: Otolo, Uruagu, Umudim, and Nnewichi. Nnewi North also includes Ichi, an autonomous neighbouring town. As of 2006, Nnewi has an estimated population of 391,227 according to the Nigerian census (Census, 2006).

3.2 Study Design

A mixed type of study design which include survey design and experiment research design was adopted for the study.

3.2.1 Survey design

This research design is one in which a group of people or items are studied by collecting and analyzing data from only a few people or items considered to be representative of the entire group (Nworgu, 2015). The survey design specifies how such data will be collected and analysed.

3.3 Population of the Study

The population of the study consisted of 155,443 resident in Nnwei North Local Government of Anambra State.

3.4 Sample Size Collection

Out of the total population of 155,443 a sample size of 400 was derived using Taro Yamane statistical formula as shown below.

$$n = \frac{N}{1 + N(e)^2}$$

n= samples size
N= population of the study

Out of the total sample size of 400,only a sample of 150 persons were willing to donate and participant in the study. Therefore, the researcher was left with the 150 participant who voluntarily accepted to be used in the study as the sample size from where blood samples were collected from

3.4.1 Experimental Design

According to Jayesh (2017) experimental designs is one that is characterized by the random selection of participants and the random assigning of the participants into groups in the study which complete control over the extraneous variables.

3.5 Collection of Blood Samples

Blood sample used were collected from the participants using 1ml syringe and transferred to 5ml blood collection tube

3.6 Equipment

The equipment's used are, blood collection tube, 1 ml syringe, microscope, microscope slide, slide cover, test tube, test tube rack, fixing tray, centrifuge, stop clock, hand glove and digital body thermometer.

3.7 Reagents

Giemsa's staining reagent, distil water, methanol was used.

3.8 Preparation of Standard Stain Reagent

Standard Giemsa: 3% standard Giemsa was prepared in buffered solution at pH 7.1

3.9 Preparation of Blood Sample

2 ml of the blood samples collected were centrifuge at 1000 rmp for 25 min in other to separate white blood cell (WBC) from red blood cell (RBC) before smear.

3.10 Preparation of Smear

A drops of the blood sample was smear on a slide to make both a thick and thin film.

Thick smear: The thick smear was air dry for 30 minutes under room temperature of 37 ± 1^0C without being fixed with methanol. This allows the red blood cells to be hemolyzed both the leukocytes so that any malaria parasites present will be the only detectable elements. Therefore, this thick smear is made in other to detect infection, and to estimate parasite concentration.

Thin smear: The thin smear was air dried under room temperature of 37 ± 1^0C for 10 minutes. After drying, the thin smear was fixed in methanol. This was done by dabbing the thin smear with a methanol-soaked cotton ball for 5 second.

3.11 Staining Procedure

The slow staining method as outlined by world health organization (2010) was used. After fixing of the sample on the slide, 2-3 drops of Giemsa's, working stain reagent was added slowly from one side of the slide and allowed to air dry for 45-60 minutes. The fixed stained sample was gently rinsed using distil water then viewed under microscope using both low and high power.

3.12 Identification of Malaria Parasite

The identification of the type of malaria parasite was done according to the procedure outlined by W.H.O (2010). The identification according to world Health Organization was based on the shape,size,colour,stipling, pigment, presence of early trophozite, schizont and gametocyte viewed in the blood sample.

3.13 Prevalence Rate of Malaria Parasite

Malaria parasite prevalence was calculated as follows

Prevalence = Incidence per unit of time x Average duration of disease in the same unit of time

3.14 Data Analysis

Survey Data collected in the study were analyzed using simple percentage.

3.15 Statistical Analysis

Data collected were analysed using Chi-square to ascertain the level of significance at 0.05% level.

4. RESULTS

Table 1 shows that a total of 150 children within age category of 1-2 years were examined and 31(20.6%) of the children tested negative to *P. facliparium* while 119(79%) tested positive for *P. facliparium*. Still among these children of age group 1-2 years, 127(8.4%%) also tested negative for *P. malariae* and 23(15.3%) tested positive to the parasite. this result means that the prevalence of *P. facliparium* is higher than while that is *P. malariae* is very low.

Table 1.1 chi-square contingency table for Prevalence of Malaria Parasite With Respect to Age

Level of significance =0.05%

$X^2_C = 23.42$
$X^2_t = 3.84$
Df =2-1 =1

Table 1.1 chi-square contingency table shows that the calculated chi-square value is higher than the tabulated chi-square value. At this level of significance, it therefore, implies that there is no real significant differences in the prevalence of malaria parasite among the children between 1-5 years.

Table 1. Prevalence of malaria parasite with respect to age

Parasite	Age(yrs)	No. Examined	No. parasite(-ve)	Parasite Present(+ve)
P. facliparium	1-2	150	31(20.6%)	119(79%)
P. malariae	3-5	150	127(84.6%)	23(15.3%)

Table 1.1. Chi-square Contingency table

S/N	O	E	O-E	$\frac{O-E^2}{E}$
1	79	47	-9	1.72
2	15	47	-32	21.7
Total				23.42

Source: Extracted and computed from Table 1

Table 2 shows that based on sex, the prevalence of malaria parasite among 61 male children is 131(67.3%) while among 89 of the female children examined is 109(72.6%). This result infers that the prevalence among female children is higher as compared to prevalence among male children. This also implies that the female gender.

Table 2.1 chi-square contingency table for Prevalence of Malaria Parasite with Respect to Sex.

Level of significance =0.05%

$X^2_C = 0.68$
$X^2_t = 3.84$
Df =2-1 =1

Table 1.1 chi-square contingency table shows that the calculated chi-square value is higher than the tabulated value chi-square value. At this level of significance, it therefore, implies that there is a significant differences in prevalence of malaria among sex of the children examined.

Table 3 shows that children between the age 3-5 years are more susceptible to malaria parasite as indicated by the high prevalence of 109(72,6%) above.

Table 3.1 chi-square contingency table Age susceptible to malaria

Level of significance =0.05%

$X^2_C = 0.16$
$X^2_t = 3.84$
Df =2-1 =1

Table 3.1 chi-square contingency table shows that the calculated chi-square value of 0.16 less than tabulated chi-square value. Hence, at this level of significance, it therefore, means that there is a significant ages that are susceptible of malaria parasite among the children.

4.1 Analysis of Data Related To Objectives of the Study

Objective 1: To Determine the awareness of caregivers regarding malaria vaccines

Table 4 shows that 123(82%) of the respondents have at one time or the other aware of child immunization while 27(28%) have not heard it. For those who are aware, result showed that 95(63%) of them became aware of it through health workers, 103(69%) said it through radio/television, 17(11.3%) said it through friends while 35(23%) responded that it through other medium they got to know about it. The responses of those who are aware as compared to those who are not is higher which indicates that the respondents are aware of child vaccination.

Objective 3: To Determine the perception of caregivers, parents and guardians.

Table 2. Prevalence of malaria parasite with respect to sex

Sex	No. Examined	No. parasite (-ve)	Parasite Present (+ve)
Male	61	19(12.6%)	131(67.3%)
Female	89	41(27.3%)	109(72.6%)

Table 2.1. Chi-square Contingency table

S/N	O	E	O-E	$\frac{O-E^2}{E}$
1	67	69.5	-2.5	0.08
2	72	69.5	6.5	0.60
Total				0.68

Source: Extracted and computed from Table 2

Table 3. Age susceptible to malaria

Age	No. Examined	No. parasite(-ve)	Parasite Present (+ve)
1-2	61	19(12.6%)	131(67.3%)
3-5	89	41(27.3%)	109(72.6%)

Table 3.1. Chi-square contingency table

S/N	O	E	O-E	$\frac{O-E^2}{E}$
1	67	69.5	-2.5	0.08
2	72	69.5	2.5	0.08
Total				0.16

Source: Extracted and computed from Table 3

Table 4.1 shows that 123(82%) of the respondents are willing to pay for malaria vaccine while 27(18%) are not willing. 114(76%) of the respondents agree that even if malaria vaccine is still under trier, they will allow their children to be tested with it while 36(24%) rejected the view of allowing their child to be tested with it. 147(98%) said that they will appreciate if malaria vaccine comes to reality while 3(2%) are not. 65(43.3%) while 85(57%) responded that they will still treat their children for malaria after being vaccinated.

Objective 2: To help motivate individuals of under five children to consider the adoption of malaria vaccine. Answer to objective is presented in Table 4.2.

Table 4. Awareness of caregivers regarding malaria vaccines

Question	Yes	No	Total
Have you heard about child immunization before?	123(82%)	27(28%)	150(100%)
How did you hear about the vaccine?	Health workers [95(63.3%)] Radio/Television [103(69%)] Friends [17(11.3%)] Others [35(23.3%)]	-	200(100%)

Table 4.1. Perception of caregivers, parent and guardians

Option	Yes	No	Total
Will like to pay much for malaria vaccine?	123(82%)	27(18%)	150(100%)
Knowing full well that malaria vaccine is still under trial, can you allow your child to be tested With malaria vaccine?	114(76%)	36(24%)	150(100%)
Will you appreciate if malaria vaccine comes to reality?	147(98%)	3(2%)	150(100%)
If your child is vaccinated, will you have to treat malaria for him or her again?	65(43.3%)	85(57%)	150(100%)

Table 4.2. Motivation of individuals under five children to consider the adoption of malaria vaccine

Question	Yes	No	Total
Have you had any of your children vaccinated before?	118(78%)	32(21%)	150
If yes, which of the vaccine?	Polio: 63(42%) BCG:137(91.3%) DPT:50(33%) Don't know 33(22%) Others [%]		150
Was there any side effect from the vaccination?	73(49%)	23(15.3%)	150
In absence of any side effect, can you allow your child to be vaccinated	69(46%)	27(18%)	150

Table 4.3. Willingness to accept a malaria vaccine among individuals of under five children

Question	Yes	No	Total
Should there be need, are you willing to pay for malaria vaccine	117(78)%	29(19.3%)	150
How much are you willing to pay for malaria vaccine?	120(80%)	26(17.3%)	150
Knowing full well that malaria vaccine is still under trial, can you allow your child to be tested with malaria vaccine?	113(75.3%)	33(22%)	150
Will you appreciate if malaria vaccine comes to reality?	146(97.3%)	-	150
If your child is vaccinated, will you have to treat malaria for him or her again	123(82%)	23(15.3%)	150

Table 4.4. Factors that affect acceptability of malaria vaccine

Question	Yes	No	Total
Poor level of awareness	77(51%)	73(48.6%)	150
Unavailability of the vaccine	90(60%)	60(40%)	150
Cultural Believes	45(30%)	105(43%)	70

Table 4.3 shows that 118(78%) of the respondents have had their children vaccinated before while 32(21%) responded that their children have not being vaccinated before. 63(42%) agree that their children have being vaccinated against polio while,137(91.3%) agree their children have being vaccinated for BCG, 33(22%) responded that they don't know. 73(49%) of the respondents also responded that there were not side effect observed in the use of the vaccine while 23(15.3%) disagreed and said they have experienced some side effect on the use of the vaccine. On the other hand, 69(42%) of the responded agree that they can allow their children take the vaccine in the absence of any side effect, while 27(18%) said they will not allow their children take malaria vaccine. This result implies that people will like to take malaria vaccine if the opportunity arises.

Objective 3: To assess the willingness to accept a malaria vaccine among individuals of under five children. Answer to objective 3 is presented in Table 4.3.

Table 4.3 shows that 117(78%) of the respondent are willing to pay for malaria vaccine, 29(19%) responded that they are not willing to pay. 120(80%) of the respondent agree that they would pay for malaria vaccine while 26(17.3%) disagreed to it that they are not willing to pay. 113(75.3%) also agree that they will allow their children take malaria vaccine even if they know that it's under trial while 33(22%) refuted it and said they will not allow that. 146(97.3%) of the respondent also said that they will appreciate if the vaccine will become a reality. On the other hand, 123(82%) responded that they will not have their children treated of malaria again if vaccinated while 23(15.3%) said they will permit their children to have the vaccine. This results implies that respondent are willing to accept malaria vaccine treatment. This responses is significant as indicated by the high percentage level of those who agreed to accept malaria vaccination.

Objective 4 To identify factors that affect acceptability of malaria vaccines among caregivers

Table 4.4 shows that there factors which affect acceptability of malaria vaccine. 77(51%) of the respondents agreed that poor level of awareness is one of the factors that affect it, 73(48.6%) responded that poor level of awareness does not affect it, 90(60%) said it is unavailability of the vaccine while 60(40%) disagree to that. On the other hand, 45(30%) said culture affect vaccine acceptance, while 105(43%) responded it does not. From the responses, it is evident that there are factors that affect the acceptability of malaria vaccines.

5. DISCUSSION, CONCLUSION AND RECOMMENDATION

This chapter discusses the findings of the study in line with the aim and objective of the study, as well as give the recommendation and suggestion for further study.

5.1 Discussion

Finding of the study showed that *P. falciparum* and *P. malariae* are the two are the most prevalent malaria parasite found in urban area of Nnewi with high intensity level. The finding also indicated that children under the age of 5yrs are also more seriously affected by this parasite. Some of the respondent have at one time had their children vaccinated against malaria infection but most of the respondent are also not even aware of the vaccine so their children are not vaccinated. The study finding also showed that most of the vaccination received by the respondents is polio vaccines and followed by BCG. Findings also showed that most of the people are willing to accept malaria vaccination as well as paying for the vaccination. This finding agrees with the finding of Onyekachi (2018) who reported that some of the reasons why the vaccine may not be accepted by people is due to fear of injection. Therefore, he suggested that malaria vaccine be given alongside with other childhood vaccines and should be given once in a year or probably once in a life time.

All the participant were observed to be anticipating for a well-developed drug that will address the problem of malaria infection. Though in as much as some said they will not allow their children take malaria vaccine under trier, most of the respondent accept to be willing to allow their wards to accept it irrespective its still undergoing trier. This means that respondent are eagerly looking forward to accept malaria vaccination that will be effective against malaria parasite. the findings also agree with the finding of Beliretu & Ikeoluwapo, [32] who said that the perception of people regarding a malaria vaccine showed that even the person who had never vaccinated their children are eagerly willing to accept a malaria vaccine.

The findings also showed that different factors such as lack of awareness affect the acceptability of the vaccines as well as poor educational background. This findings agree with the finding of WHO [8] that reported that malaria still remains a significant public health problem in sub-Saharan Africa, including Nigeria, accounting for 10 % of the burden of disease and for such development of vaccine a recent, technical innovations to control malaria have contributed to a decline in the malaria burden, but the disease remains a significant threat due to persistent enabling environments, poverty and fragile health systems.

The findings further agree with that of Graves & Gelband, (2016) who said that additional strategies are needed to ensure a combination of interventions that target the various phases of the malaria life cycle, including malaria vaccination.

The finding also disagree with Uchechukwu *et al.* [10] finding who in his study said that 100% caregivers are aware of malaria and identified mosquito as the possible cause of malaria and that they are also aware of the signs and symptoms of malaria, identified as fever which include headache, cold, swollen eyes , bitter tongue and deep yellow urine.

5.2 Conclusion

The evidences form the study as shown that *P. falciparum* and *P. malariae* are the two most common malaria parasite with high intensity level among people living in Nnewi urban area of Anambra state. Most of these persons are aware of malaria but not quite aware of the vaccinations and are willing to accept the vaccination if opportune. Hence, from the study it can be concluded that malaria parasite is prevalent with high intensity among children under 5 yrs in Nnwei urban area of Anambra state.

5.3 Recommendation

Based on the study, the followings are recommended.

1. Government ensure more awareness on malaria vaccination is created to sensitize the masses on it acceptance
2. More fund should be disbursed into malaria prevention programmed in other to enable all a sundry to receive free malaria vaccination.

ETHICAL APPROVAL AND CONSENT

Ethical approval was obtained from Anambra state Ministry of Health and the study Protocol approved. A written and oral informed consent was obtained from the participants to ascertain their wiliness to participant on the study.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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