

**PREVALENCE OF MALARIA AND USE OF LONG LASTING INSECTICIDE  
TREATED NETS IN CHILDREN AGED 6 – 59 MONTHS AT INTERNALLY  
DISPLACED PERSONS CAMPS ABUJA**

**BY**

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## DECLARATION

I declare that the work in this dissertation “MALARIA PREVALENCE AND USE OF LONG LASTING INSECTICIDE TREATED NETS IN CHILDREN AGED 6 TO 59 MONTHS AT INTERNALLY DISPLACED PERSONS CAMPS ABUJA ” was performed by me in the Department of Community Medicine under the supervision of Prof A.T. Olayinka and Prof. S.A Ahmed. The information derived from literature has been duly acknowledged in the text and a list of references provided. No part of this dissertation was previously presented for another degree or diploma at any University.

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Date

## CERTIFICATION

This thesis entitled “PREVALENCE OF MALARIA AND USE OF LONG LASTING INSECTICIDE TREATED NETS IN CHILDREN AGED 6 TO 59 MONTHS AT INTERNALLY DISPLACED PERSONS CAMPS ABUJA ” by Ejembi Joan meets the regulations governing the award of the degree of Master in Public Health of Ahmadu Bello University, Zaria and is approved for its contribution to knowledge and literary presentation.

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## **DEDICATION**

*I dedicate this work to Almighty God. my Shield. my Glory and the lifter up of my head*

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## ACRONYMS

ACT	Artemisinin Combination Therapy
AIDS	Acquired Immunodeficiency Syndrome
DHS	Demographic Health Survey
DRC	Democratic Republic of Congo
FCT	Federal Capital Territory
HIV	Human Immunodeficiency virus
HPF	High power field
IDP	Internally Displaced Persons
IHD	Ischaemic Heart Disease
IRS	Indoor Residual Spray
ITN	Insecticide Treated Net
ITPS	Insecticide Treated Plastic Sheeting
IPT	Intermittent Preventive Therapy
LLIN	Long Lasting Insecticide Treated Nets
MDG	Millennium Development Goals
NDS	Non- displaced persons
NMIS	National Malaria Indicator Survey
NMEP	National Malaria Elimination Programme
NWH	Net Wall Hanging
RBC	Red blood cell
RDT	Rapid Diagnostic Test
SDG	Sustainable Development Goals
SSA	Sub-Saharan Africa
TB	Tuberculosis
UNHCR	United Nations High Commission for Refugees
WBC	White blood cell



WHO

World Health Organisation

YLL

Years of Life Lost

## ABSTRACT

Globally there has been an increase in Internally Displaced Persons (IDP). IDPs are a disadvantaged population and prone to numerous challenges including insecurity, sexual violence, poverty and malnutrition among others. For IDPs in malaria endemic countries, malaria is a major cause of morbidity and mortality, especially among vulnerable populations of under-five aged children and pregnant women. This study was conducted to determine the prevalence of malaria and utilization of Long Lasting Insecticidal Treated Nets among IDPs aged 6 – 59 months in FCT-Abuja.

A cross-sectional community based survey was conducted in the 3 IDP Camps located in Abuja and a total enumeration of children aged 6-59 months was done. Mother – child pairs of children aged 6-59 months were interviewed using a structured interviewer administered questionnaire. Finger prick blood samples were collected from eligible consenting children and tested for malaria parasitaemia.

A total of 393 children from 242 households were recruited. The prevalence of malaria was found to be 32% and 51% via RDT and malaria microscopy respectively. The LLIN ownership and coverage was 76.7% and 11.2% respectively. Utilisation was high with 89.7% of children aged 6-59 sleeping under an LLIN the night before the survey. The odds of LLIN utilization was higher in nets that were hanged (OR:55.9, 95% CI:18.12-172.14), those that lived near stagnant water (OR: 2.9, 95% CI: 1.33-6.59 ),had owned the LLIN for 6 months or less, (OR: 2.6, 95% CI:1.20-5.57 ),Christians (OR:2.4, 95% CI: 1.10-5.62 ),and nets with holes (OR: 2.2, 95% CI:1.01-4.90),The odds of Malaria parasitaemia was significantly higher in females (OR: 1.7, 95% CI: 1.08-2.61) and children who had traveled but not statistically significant (OR: 1.9, 95% CI: 0.73-4.70) while those who owned LLINs for less than 6 months were less likely to have parasitaemia. (OR: 0.6, 95% CI: 0.31-0.97).

The prevalence of malaria among IDPs aged 6-59 months was high in spite of high ownership and utilization of LLIN.LLIN coverage was low and factors significantly associated with LLIN utilization were type of breeding sites near dwellings and net factors. There is need to improve coverage of LLIN among IDPs and explore other malaria preventive strategies like the use of pre-treated tarpaulins among IDPs.

**Key words:** Malaria, prevalence, internally displaced persons, long lasting insecticidal treated nets, children

## CHAPTER ONE

### INTRODUCTION

#### 1.1 Background Information

Malaria is a major cause of morbidity and mortality in tropical and subtropical countries particularly in Africa. It is the most common cause of death in children less than five years of age and also the most common cause of outpatient hospital visits in the general population.<sup>1, 2</sup> Thus it has been targeted for elimination in the year 2020 and malaria preventive strategies have been employed. These strategies are the use of Long Lasting Insecticide Nets (LLIN), Intermittent Preventive Therapy (IPT), prompt diagnosis with Rapid Diagnostic Tests Kits (RDTs) and treatment with Artemisinin Combination Therapy (ACT) .Of these, LLIN is considered the cornerstone of malaria prevention and its preventive effect is comparable with that of immunization in the prevention of malaria in children.<sup>1, 3,4,5</sup>

An estimated 1.5 billion people globally live in conflict affected countries which results in people becoming internally displaced or refugees as they flee from emergencies, either manmade or naturally occurring such as wars, conflicts, communal strife and floods, earthquakes respectively. Malaria prevention and control is hindered during strife and disaster.<sup>2,6, 7</sup> Countries which have suffered or been greatly affected by displacements include Syria, Afghanistan, Iraq in the middle East, DRC, Nigeria, Ethiopia, Sudan in Africa, India, Nepal, China and the Philippines in Asia among others. Countries which have suffered from protracted conflicts for more than ten years include the DRC, Sudan and South Sudan, Colombia and Iraq.

In recent times, there has been an upsurge of internally displaced persons both internationally and locally as a result of insurgency, communal clashes, strife of all forms as well as natural disaster. Countries mainly affected by conflict, violence and strife in the last five years include

Nigeria, Syria, Ukraine and Yemen. Globally, 27.8 million people were displaced in the year 2015 alone and about one third of this was from conflict bringing the global estimate of internally displaced persons (IDPs) to 40.8 million people at the end of the year, the highest figure ever recorded.<sup>2</sup> Though malaria has been targeted for elimination, the community of IDP and refugees is yet to be incorporated in many National malaria elimination or control programmes.<sup>3,9</sup> This is unfortunate as more than half of IDPs, refugees and returnees live in malaria endemic zones so it remains a significant threat not only to displaced populations but also to malaria control programmes in these areas.<sup>9,10,11,12</sup> It has been demonstrated that the prevalence of the disease has been found to be higher in conflict affected areas among IDPs and refugees than the general populace.<sup>7,11</sup> Of these group of people, Children and pregnant women tend to be more affected.<sup>4,5,7</sup> Studies conducted at UNHCR centres in nine countries showed that the incidence of malaria was higher among the displaced persons and twice as high in children under five years than the other displaced persons.<sup>7</sup> This is understandable considering the living conditions within IDP camps which are favourable to the malaria vector, other co-morbidities such as malnutrition, respiratory tract infections and diarrhea, orphan status or lack of caregiver and limited access to health care.<sup>13,15,16</sup> Among those studied in the nine countries, malaria accounted for 1% - 25% of mortality among refugees, with the rates highest in Sudan and Thailand and lowest in Ethiopia.<sup>7</sup>

Malaria remains a significant problem during conflict and post conflict periods due to the interplay of factors which aid its transmission such as breakdown of existing health systems, displacement of non-immune populations to endemic areas, poor sanitary camp conditions, poverty and restricted access to health care.

## 1.2 Problem Statement

Malaria is the most common cause of morbidity and mortality in Sub-Saharan Africa and also the most common cause of outpatient visits. Globally, 214 million cases and 438,000 deaths from malaria occurred in 2015 alone. Nigeria in conjunction with the DRC, is responsible for two thirds of the global malaria burden.<sup>2</sup> Nigeria, which is Africa's most populous country has 97% of its 180 million citizens at risk from the disease which is also the most common cause of under-five mortality in the country.<sup>1,17</sup> Analysis of the common causes of years of lives lost (YLL) in the country revealed that of the 25 disease conditions assessed, malaria topped the list with the percentage of years of lives lost having increased from 15% to 24% in assessments done in 1990 and 2010 respectively. Malaria affects the quality of life even more than other conditions like HIV /AIDs, tuberculosis (TB), and non-communicable diseases like Ischaemic heart disease (IHD), diabetes, stroke and injury <sup>4</sup> . In malaria endemic countries like Nigeria, it has been established that it is the most common cause of morbidity and mortality among IDPs.<sup>5,7,18</sup> In the last five years, there has been an upsurge of IDPs in Nigeria with problems of insurgency in the North-East, Fulani cattle herds men and inter-communal clashes in the North-Central and South-East.<sup>19 20</sup> In the country, at the end of 2015, an estimated 2.2 million people were displaced.<sup>1920</sup>

During strife, women and children are the most affected and also most at risk from malaria <sup>7</sup> It has been found that among IDPs in malaria endemic zones, it accounts for more deaths than that attributed to the emergency which caused the resulting displacement <sup>4</sup> In spite of the malaria preventive strategies in place, the prevalence of the disease is still high in the North-Central where a rate of 50.7% was reported in 2015.<sup>1</sup> Some IDP camps are located in this region in addition to those located in the North East and South East. However, most of the displaced persons in the North Central came from the North East which reported a malaria prevalence of

42.7% in the same period thus are now displaced to an area with a higher malaria endemicity than the initial place of residence. Displaced persons from areas of lower to higher malaria endemicity are prone to more severe and recurrent episodes of the disease. Nigeria already is the second largest contributor to under-five mortality in the world and with the upsurge of IDPs in the country, the already poor under five mortality indices may worsen.<sup>1</sup> Most National malaria programs do not take into consideration displaced populations. Only 20% of African countries with forcibly displaced persons included IDPs in their National Malaria Strategic plan irrespective of the fact that Africa is home to an estimated 37% of the global IDP population. Conditions rife for malaria transmission are prevalent among displaced populations who are exposed to the vector with poor housing and infrastructure, poor drainage and waste disposal systems, co-morbidities and limited access to health care.<sup>8,4</sup>

Malaria endemic countries with IDPs face challenges in the implementation of malaria control programmes. This has been demonstrated by research among IDPs in other countries. Nigeria is listed among those countries in which conflict and strife may become intractable with the problems from insurgency, Fulani herdsmen, communal clashes and Niger Delta militants. With the current and projected burden of IDPs, It will be difficult to achieve the desired goal of malaria elimination or improving under-five mortality indices in the country without incorporation of the IDPs in the National Malaria Elimination Programme. Research among IDPs tend to focus on nutrition, shelter, psychological conditions, and sexual violence There is paucity of data on the malaria burden and preventive strategies employed among IDPs in the country which highlights the need for research in this population. This study aims to provide baseline data on the prevalence of malaria in this vulnerable group and assess the coverage and

utilization of LLIN in its prevention which will help guide the National Malaria Elimination Programme and other stakeholders.

### **1.3 Justification**

IDPs are among the poorest in society, are disadvantaged and prone to several problems such as insecurity, sexual violence, malaria, malnutrition among many others. Of these problems, malaria is the most common cause of morbidity and mortality in endemic countries like Nigeria however, more attention is given to other problems so it becomes imperative to determine the disease prevalence in vulnerable groups such as the IDPs and children under 5 years of age and also assess the availability and use of malaria preventive strategies among them to identify and address gaps. This will help to further address the current poor under 5 indices in the country especially as malaria is a major contributor.

IDP camp assessments usually focus on shelter, food, clothing, wash and sanitary conditions with little information on malaria preventive strategies.<sup>3,8,21</sup> Despite the fact that effective malaria preventive measures and strategies are available which have proven to be effective in the control of the disease, with previously endemic countries like Brazil and India achieving marked reduction and control of malaria. Unfortunately, the picture is not the same in Nigeria as there are still problems with availability and utilization of malaria preventive strategies among the general populace since the prevalence of the disease was still as high as 45.1% in 2015 and this, among persons who have better living conditions, purchasing power and access to health care than displaced persons. This study aims to provide some baseline information on the malaria preventive strategies availability and utilisation among under 5 aged children in IDP camps.



Abuja which is the country's capital city is located in the North-Central geopolitical zone and hosts IDPs from States affected by conflict and strife probably due to assumptions that camps in the capital city will be better attended to by the Government, NGOs and other stakeholders. IDPs from the various insurgency and conflict affected States such as Borno, Yobe, Adamawa, Plateau, Kaduna and Nasarawa can be studied at the IDP camps within the Nation's capital. Furthermore, this geo-political zone has the second highest malaria prevalence in the country with a rate of 50.7%<sup>1</sup>. Except for IDPs from the North Western States which has a higher malaria prevalence than the North Central Zone, those IDPs from the North East with a lower malaria prevalence rate of 42.8% are displaced from regions of lower to higher malaria prevalence. People displaced from areas of lower to higher prevalence of the disease tend to have more episodes of malaria and severe disease while those displaced from zones of higher to lower prevalence may help propagate malaria transmission. At the Abuja camps there are displaced persons from various geo-political zones with varying malaria prevalence, thus there is a need to determine the prevalence of the disease and access to preventive measures in this population.<sup>6,10</sup>

Most IDPs live in shanties, tents, uncompleted buildings and shacks which are factors associated with transmission as they are exposed to the malaria vector. This makes it important to determine the distribution of LLIN among IDPs as a useful preventive measure. As IDPs living conditions make them prone to malaria, its control cannot be achieved without the consideration and implementation of malaria control measures among the IDPs.<sup>5</sup>

There is paucity of data on prevalence of malaria, the preventive strategies available and its utilisation among IDPs in Nigeria. Information which is required to drive Government and other stakeholder action especially with the public health importance of the disease in question as this can determine their commitment to addressing the situation.

## **1.4 Research Questions**

1. What is the prevalence of malaria among IDPs aged 6-59 months in Abuja?
2. What is the ownership and universal coverage of LLIN among IDPs in Abuja?
3. What are the factors associated with utilization of LLIN in IDPs aged 6-59 months in Abuja?
4. What are the factors associated with malaria parasitaemia among IDPs aged 6-59 months in Abuja

### **1.5.0 Objectives**

#### **1.5.1 General objective**

To determine the utilization of LLIN among internally displaced children aged 6-59 months in Abuja.

#### **1.5.2 Specific objective**

1. To determine the prevalence of malaria in internally displaced persons aged 6-59 months using Rapid Diagnostic Test kits and microscopy
2. To assess the universal coverage of LLIN among IDPs aged 6-59 months in Abuja
3. To assess the utilization of LLIN among IDPs aged 6-59 months in Abuja
4. To identify factors associated with Malaria parasitaemia and use of LLIN among IDPs aged 6-59 months in Abuja

## **CHAPTER TWO**

### **LITERATURE REVIEW**

#### **2.1 Malaria Prevalence**

Worldwide there has been a reduction in the incidence of and mortality associated with malaria such that the world has celebrated achieving the Millenium Development Goal (MDG) 6C to halt and reverse the incidence of malaria <sup>1</sup>. In spite of this global reduction, more than two thirds of the cases that occurred in 2015 is attributed to the WHO African region followed by the South - East Asian and then the Eastern Mediterranean region. The trend in children less than 5 years of age is similar with a reduction globally of malaria related cases and deaths such that it is no longer rated the number one killer of children in this age group. In SSA, the under 5 mortality rate in malaria endemic countries reduced from over 4 million in 2000 to less than 3 million in 2015.

Nigeria is holoendemic for malaria with a malaria prevalence of 42% at the last NMIS survey with the North central having a higher prevalence of 49% surpassed only by the South west with a prevalence of 50.3%. Studies in the south east have demonstrated prevalence's as high as 86.4% and 74.4% in two urban cities. In North central Nigeria at a Local Government area in Kaduna state a prevalence of 35.7% and an under five prevalence of 11.7% was found in a hospital based study.<sup>1</sup>

#### **2.2 Malaria in Vulnerable Groups**

Pregnant women and children less than 5 years of age are most at risk of malaria and complications arising from malaria infection. Malaria during pregnancy is associated with severe anaemia, placental parasitaemia, maternal mortality and unfavorable fetal outcomes such as Intrauterine Growth Retardation (IUGR), abortion and fetal death.<sup>7,9</sup> Maternal mortality and

under-five mortality are important indices used to assess the development and health status of countries. For this reasons certain malaria preventive interventions such as the Intermittent Preventive Therapy (IPT) and use of LLIN to prevent bites from the mosquito vector targets these vulnerable groups. Furthermore, projects such as the MOM project were developed to aid the delivery of maternal health services to pregnant women in crises situations such as violence and strife causing displacements.<sup>7</sup> This is because more so during stle, pregnant women and under five aged children are the worst affected.

Nigeria has one of the worst maternal and under-five aged mortality indices globally in spite of the demonstrated successes of malaria preventive strategies globally.

### **2.3 Global Burden of IDPs**

Internally Displaced Persons are those forced to flee their homes but have remained within the boundaries of their own country this distinguishes them from Refugees who are classified as displaced persons that have been forced to flee from their country of origin or residence thus cross international borders/boundaries. Reasons for displacement are either man made as occurs with conflict or due to natural disasters such as fire, flooding or drought.

In 2015, 72% of the world's countries experienced new displacements with almost 30 million people affected globally. Of these, two thirds of the displacement affecting 113 countries was attributed to natural disasters while one third in 28 countries occurred as a result of conflict and violence. At the end of the year the highest ever recorded displacements occurred with more than 40 million people affected.<sup>2</sup>

Over a 5 year period from 2008-2015,the most common natural disasters globally were Floods(64%),storms (35%), extreme temperatures (0.6%),wet mass movement(0.4%) and then

wild fires(0.2%).Natural disasters occur more commonly in the Asian continent and cause displacements in magnitudes greater than has been noticed with Conflict and Violence. The areas mainly affected by Natural disaster in decreasing order are; East Asia (44%) South Asia (41%), Latin America (8%) and SSA (6%).The top 3 countries affected by natural disasters in 2015 were India, China and Nepal with Malawi from Africa tenth on the list. The displaced persons population during this period ranged from 3.6 million in India to 343,000 in Malawi.<sup>2</sup>

Conversely, with regards to conflict and violence as a cause of displacements, most of the countries affected are mainly from the Middle East and Africa namely, Syria, Yemen, Iraq, DRC, North and South Sudan, Ukraine, Colombia, Yemen and Nigeria. Two thirds of the total IDPs resulting from conflicts are in only 10 counties of the world and Nigeria is listed amongst those countries in which displacements increased over the last five years.<sup>2</sup>

Though more people were displaced by natural disasters, since 2003, there has been a steady increase of displacements attributed to conflict and violence. The numbers have increased from less than 20 million in 1990 to over 40 million at the end of 2015.According to region, the Middle East and North Africa accounts for 13.2 million IDPs followed by SSA with 12 million IDPs then Latin America and the Caribbean with 7.8 million IDPs. Central Asia and Europe account for about 4 million followed closely by South Asia with3.8 million however unlike the situation with natural disasters, East Asia accounted for the least number of IDPs resulting from conflict and violence with figures less than 1 million IDPs. Of the 10 countries mostly affected by displacements from strife, Nigeria ranks fifth while the top 3 are Yemen followed by Syria and then Iraq with Pakistan ranking tenth.<sup>2</sup>

In some African countries such as the DRC, the reasons for conflict was political with resultant displacements of averagely 600,000 people in 2015. The picture differs in Kenya where the main cause of displacements was Natural disasters with flooding and mud slides displacing 103,500 people.

In Nigeria, the figures are higher and the regions mostly affected are the North East, North Central and the South East mainly from Insurgency, Intercommunal clashes and clashes between herdsmen and farmers respectively which resulted in about 738,000 displacements in 2015.<sup>2,10</sup>

Nigeria is listed among the countries in which conflicts and violence may become intractable thus the population of IDPs may increase.<sup>2</sup>

As with most disasters, the most vulnerable and affected population are women and children who suffer from the security challenges, hunger, malnutrition and various health conditions.

#### **2.4 Burden of IDPs in Nigeria**

In Nigeria, by February 2015, the IDP population was estimated at over 1.2 million. Borno State accounted for more than half of them (56.6%) followed by Adamawa (18.5%) and then Yobe State (11.4%). The rest (13.5%) were from Bauchi, Gombe and Taraba, Plateau, Nasarawa, Kano, Kaduna States and Abuja.<sup>10</sup> Children made up more than half of the population (56%) and most of these were 5 years of age or younger. The Adult population had more females (53%) than males.<sup>10</sup>

The main reason for displacements was conflict and violence in 99.9% of cases. Of these, Insurgency in the North East contributed 91.98% while Communal clashes made up 7.95% and Natural disasters accounted for less than 1% of displacements.<sup>10</sup> However, this picture varies in

individual States for instance in states like Borno, Adamawa and Yobe, Insurgency caused 99% of displacements while in Taraba and Bauchi States Communal clashes were responsible for over 50% of displacements.<sup>10</sup> Two thirds of the displacements occurred in the year 2014 when the Insurgency was at its peak and more than 80% of the IDPs resided with host communities or families while the rest resided at Camps, Transitional sites or Collective centers.<sup>10</sup>

## **2.5 Prevalence of Malaria among IDPs**

Globally from 2000 – 2015, there were successes and gains in malaria prevention and control which culminated in the achievement of the 6th MDG which states that a reduction and reversal in the incidence of malaria.<sup>9</sup> However, in spite of these gains, 2 countries of the world namely Nigeria and the DRC are responsible for more than two thirds of the global malaria burden. An estimated 70% of IDPs and Refugees live in malaria endemic zones and thus malaria is a significant threat in addition to other challenges such as malnutrition, RTI, Communicable diseases, insecurity and poor access to health care faced by this vulnerable group of people.<sup>6</sup> Malaria is the most common cause of mortality in children in IDP camps in Africa.<sup>11</sup>

The prevalence of malaria is purported to be higher in Internally Displaced Persons than in the general population and among the IDPs, the prevalence is higher still in those less than five years of age compared to the rest. Thus malaria it is one of the main causes of under 5 morbidity and mortality among IDPs less than five years of age. This has been shown in studies carried out in the DRC, United Nations High Commissioner for Refugees (UNHCR) Camps in nine countries which were all in Africa except for one. The incidence of malaria was lowest in Kenyan and highest in Tanzanian camps and ranged from 10% - 40% among all refugees and 21% - 73% in children less than 5 years of age with a mortality rate of 16%.<sup>6</sup> A case control study in the DRC

on the prevalence of malaria at IDP camps and neighboring villages showed that the prevalence was more than two times higher among the IDPs than the non-displaced population.<sup>4</sup>

## **2.6 Risk factors for malaria in IDPs**

Displaced populations such as the IDPs and Refugees are forced to abandon their homes, property and sources of livelihood to live dependent on aid in Camps which are often lacking in shelter, adequate potable water, drainage and toilet facilities, sanitary conditions, proper waste disposal and access to health care.<sup>6,10</sup> The Living conditions among Refugees and IDPs are deplorable with camps situated in sites which are favourable breeding grounds for mosquitoes as most are surrounded by bush, have farmland within and around with poor drainage facilities. Some IDPs who dwell in Collective centers where they live in previously constructed buildings/ structures some which may be uncompleted or abandoned. In such cases, fittings such as a windows, doors, roofs may be missing, have wall defects coupled with poor drainage and bushy surroundings thus present conditions favorable for the vector with subsequent Malaria transmission.<sup>4,10,22</sup>

Having lost their means of livelihood and property, makes it more difficult to access health care and afford malaria preventive measures. Most of the shelter available are makeshift tents made of tarpaulin, do not have adequate ventilation as most do not have windows. This makes it difficult for the IDPs to use preventive measures like LLIN/ITN due to the heat, inadequate space and overcrowding.

Displaced populations are forced to migrate in a bid to avoid conflict, violence or natural disaster to places where there is stability and security to seek refuge. This causes movement to or from places with varying malaria endemicity. Persons displaced from areas of low to high malaria



endemicity are more prone to severe and frequent episodes of malaria while those who migrate from areas of high to lower endemicity aid the transmission of the disease.<sup>6</sup>

## **2.7 Determinants of malaria mortality among IDPs**

Malaria is implicated as a common cause of mortality among IDPs especially children.<sup>13,23,</sup>  
<sup>24</sup>Two thirds of the deaths due to malaria in Sudan occurred among displaced persons.<sup>25</sup> Other studies carried out at UNHCR camps in countries mainly in Africa also had similar findings as more than twice the deaths at the sites occurred in children less than 5 years of age than in adults.<sup>18</sup> The common symptoms of the disease associated with mortality were vomiting, diarrhea and fever.<sup>23,25</sup> This is as a result of dehydration and electrolyte imbalances which occur with more dire consequences in children than adults. Furthermore, patients who are vomiting are less likely to retain oral medication which can reduce efficacy of treatment. It costs more in terms of time required and financial cost to obtain treatment with parenteral antimalarials which is a challenge among displaced persons.<sup>25</sup>

Households which had recurrent or regular malaria attacks were more likely to have deaths occur than those households where fewer cases of malaria occurred. More frequent cases could result in complications and stretch already scarce resources to access health care. Households which have members with parasitaemia also serve as a source of parasites aiding parasite transmission by making available the parasites to the vectors present in living quarters. Other factors associated with mortality included poor knowledge of malaria. Households where the heads demonstrated a poor knowledge of malaria were significantly associated with malaria mortality. Factors assessed which were not found to be significantly associated with mortality included age, sex, poor housing conditions, poor attitudes and practice towards malaria.<sup>25</sup>

Other factors which are associated with mortality from malaria among IDPs are the species causing the infection and the presence of co-morbidities. *P.falciparum* malaria infection is associated with mortality more than the other malaria species such as *P.vivax*, *P.malariae* and *P.ovale*. In addition, co-morbidities such as sepsis, respiratory tract infections and malnutrition is associated with mortality among IDPs with malaria.<sup>26</sup>

Factors associated with malaria mortality among IDPs were no source of income, poor knowledge on malaria and higher education.<sup>13</sup> This is notably so because IDPs within the lowest wealth index are hampered when it comes to accessing malaria preventive measures or treatment during the disease except if given free or at highly subsidized rates. Poor knowledge of malaria makes it even more difficult to adequately prevent the disease and recognize symptoms during an attack which can lead to promptness in accessing health care.

## **2.8 Malaria Epidemics during crises situations**

Malaria has been documented to occur in epidemic proportion at IDP camps and rural areas and during emergency situations such as civil unrest and strife.<sup>11,28</sup> Factors identified which were associated with malaria epidemics are delayed diagnosis and treatment, disasters which could be natural or manmade from strife and conflict as displaced persons are exposed due to lack of shelter, limited resources to access health care promptly and resistance of parasites to antimalarials as have been reported in Burundi, Ethiopia and Kenya.<sup>28</sup> There are unpublished reports of malaria epidemics occurring at IDP camps in Nigeria. The epidemics have been reported in places affected by conflicts and violence, rural areas which have shortage of health centres, communities with limited access to health care and prevalent conditions favourable for the malaria vector. Malaria epidemics that occurred in four countries namely Burundi, Ethiopia, Kenya and Sudan were associated with conflict, insurgency, forced resettlement and drug

resistance. Malnutrition also played a major role in three of the four countries and there was demonstrable drug resistance to either Chloroquine or Sulphadoxine in all four countries.<sup>28</sup>

Attack rates from the epidemic in Burundi ranged from 68% to 203% at three sites studied.<sup>29 11</sup> Except for Ethiopia, where the malaria epidemic was reported by a malaria specific surveillance system, in the other countries the alert was issued by either the media or NGOs. Breakdown of surveillance systems during emergency situations could also contribute to delayed awareness and poor public health response which can increase mortality rates.<sup>28</sup>

## **2.9 Interventions for Malaria Prevention and Control among IDPs**

IDPs are exposed to the malaria vector and due to the living conditions such as overcrowding, heat, inadequate space and cramped housing, proven interventions like the LLIN/ITN are a challenge to use. To overcome this, the Tarpaulin used for tents can be impregnated with the chemicals at production or sprayed with the chemicals after the tents have been set up.<sup>12</sup> This will reduce parasite biting rates and blood sucking and also protect as many as sleep within treated tents. LLIN/ITN can also be used to cover eaves to keep the vector at bay. This has been found to reduce the biting rates and incidence of malaria by about two thirds.<sup>12</sup>

Other than vector control, the use of IPT in displaced pregnant women should be advocated especially as utilization of LLIN among displaced pregnant women is usually low. An LLIN utilization rate of 35% was found after studying pregnant women in 20 IDP camps.<sup>17</sup> Pregnant women tend to be irritated with chemical smells and are intolerable of heat so find it difficult to utilize LLIN for their protection. It has also been demonstrated that poor knowledge of malaria, its preventive measures and complications arising during pregnancy and affordability, influences

the use of LLIN among displaced pregnant women <sup>31</sup> Women with poor knowledge and those without a source of income were less likely to use LLIN.<sup>17</sup> Considering that the living environment at IDP camps exposes them more than non-displaced pregnant women to mosquitoes, it becomes even more imperative to provide IPT to this vulnerable group of women. Different programs have tried to develop innovative ways of catering to women in this condition. <sup>32, 33</sup> Some of the methods include the training of refugee women and female IDPs in basic health services so they can cater to the health needs of displaced persons especially women and children within the camps. <sup>32,33</sup>.This is important as the IPT intervention is lifesaving in displaced pregnant women who are however incapacitated by resources to access health care at other routine health centers during pregnancy.

## **2.10 Predictors of LLIN Utilization**

Factors associated with LLIN utilization in under five aged children included the presence of fever or convulsion in children two weeks prior to survey, religion, wealth index, presence of health facility within the community and place of residence.<sup>14</sup> The odds of sleeping under an LLIN the night before the survey was higher in children who had a prior history of fever or convulsion, those whose caregivers were Christians and lived in communities where health facilities were present and among rural than urban dwellers.<sup>14</sup>

## **2.11 Predictors of LLIN ownership and Malaria Parasitaemia**

In the general population, predictors of LLIN ownership include having an under 5 aged child in the household, gender of household head, household size, health facility status, region, place of residence and religion.<sup>14</sup> Households which had children less than 5 years of age, with male

household heads dwelling in rural areas and Christians were more likely to own an LLIN than those who were not.<sup>14</sup> Malaria parasitaemia is associated with younger ages of household heads, male sex, those within the lower wealth index, poor knowledge and lack of income.<sup>15,16,22,37</sup>

## **2.12 Malaria Program in Nigeria (NMEP)**

Malaria in Nigeria has been targeted for elimination.<sup>8</sup> It is one of the main causes of under-five morbidity and mortality and the most common cause of out-patient visits. In 2014, a joint programme was instituted for the elimination of malaria and lymphatic filariasis.<sup>38</sup>

The Integrated Vector Management is one of the strategies employed for malaria control and elimination and LLIN is the cornerstone of this strategy. The other components of this strategy are Indoor Residual Spraying (IRS), larviciding and Environmental management also known as larval source management.

Specific targets for malaria control in the Fiscal year 2009-2013 include reduction of malaria-related mortality by 50%, to reduce malaria parasite prevalence in children under age 5 by 50% compared with a baseline prevalence of 38% in 2007 and to increase net ownership to at least 80% of households in 2010 and to sustain this in 2013. To this wise billions of dollars have been invested in the procurement and distribution of LLIN in Nigeria. From five years ago, about 24 million LLINs had been distributed to 14 states of the federation and the FCT however the FCT and 23 states of the federation did not yet have an LLIN campaign at the time of the 2010 NMIS.

## **2.13 LLIN Awareness and Ownership in IDPs**

In Nigeria, net ownership has improved from 2010 to 2015 with most of the population owning a LLIN<sup>1</sup>. LLIN ownership within the country by geographic zone ranges from 51% to 91%, lowest

in the South East, highest in the North East and also higher in Rural than Urban settlements.<sup>1</sup> This finding is contrary to studies conducted in different regions of the country which showed ownership and utilisation of treated mosquito nets was higher in the Niger Delta region than the Sahel Savannah region of the country. Despite the improvement in net ownership, universal coverage is still sub-optimal as only one third of households during the last Malaria Indicator survey in 2015 had the ideal ratio of one LLIN to two people per household.<sup>1</sup> Factors associated with LLIN ownership and coverage include, age of household head, marital status, wealth index and distance of household to nearest health centre. It was found that households with heads older than 60 years of age were more likely to own and achieve universal coverage as opposed to households where the heads were 30 years of age or younger. Similarly households with married heads were more likely to have LLINs than those in which the heads were divorced, single or widowed. In addition the households which were less than a kilometer to a health facility were more likely to own LLIN than those farther away and those within the 5th wealth quantile were more than 3 times likely to own LLIN as opposed to those in the 1<sup>st</sup> and 2<sup>nd</sup> wealth quantile.<sup>7,17,18</sup>

#### **2.14 Obstacles to LLIN use among IDPs**

In most studies, one of the major barriers to LLIN use was access in terms of affordability and the time and cost required to access a facility where the nets are distributed freely. Furthermore other barriers identified were the shape and colour of the nets. Rectangular, white nets are perceived to resemble coffins which hinders their use. Oftentimes these nets are torn or utilised for other purposes.<sup>19</sup> A study conducted among IDPs in Pakistan and Uganda identified other barriers to LLIN utilization as poor knowledge of malaria and the preventive measures available in addition to lack of training on how and when to use LLIN during distribution campaigns and failure to replace torn or worn out nets in this group.<sup>19,20</sup> Also it is purported that since children

sleep in groups on mats, the nets are not large enough to cover all the children. In addition, there is fear of fire hazard where source of light at night is open flame and children can be adventurous or accidents can occur.<sup>21</sup> Reports have been made of fire incidents which have occurred and resulted in severe burns and death.<sup>43</sup> The LLIN material burns easily when exposed to flame and sticks to skin. Also the combustible nature of the material used to produce it enables fire to spread easily. Often times the reported source of fire was open flame from candle or lantern, which are common sources of light at IDP camps and rural areas where there is high usage of LLIN.<sup>43</sup> Other barriers include heat, insufficient or inadequate nets and inadequate room space.

### **2.15 Factors associated with LLIN utilization in IDPs**

It is the eventual use of LLINs that protects the individual from the mosquito vector and so has a greater epidemiological impact than ownership of LLIN. It has been demonstrated that though the use of LLIN increases with possession, ownership of LLIN does not equate with use.<sup>22</sup> Predictors of LLIN use were nets already hanging, availability of LLIN, good knowledge of malaria and its preventive factors, access to health facility and good knowledge of beneficial effects of LLIN use and net condition.<sup>36,45</sup> It is easy to appreciate the fact that LLINs which are already hanging tend to be easier to use as opposed to nets which have to be hung each time before use. However some reasons why nets are taken down daily is to protect them from destruction by children and prolong serviceability also where there is inadequate space in living quarters where sleeping rooms also double as sitting rooms, nets tend to be taken down daily. In homes where there is adequate LLIN, Social support from government, NGOs, community leaders and household heads also determine to a large extent LLIN utilization. In homes and communities where the Community heads advocate for LLIN use, utilization is more consistent.

<sup>36</sup>Communities where positive messages on benefits of LLIN use are broadcast on television and radio report consistent LLIN use.<sup>36,34,46</sup>

Factors which hinder LLIN utilization include negative publicity arising from rumours on the harmful potential of the chemicals with which the LLIN is impregnated and reports of fire hazards.<sup>36</sup>

## **2.16 Factors affecting effectiveness of LLIN**

Countries which have successfully controlled malaria like India, Vietnam, Eritrea and Brazil used the Integrated Vector management approach. Factors which contributed to their success include community participation, data-driven decision-making and active leadership and participation of Government at all levels.<sup>23</sup> The development of Pyrethroid resistance reported in 64 countries globally and in 12 states in Nigeria has hampered the effectiveness of LLIN in malaria prevention thus promoting ineffectiveness.<sup>24,25</sup>

The use of LLIN deters mosquitoes from entering houses and also causes the mosquitoes to exit from houses in which the nets are in use. It also confers a protective effect on the community. However with the reports of resistance to Pyrethroid, in some countries and in twelve states in Nigeria, these effects may be hampered. In some communities where the coverage of LLIN was adequate, factors which hampered its use and effectiveness were mainly behavioral. Furthermore breeding sites within 20 meters of households and recent travel to other malaria endemic zones, farming of grains close to houses and inconsistencies with net use were significant factors.<sup>21,24</sup>

## **2.17 LLIN Durability**

It is advocated that LLINs can be used for three to five years. However, it has been shown that various factors which affect the durability and integrity of LLIN differ between geographic areas



and as such, regions should establish their practicable periods of durability.<sup>49,50,51,52</sup> Studies in Nigeria conducted in three different geographic zones showed a durability range of 3-4.7 years while in a neighbouring country, Benin, the serviceable period of LLIN was determined to be 2 years.<sup>50 49</sup> The durability of LLIN was found to be inversely proportional to the period of use. After six months of use, more than 90% of nets were in good condition which deteriorated over time until less than 60% of nets were durable after 18 months of use.<sup>49</sup> Factors associated with LLIN durability were wealth index, presence of rodents, households with children less than five years of age and if net was used over a bed or mat on the floor.<sup>50 10</sup> Studies in Kenya identified net washing frequency, living in estuarine communities and longer duration of use as determinants of LLIN durability.<sup>51</sup>

## **2.18 Innovations for malaria vector control at IDP camps**

Displaced persons are usually re-located or temporarily settled at either camps, collective centres or transitional centres. The terminology 'Camps' usually refer to open air settlements which has tents often times made of tarpaulin or makeshift structures or shanties as living quarters for the displaced persons. Collective centers on the other hand refer to buildings or structures such as estates or quarters which are used for the collective and communal settlement of displaced populations while Transitional centers refer to centers where displaced persons are housed for short periods of time such as schools, halls or worship centers while awaiting re-location to more conducive living quarters or settlement areas.<sup>20,42</sup>

The use of insecticidal treated bed nets such as LLIN can be implemented as malaria preventive measure at any of the displaced persons settlement type, whether camps, transitional sites or collective centers. Though the challenges encountered during utilization varies between the various settlement types. Often times the challenges encountered are, place to hang, inadequate sleeping space, size of net and heat to mention a few. At camps with tents made of tarpaulin which is the common scenario, one of the

challenges encountered which hamper LLIN use is heat. This is as a result of the heat generated from the tarpaulins used to build the tents, lack of ventilation as often times there is only one opening into the tent which is compounded by the heat from the LLIN. To help overcome these challenges, some innovations have been developed. This includes the development of insecticide-treated tarpaulin, insecticide-treated net wall hangings (NWH), insecticide-treated plastic sheets (ITPS) and mosquito proofing of night shelters<sup>30 53 54 55</sup>

The concept of insecticide-treated net wall hangings is similar to indoor residual spraying (IRS), In this case wall hangings for aesthetics and decorations are made from netting material impregnated with insecticides and so serve a dual purpose of beautifying the house and killing mosquitoes.<sup>53</sup> So in situations when IRS is impracticable or LLIN inconvenient for reasons such as heat in tarpaulin tents, then they can be utilized. Although it is advocated they are used in conjunction with LLIN. The advantage is that the challenge of hanging bed nets, unavailability of nets when washed and heat is overcome while also providing aesthetics to the dwelling. ITPS also has a similar concept with IRS and also dual purpose like NWH. In this case the plastic sheeting used to build the tent is impregnated with the insecticide so it provides shelter as well as kill the mosquito vector.<sup>54</sup> In addition it also addresses some of the challenges faced with the use of LLIN like hanging, inadequate nets or sleeping space, washing and heat

## **CHAPTER THREE**

### **METHODOLOGY**

#### **3.1 Study Area**

The study was conducted in the Federal Capital Territory which is located between latitude 8.25 and 9.20 north of the equator and longitude 6.45 and 7.39 east of the Greenwich Meridian. It falls within the Savannah region with moderate climatic conditions, is endemic for malaria and has perennial malaria transmission. It has an estimated population of 2,238,800 and is geographically located in the North central which has a malaria prevalence of 49.4%, higher than the National malaria prevalence of 42%.

The FCT has 6 Area councils with rural, semi-urban and urban settlements. Though the FCT is well planned with drainage and waste disposal systems in place, the area where the IDPs settlements are located have poor drainage systems, indiscriminate disposal of waste, vegetation and bushy surroundings and so provide breeding grounds for the vector.

There are seven IDP settlements located within the FCT. Three of these are camp like sites while the rest are in host communities where the IDPs reside with host families, rent accommodation or live in abandoned houses within the communities or settlements. The three Camp like sites are in AMAC Area Council and located at New Kuchingoro, Wassa and Area 1. Other host communities are cited at Wassa, Jikwoyi, Karu, Orozo, Lugbe and one host community at Pegivillage in Kuje area council.

New Kuchingoro IDP camp is situated at Kuchingoro AMAC about 20 meters from the popular Games Village Abuja. The settlement is made up of makeshift tents to house families and an open space/field for a school. The main source of water is a borehole which supplies water to 2

Geepee tanks with taps attached for community use. There are 3 toilets and bathrooms to serve the entire population of 1523 people. There is no proper drainage system so around bathrooms and the water points, water tends to stand. The IDP camp Kuchingoro has 150 households registered and has 190 women, 931 men and 402 children. The camp has a Chairman, a Secretary, Storekeeper and 7 Tribal heads to aid in administration of the camp. There is no security post at the camp and it is surrounded by bush, trees and farmland.

The Area 1 IDP camp is located after the Dunamis and Redeemed Churches at Area 1 Abuja. It has an estimated population of 2226 people with 221 children. Unlike the camp at New Kuchingoro, there are no bathrooms or toilets available except commercial ones which require payment before the facility can be used so there is a lot of indiscriminate dumping of human waste. The main source of water is borehole which supplies tanks provided by NGOs. The housing units are mainly makeshift tents made from tarpaulin which usually have only one opening a door and no windows. The camp site is also surrounded by a thickset of trees and farmland and has no drainage or waste disposal system in place.

The third Camp is located at Wassa which is 20 kilometers from Abuja town unlike the camps at New Kuchingoro and Area 1, the camp at Wassa is a collective center where the IDPs live in previously constructed but abandoned houses or quarters. Here the housing units have bathroom and toilet facilities however not all households can utilize them because of water shortage as some houses are located more than 1km from the borehole.

## **3.2 Study Design**

A Descriptive cross-sectional household survey was carried out to determine the prevalence of malaria, ownership and use of LLINs in children aged 6-59 months at IDP camps in Abuja.

## **3.3 Study Population**

This consists of internally displaced mother-child pairs with children aged 6 - 59 months of age who live in internally displaced persons camps (IDP) within Abuja

### **3.3.1 Inclusion criteria**

- Internally Displaced Children aged 6-59 months living within IDP camps Abuja

### **3.3.2 Exclusion criteria**

- Eligible Children who have taken any anti-malarial treatment  $\leq$  3 weeks prior to sampling
- Children who are taking anti- malaria prophylaxis
- Children who are severely sick

## **3.4 Sampling Technique**

There was total enumeration of all eligible children at the three Camp like sites within Abuja. In households with more than one eligible child, all eligible children were recruited and the youngest child identified as the index child, to whom maternal details were linked to avoid duplication.

## **3.5 Definitions**

3.5.1 Household: a group of people with an identified, common head, eating together and regularly sleeping under the same roof.

3.5.2 IDP: someone forced to flee from his or her home but remains within the country's border

3.5.3 Index child: The youngest child by age in a household

3.5.4 LLIN ownership: Availability of at least one LLIN in a household

3.5.5 LLIN utilization: Child aged 6-59 months slept under an LLIN the night before the survey

3.5.6 LLIN universal coverage: Proportion of households that have at least one LLIN to two persons in the household

### **3.6 Study Instruments**

Two structured interviewer administered questionnaires with close and open ended questions, adapted from the 2015 Malaria Indicator survey was used to collect information on the household and child. The questionnaire was uploaded on the Open Data Kit (ODK) platform so Android phones and tablets were used to collect real time data.

1. Household questionnaire was used to collect information on the socio-demographic characteristics of the Caregivers, number of household members, state of residence before displacement, reason for displacement, duration of stay in camp and type of housing or shelter structure
2. Child questionnaire collected information on demographic characteristics, risk factors for malaria, net ownership and utilization.
3. Thermometers were used to collect Clinical measurements of axillary temperature.

4. Blood samples were collected from eligible children and checked for malaria parasitaemia using Rapid Diagnostic Test (RDT) kits and microscopy of thick and thin blood films stained with 3% Giemsa.

### **3.7 Data Collection Method**

A structured interviewer administered questionnaire was used. The questionnaires were pre-tested after which two variables, Religion and Duration of stay in the camp were included and skip patterns incorporated to serve as quality checks. For the three enumeration areas, three, eight and nine research assistants (interviewers) for New Kuchingoro, Area 1 and Wassa respectively were trained on the study protocol, administering the questionnaires, capturing data on the ODK and two Laboratory Technicians were trained on sample collection and processing.

ODK was used to collect real time data on the field while hard copies were also filled as back up.

Finger prick samples for RDT and malaria microscopy were collected from eligible children to test for malaria parasitaemia. The slides prepared and RDT kit cassettes were labelled with the respondent's unique identifier so that the results could be linked to respondents in data analysis

### **3.8 Laboratory Methods**

#### **3.8.1 Sample Collection**

Blood samples were collected aseptically by finger prick using a sterile single use 2.2 mm Lancet for RDT and preparing thick and thin blood smears for malaria microscopy.

The sample were collected from the lateral side of the second finger of the left hand. 70% alcohol will be used to swipe the pulp of the selected finger, allowed to air dry then a little pressure applied and a quick stab with the lancet.

The first drop of blood was wiped off with absorbent cotton wool, then the second drop applied to the RDT kit cassette sample window and a third drop of blood applied to the middle of the labelled, clean, grease, free slide for the thin film preparation. Further pressure was applied to the pricked finger and two drops of blood put on the slide, about one (1) cm from the drop for thin film for the thick film. The remaining blood on the finger wiped off using cotton wool.

With the slide on a firm flat surface, the drop of blood for the thin film was spread with another clean slide which was placed at the edge of the drop of blood and aligned at 45<sup>0</sup>C, the blood was allowed to run along the edge of the spreader after which it is spread (away from the drops of blood meant for the thick film) to the opposite edge of the slide, maintaining the spreader at 45<sup>0</sup>C.

For the thick film, the corner of the spreader was used to spread the drops of blood into an even, circular, film about 1 cm in diameter.

The films were allowed to air dry on racks in a safe, dust free environment protected from heat and sunlight. The dried thin films were fixed with absolute methanol

### **3.8.2 Sample Storage and Transportation**

The dried thick and fixed thin blood films were stored and transported in slide boxes to the designated Laboratory daily at the end of the days field work for further processing and reading.

### **3.8.3 Sample Processing**

The thin and thick films were stained with 3% Giemsa stain for 45 minutes, allowed to dry and then read by a certified microscopist. The thin films were checked for specie identification of the malaria parasites and the thick films for parasite density



#### **3.8.4 Malaria RDT test result interpretation**

The RDT were read after 15 minutes according to manufacturer's instructions. A band appearing at both the test and control windows was interpreted as positive, a band at only the control window was negative while no band showing at the control window irrespective of the appearance of a band at the test window was taken as an invalid result. The RDT result was given verbally to the parent or care giver and then documented on the result slip section of the questionnaire.

#### **3.8.5 Malaria microscopy test result interpretation**

The thick films were used to determine malaria density. An oil immersion field examined under the microscope at  $1000\times$  magnification is considered a high power field (HPF). A 100 HPF were examined for malaria parasites and the number of parasites and white blood cells detected per thick film were recorded to determine the parasite density.

A thick smear was taken as negative if there were no parasites detected after examination of 100 HPF

#### **3.8.6 Quality Control**

The RDT kits were stored and the tests performed according to the manufacturer's instructions. The internal control of the RDT kit was used to determine valid and invalid results while daily known positive and known negative samples were used to quality control the RDTs.

For each set of slides to be stained, the stains were used to stain known positive and known negative slides and read by a certified Microscopist. 5% of the positive and negative slides were rechecked for consistency and quality control by a certified microscopist.

### **3.9 Data Management**

The structured questionnaires were checked manually for completeness, adherence to skip patterns and running frequencies on all variables while for the ODK platform, required responses, skip patterns and prompts when out of range values are imputed were incorporated into the software. The data collected was cleaned and backed up on external hard drives and CD ROMS.

Cleaning was done by running frequencies on all variables and checking for incompletely filled variables and fields

Hard copies of data collected (questionnaires and notes taken) were locked up safely and will be stored for 5 years minimum with restricted access. Electronic data was backed up and stored on external hard drives and CD Roms All electronic data will be encrypted and pass-worded to restrict access.

### **3.10 Data Analysis**

3.10.1 *Independent variables*: Demographic variables (Age, sex, education, socio-economic factors and occupation of parents/care givers, malaria risk factors (breeding sites, malaria preventive measures) House hold variables ( number of people in household, duration of stay in camp, place of residence before displacement and reason for displacement), LLIN variables (Number of holes in net, duration of use, duration of ownership, number of times net

has been washed, how net is dried, education on how to use LLIN, number of times net has been re-treated)

3.10.2 *Dependent variables*: Malaria parasitaemia, LLIN ownership and utilization.

### **3.11 Statistical Analyses**

Univariate analyses was done for discrete variables using frequencies, proportions and means. For Bivariate analysis the test statistic used was Chi square and confidence intervals (CI) and odds ratio (OR) was used to show associations. Multivariate analysis was done on statistically significant associations to determine the predictors of the dependent variables. Significance level was set at alpha less than 0.05. Data collected was analysed with EpiInfo version 7.1.2.6

### **3.12 Ethical Considerations**

Ethical approval was obtained from the Federal Capital Territory Health Research Ethics Committee Abuja with reference code FHREC 2016/01/10 /22-02-16.

3.12.1 Consent: Consent to participate was obtained from parents or care givers of eligible children and a consent form was duly signed consenting parents and or caregivers.

3.12.2 Maleficence: No harm was done to subjects recruited. They were allowed to withdraw from the study at any time and not coerced to participate.

3.12.3 Beneficence: Furthermore, children who were positive for malaria with the RDT were treated with ACT's according to the national guideline. Other eligible children were treated with Combantrin deworming agent with dosage according to age and body weight

3.12.4 Justice: Respondents were not coerced, forced or threatened to participate and were allowed to withdraw from the study at any point.

3.12.5 Confidentiality: All information obtained from respondents was protected. The questionnaires and laboratory samples were given unique identifiers to protect and conceal the identity of respondents. Hard copies of filled questionnaires were retrieved and access restricted by locking them up while soft copies and questionnaires uploaded to the server were password protected.

### **3.13 Limitations**

The malaria RDT kit was specific for *Plasmodium falciparum* so malaria caused by other species may not have been detected.

Since the LLIN is utilized during sleeping at night, mosquito bites which occur at other times when the child is outside the net which may occur during playtime or sleeping time before taken to bed and may be a confounding factor

The study also required maternal recall of LLIN use which could not be verified however, the duration of recall was kept at one month and utilization of LLIN was verified by viewing the LLIN to see if it was hanging.

All eligible children in the household were recruited so variables like LLIN ownership would have been duplicated.

## CHAPTER FOUR

### 4.0

### RESULTS

Table 1: Demographic variables of children aged 6-59 months at IDP camps in Abuja (n=393)

Variable	Frequency	Percentage (%)
<b>Age (months)</b>		
6-11	49	12.5
12-23	72	18.3
24-35	68	17.3
36-47	80	20.4
48-59	124	31.5
<b>Sex</b>		
Female	203	51.6
Male	190	48.4
<b>Religion</b>		
Christianity	172	43.8
Islam	221	56.2
<b>Enumeration area</b>		
New Kuchingoro	50	12.7
Area 1	110	28.0
Wassa	233	59.3

A total of 393 children aged 6-59 months from 242 households, within the 3 Internally Displaced Persons camps in Abuja were recruited into the study. The mean age was  $33.3 \pm 17.4$  months and the age group 48-59 months had the highest percentage (31.5%) of study participants. More respondents were female (51.6 %), Muslims (56.2%) and from the IDP camp in Wassa (59.3%) (Table 1).

Table 2: Socio-demographic variables of mothers and households of children aged 6-59 months at IDP camps Abuja

Variable	Frequency	Percentage (%)
<b>Age of mother (years)</b>		
15-19	5	2.2
20-24	74	32.5
25-29	73	32.0
30-34	39	17.1
35-39	24	10.5
>39	13	5.7
<b>Educational status of mother</b>		
None	104	45.6
Primary	40	17.5
Secondary	83	36.4
Tertiary	1	0.5
<b>Number of household members</b>		
1-3	49	21.3
4-6	107	46.5
7-9	59	25.7
>9	15	6.5

<b>Duration of stay in camp (months)</b>		
<6	15	7.0
6-11	13	6.1
12-17	34	15.8
18-23	18	8.4
24-29	116	54.0
>29	19	8.8
<b>Place of residence before displacement</b>		
Adamawa	3	1.3
Bauchi	3	1.3
Plateau	7	3.1
Borno	201	88.94
Others	12	5.3
<b>Religion</b>		
Christianity	100	42.5
Islam	135	57.5
<b>Enumeration area</b>		
New Kuchingoro	31	12.8
Area 1	75	31.0
Wassa	136	56.2

Out of the 242 households surveyed, more than half (56.2%) were living at the Wassa IDP camp. Duration of stay ranged from 1 to 90 months with a median of 25 months. More than half of the households, 116 (54.0%) had stayed for a duration of 24-29 months. The number of household members ranged from 2 to 16 with a median of 5 and most households 107 (46.5%) had 4 to 6 members.

The mothers of the study participants were mainly in the 20-24 year age group (32.5%) most (104; 45.6%) had no formal education, were muslims (135; 57.5%) and had been displaced from Borno State (201; 88.9%) (Table 2).



Table 3: Test results of children aged 6-59 months at IDP camps Abuja

Malaria test	Frequency	Percentage (%)
<b>RDT</b>		
Positive	117	30.5
Negative	266	69.5
<b>Microscopy</b>		
Positive	129	48.1
Negative	139	51.9

The prevalence of malaria among the children aged 6-59 months was 30.5% and 48.1% with RDT and malaria microscopy respectively (Table 3).

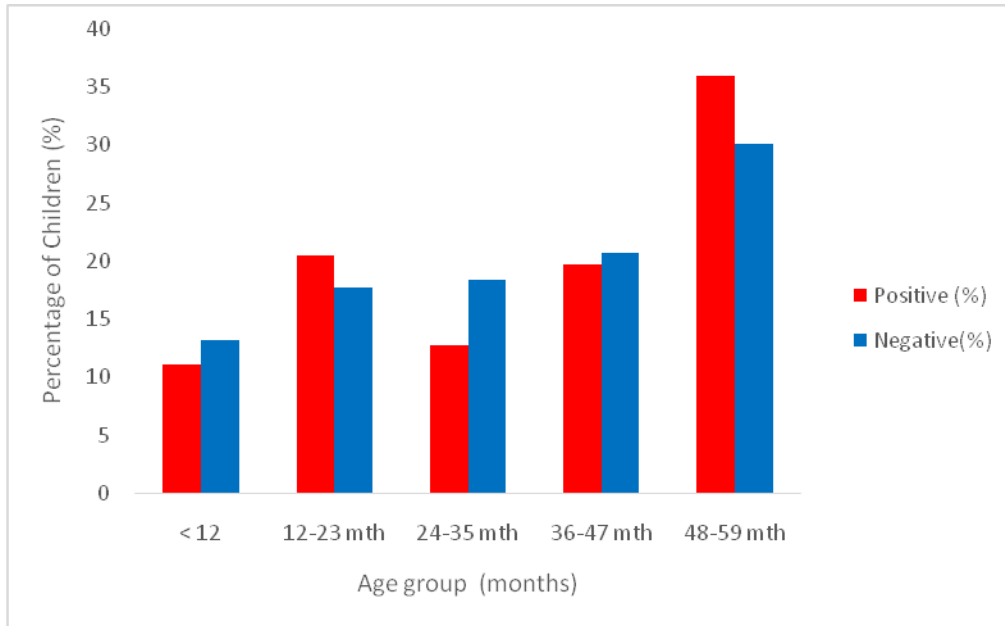


Figure 1: Distribution by age group of children aged 6-59 months at IDP camps Abuja according malaria test results

The older age group 48 -59 months had the highest number of malaria positive clients (42; 35.9%) while the youngest age group less than 12 months of age had the least number of positive clients (13;11.1%) (Figure 1).

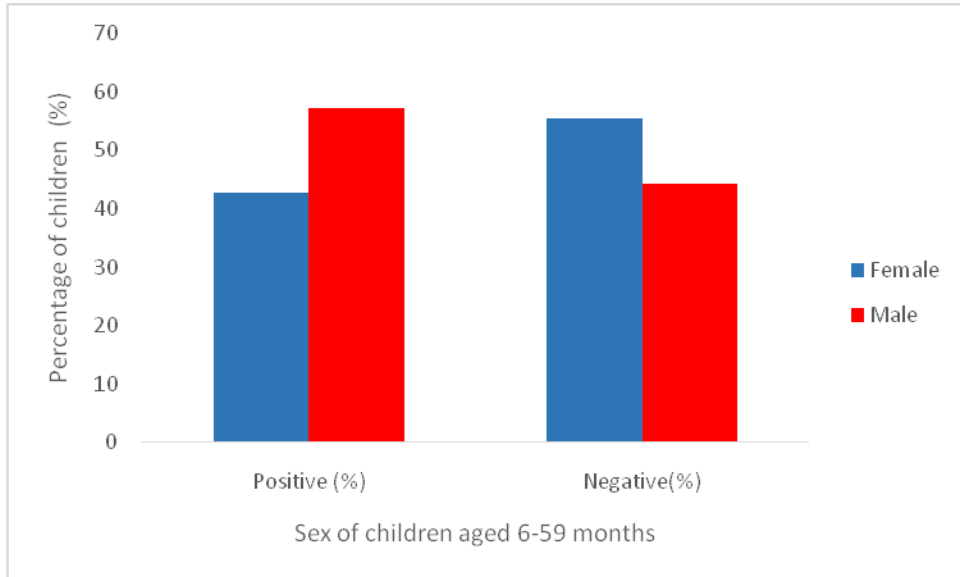


Figure 2: Distribution by sex of children aged 6-59 months at IDP camps Abuja according to malaria test results

More males (67; 57.3%) were positive

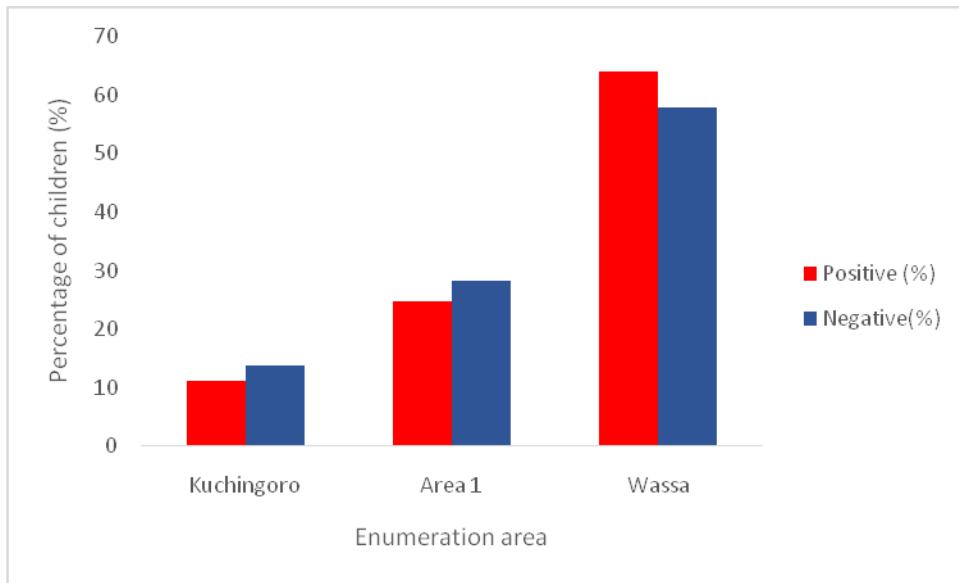


Figure 3: Distribution by enumeration area of children aged 6-59 months at IDP camps Abuja according to malaria test results

More children from the Wassa IDP camp were positive (75; 64.1%).Kuchingoro camp had the least number of respondents as well as children with parasitaemia (Figure 3).

Table 4: Ownership and characteristics of LLIN among children aged 6 -59 months at IDP camps Abuja

LLIN Characteristics	Frequency	Percentage (%)
<b>Own LLIN</b>		
Yes	290	74.5
No	99	25.5
<b>Number of nets owned</b>		
1	147	50.7
2	118	40.7
3	22	7.6
4	3	1.0
<b>Source of LLIN</b>		
Church/Mosque	14	4.8
Hospital	10	3.5
Malaria programme & supermarket	4	1.4
NGO	107	36.9
Net distribution campaign	39	13.5
Shop/supermarket/open market	80	27.6
Other	5	1.7
<b>Bought</b>		
Yes	88	30.3
No	202	69.7
<b>Holes in LLIN</b>		
Yes	158	55.6
No	126	44.4
<b>Ever washed</b>		
Yes	272	94.4
No	16	5.6
<b>Number of times washed</b>		
< 6	140	52.8
6-10	91	34.4
>10	34	12.8
<b>Where dried</b>		
Shade	82	31.3
Sun	180	68.7
<b>Net Hanging</b>		
Yes	236	81.7
No	53	18.3

The data of three hundred and eighty nine children aged 6-59 months at the camps was analyzed for LLIN ownership, coverage and utilisation. Of these, 290 (74.5%) respondents owned LLIN and half of them (147; 50.7%) had at least one LLIN. The most common source of nets were Non-Governmental Organisations (NGO) (107; 36.9%) and only 88 (30.3%) of the nets had been bought. Duration of LLIN ownership ranged from 2 days to 42 months with most of the participants 114 (39.9%) owning LLINs for 7 to 12 months. More than half of the LLINs, 158 (55.6%) had holes, 272 (94.4%) had been washed at least once with more than half of the nets (140; 52.8%) washed between 1 to 5 times. Of those washed, 180 (68.7%) were dried in the sun and 236 (81.7%) of the LLINs were observed hanging at the time of the survey. Table 4

Table 5: LLIN ownership, coverage and utilization of households with children aged 6-59 months at IDP camps in Abuja

Variable	Frequency	Percentage (%)
<b>Households with LLIN (Ownership)</b>		
Yes	178	76.7
No	54	23.3
<b>Ratio of HH members to LLIN (Coverage)</b>		
$\leq 2$	26	11.2
$>2$	152	65.5
0	54	23.3
<b>Slept under LLIN night prior to survey (Utilisation)</b>		
Yes	260	89.7
No	30	10.3

Of the 232 households analyzed, majority, 178 (76.7%) had LLINs however, the ratio of household members to LLIN owned showed that only 26 households (11.2%) had the ideal ratio of one LLIN to two people and out of the 290 children who had LLINs, 260 (89.7%) slept under the net the night before the survey, Table 5.

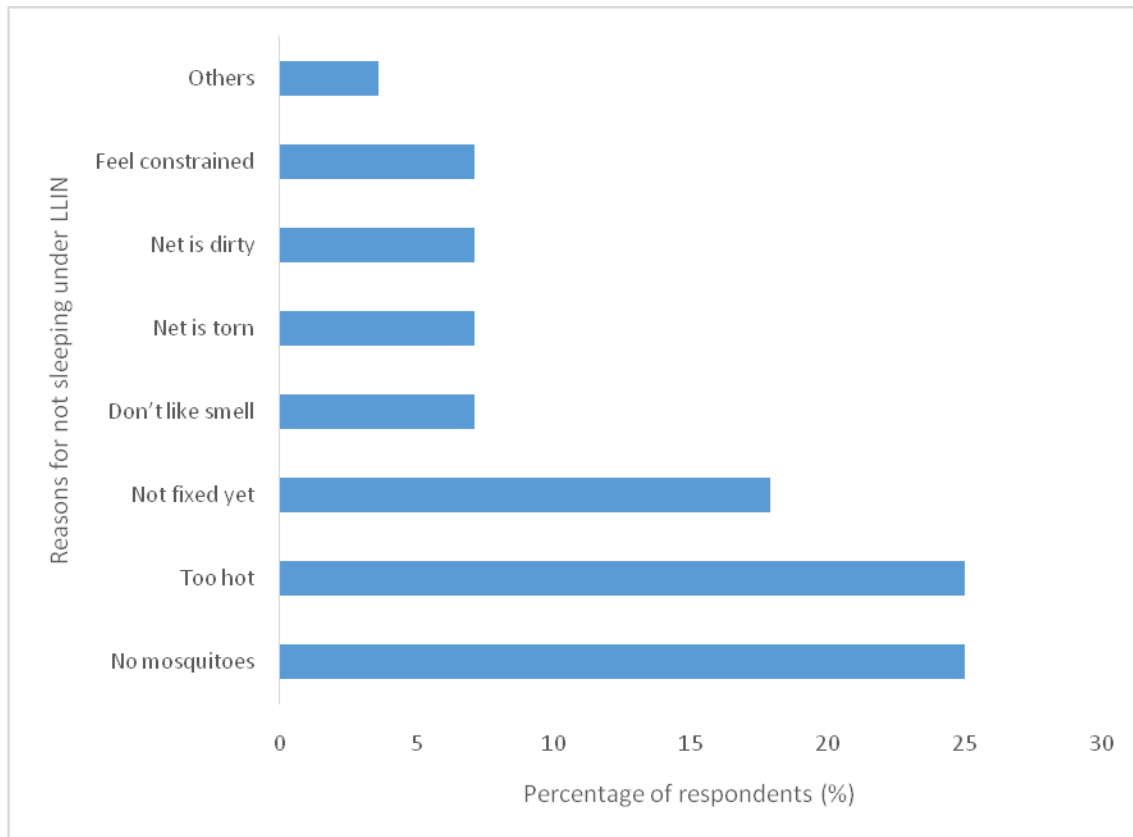


Figure 4: Reasons proffered by respondents for not sleeping under the LLIN the night prior to the survey at IDP camps Abuja

For the 30 respondents who didn't, the most common reasons proffered was it being too hot (25.0%) and not liking the smell (25.0%). Other reasons were the room being too small, yet to wash the LLIN as instructed and had used other preventive measures like mosquito coil (Figure 4).



Table 6: Factors associated with LLIN use among children aged 6-59 months at IDP camps

Variable	Used LLIN	Did not use LLIN	OR	Chi square	p-value (<0.05)	95% CI
<b>Sex</b>						
Female	139 (90.3)	15(9.7)	1.1	0.13	0.78	0.54-2.45
Male	121(89.0)	15 (11.0)				
<b>Age group (months)</b>						
<36	127 (90.7)	13 (9.3)	1.2	0.33	0.57	0.58-2.68
36-59	133 (88.7)	17 (11.3)				
<b>Religion</b>						
Christianity	134 (93.7)	9 (6.29)	2.4	4.99	0.03	1.10-5.62
Islam	126 (85.7)	21 (14.3)				
<b>Net Hanged</b>						
Yes	232 (98.3)	4 (1.69)	55.9	104.4	< 0.001	18.12-172.14
No	27 (50.9)	26 (49.1)				
<b>Net free</b>						
Yes	77 (87.5)	11 (12.5)	0.7	0.63	0.43	0.33-1.60
No	183 (90.5)	19 (9.41)				
<b>Duration of ownership</b>						
0-6 mth	86 (83.5)	17 (16.5)	2.6	6.20	0.01	1.20-5.57
>6mth	170 (92.9)	13 (7.1)				
<b>Holes in LLIN</b>						
Yes	147 (93.0)	11 (7.0)	2.2	4.10	0.04	1.01-4.90
No	108 (85.7)	18 (14.3)				
<b>Breeding site type</b>						
Farmland/bush	205 (91.9)	18(8.1)	2.9	7.68	0.005	1.33-6.59
Stagnant water	46 (79.3)	12 (20.7)				

The odds of using LLIN was higher with nets that were hanged (OR:55.9, 95% CI:18.12-172.14), those that lived near bush and farmland (OR: 2.9, 95% CI: 1.33-6.59 ), had owned the LLIN for 6 months or less, (OR: 2.6, 95% CI:1.20-5.57 ), Christians (OR:2.4, 95% CI: 1.10-5.62), and nets with holes (OR: 2.2, 95% CI:1.01-4.90), Other factors which were not found to be statistically significant were age, sex and if nets were free or bought (Table 6).

Table 7: Factors associated with malaria parasitaemia among children aged 6-59 months at IDP camps

Variable	RDT Negative	RDT Positive	OR	Chi square	p-value <0.05	95% CI
<b>Sex</b>						
Female	148 (74.8)	50(25.3)	1.7	5.42	0.02	1.08-2.61
Male	118(63.8)	67 (36.2)				
<b>Age group (months)</b>						
<36	131 (71.6)	52 (28.4)	1.2	0.75	0.39	0.78-1.88
36-59	135 (67.5)	65 (32.5)				
<b>Religion</b>						
Christianity	118 (69.4)	52 (30.5)	0.9	0.00	0.98	0.64-1.54
Islam	148 (69.5)	65 (30.5)				
<b>Own LLIN</b>						
Yes	194 (69.0)	87 (31.0)	0.9	0.00	0.94	0.60-1.62
No	68 (69.4)	30(30.6)				
<b>Net Hanged</b>						
Yes	158 (69.3)	70 (30.7)	1.1	0.07	0.77	0.57-2.09
No	35 (67.3)	17 (32.7)				
<b>Duration of ownership</b>						
0-6 mth	76 (76.8)	23 (23.2)	0.6	4.4	0.04	0.31-0.97
>6mth	115 (64.6)	63 (35.4)				
<b>Child travel</b>						
Yes	24 (80.0)	6 (20.0)	1.9	1.78	0.18	0.73-4.70
No	228 (68.3)	106 (31.7)				
<b>Breeding site type</b>						
Farmland/bush	193 (67.3)	94(32.7)	0.5	3.0	0.08	0.31-1.08
Stagnant water	56 (77.8)	16 (22.2)				

The odds of Malaria parasitaemia was significantly higher in females (OR: 1.7, 95% CI: 1.08-2.61) and children who had traveled but not statistically significant (OR: 1.9, 95% CI: 0.73-4.70) while those who owned LLINs for less than 6 months were less likely to have parasitaemia. (OR: 0.6, 95% CI: 0.31-0.97). Other factors assessed which were not statistically significant were age, religion, net hanging and type of breeding site located 10 meters from dwelling (Table 7).

## CHAPTER FIVE

### 5.0

### DISCUSSION

The prevalence of malaria among children aged 6 -59 months was found to be high in this study. This implies one third to half of the under 5 population of IDPs had malaria at the time of the survey, especially as this is among a vulnerable group who tend to have more serious consequences from the disease thus the associated morbidity and expected mortality from the disease is high.

Though the prevalence of malaria in this study was found to be high, it is comparable to the findings from the 2015 NMIS which had an overall prevalence of 45%, 51% and 39% nationally, in the North Central Zone and in Abuja respectively.<sup>1,24</sup> This finding was among the same age group though not among similar population since it was conducted among residential, non-displaced populations. Nigeria along with the DRC accounts for a high proportion of malaria cases globally.<sup>9</sup> The prevalence of malaria in this study was more than twice what was found among IDPs in the DRC (17.5%) where a comparative study was done among children less than 5 years of age in IDP camps and non-displaced residential community. A malaria prevalence of 17.5% and 7.5% was found respectively. This finding was similar to our study where the prevalence of malaria was higher among IDPs than residential communities<sup>4,26</sup> as was also found in a research conducted in Ethiopia where the incidence of malaria was threefold higher in resettlement than non-resettlement communities.<sup>24</sup> Contrary to our study, a research conducted in China among IDPs and residential communities showed that the incidence of malaria was higher among the non-displaced residential communities than the IDP camps. This is as a result of

provision of malaria preventive commodities and effective control measures within the IDP camps as compared to the non-displaced communities.<sup>27</sup>

The China study differs from this study as the incidence of malaria was determined among all age groups unlike this which studied children aged 6-59 months. In addition, the study commenced one month after the IDP camps were established so it will be likely that facilities, supplies would still be adequate and interest from the Government and other bodies would be high. Other factors which might account for the differing results are the availability of health centers within the camps as opposed to the non-displaced villages and the focused interest on the displaced population which led to the provision of malaria preventive measures.<sup>22</sup> Considering the fact that malaria is targeted for elimination and that preventive measures against the disease are available and free in most instances, this prevalence rate is quite high. However, this is not surprising as the living and housing conditions prevalent in IDP camps, proximity of mosquito vector breeding sites to tents and dwellings and the difficulties associated with using the LLIN where available. This high prevalence highlights the need for facilities for prompt diagnosis and treatment of malaria at IDP camps so as to control the morbidity and mortality which can result and also the need for provision and utilization of malaria preventive strategies among IDPs.<sup>6,28</sup>

This study showed that a high proportion (76.7%) of the households assessed owned at least one LLIN. Thus most households at the IDPs camps are protected from the malaria vector as the LLIN has been demonstrated to have a protective effect in households in which it is used, protecting also those who don't sleep under the nets but in the same room where the LLINs are hung. IDP camps tend to have LLIN distribution from NGOs, faith based organisations, Philanthropists and malaria campaign distribution programmes which can explain the high ownership rate of nets among displaced populations. To achieve universal coverage, camp

statistics should show ratio of household membership to LLIN allocated and duration of ownership so that the efficacy and durability of the LLIN can be assured. In Nigeria, LLIN ownership has increased gradually from 44% in 2010 to 69% in 2015<sup>1</sup>. Studies done among residential households in Calabar showed that net ownership was high at 71.5%.<sup>29</sup> Though LLIN ownership among IDPs was found to be higher in our study than residential communities, the values are comparable. This is contrary to the comparative study in the DRC where LLIN ownership was found to be much higher among households in residential communities than IDP camps.<sup>4,30</sup> This might be a fallout from the fact that those in non-displaced residential communities have better purchasing power and thus access to LLINs. However universal access intends that every person at risk from malaria should have an LLIN.<sup>31</sup>

Ownership of LLIN was high, though still falling short of universal access.<sup>31</sup> A comparative study in Ethiopia found ownership rates of LLIN was less than 60% this is less than the findings among the IDP camps in Abuja however a camp in Abia State mainly focused on HIV counselling and testing, food, clothing and shelter with no records on LLIN ownership<sup>3</sup> Most interventions available at the Abia IDP camp tended towards reproductive health ,food and shelter.<sup>3</sup> In China, a research on IDPs revealed the ownership rate to be slightly more than two thirds of the IDPs (61%).<sup>27</sup> This is still lower than the ownership rates determined in this study. In spite of the high LLIN ownership rates, the coverage was quite low as only 11% of households had the ideal person net ratio which is one LLIN to two people in 80% of the population.<sup>31</sup> This is much Less than the findings from the 2015 NMIS where at least 30% of households had ideal net - person ratio.<sup>32,33</sup>

LLIN utilization was quite high in this study as 90% of children less than 5 years of age slept underneath an LLIN the night prior to the survey. This is encouraging as it denotes compliance

and acceptability of LLIN a major malaria preventive measure among IDPs. The housing conditions and prevalence of mosquito breeding sites within the camps may explain this high level of utilization. This was quite contrary to the Calabar study and the NMIS where only 35.6% and 43.4% of children less than 5 years slept under an LLIN the night before.<sup>1,29</sup> This may be because in households in non-displaced residential communities, other mosquito preventive measures like window and door nets, insecticides and IRS may be utilised unlike IDP camps where the malaria preventive measures available is limited basically to LLIN. Similar studies at IDP camps revealed the main reasons proffered for not sleeping under the LLIN the night before the survey was it “being too hot” and “not liking the smell.” This is similar to the Calabar study where the most common reason proffered for non-utilisation of LLIN was heat.<sup>29</sup>

The odds of using an LLIN was 60 times higher when the net was hanging. This is a measure of utilization of LLIN as it is much more convenient to sleep underneath an already hanging net.

Factors significantly associated with LLIN use in this study were religion and net characteristics such as the duration of ownership, presence of holes, if net was hanging and the types of breeding site close to the dwelling. The newer the nets the more likely for it to be used probably because the chance of it having hole was less. The presence of holes in nets was a factor as the odds of using LLIN was higher in those who owned nets without holes than in those with holes.<sup>29,34</sup> This can be attributed to the perceived notion that LLINs with holes are not as effective as those without holes. A case controlled study in Ethiopia revealed that the odds of using LLIN was higher in dwellings close to mosquito breeding sites as opposed to those without.<sup>18</sup> This is similar to the findings in this study where the odds of using LLIN was higher in dwellings surrounded by farmland and bushy vegetation which tend to harbor mosquitoes. Other predictors of LLIN utilization from the Ethiopia study were the age of Household head, the



distance to the nearest health facility the relative wealth index. These are factors which were not assessed in this study.

The odds of having malaria parasitaemia was higher in males and the older age group of children aged 36-59 months. This is understandable as older children tend to spend longer hours playing outside the net and at that age sleep less with the parents and can resist being put to bed under the net or occasionally roll of from underneath the nets at night.<sup>5,18</sup> The odds for Malaria parasitaemia was higher in children who traveled within a month of the survey. This is because the consistent use of mosquito preventive measures like LLIN is usually interrupted during travels.<sup>1</sup>

The predictors of malaria parasitaemia were non-use of LLIN in this study. This is a plausible finding as it aligns with scientific observations on the protective effect of LLIN in the prevention of malaria.<sup>2122</sup>

## **CHAPTER SIX**

### **CONCLUSION AND RECOMMENDATIONS**

#### **6.1 Conclusion**

The prevalence of malaria among Internally Displaced Persons aged 6-59 months living in IDP camps in Abuja was found to be high. Ownership and utilization of Long Lasting Insecticidal Treated Nets among households and in children aged 6-59 months in the IDP camps was high however, LLIN coverage was abysmally low. Significant factors associated with LLIN use were religion, duration of net ownership, if net was hanging, presence of holes in the net and the type of mosquito breeding ground close to the dwelling. The odds of malaria parasitaemia was significantly higher in males and those with LLINs older than 6 months.

#### **6.2 Recommendations**

The IDPs should cooperate in clearing the camp grounds of mosquito breeding sites to reduce the prevalence of malaria.

The camp administrators should organize regular clean up and sanitation exercises to rid the camp grounds of mosquito breeding sites to reduce the prevalence of malaria.

The Government and NGOs should organise sensitization and awareness campaigns on LLIN utilization and management to prevent malaria among the IDPs.

The camp registers which contain information on household membership should be used by NGOs, FEMA and other bodies or philanthropists during LLIN distribution campaigns in camps to ensure LLIN universal coverage.

Other mosquito preventive measures like the pre-treated tarpaulins and newer vector control innovations such as net wall hanging and Insecticide treated plastic sheeting should be incorporated by FEMA to overcome obstacles that hinder the use of LLIN in IDP camps.

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## Appendix 1

### A QUESTIONNAIRE ON THE USE-EFFECTIVENESS OF LONG LASTING INSECTICIDE TREATED NETS IN THE PREVENTION OF MALARIA

State \_\_\_\_\_ LGA \_\_\_\_\_ Enumeration area \_\_\_\_\_ Date \_\_\_\_\_

Household number \_\_\_\_\_ Questionnaire ID \_\_\_\_\_ Child number \_\_\_\_\_

#### Demography / Household and care giver information

1. Respondent/Care giver: Age \_\_\_\_\_ Sex \_\_\_\_\_
2. What is occupation of child's Father \_\_\_\_\_ Mother \_\_\_\_\_
3. Highest level of Education attained Father \_\_\_\_\_ Mother \_\_\_\_\_
4. What is your state of origin \_\_\_\_\_ Ethnic group \_\_\_\_\_
5. Religion                      Christianity                      Islam
6. For Internally Displaced Persons (IDP)
  - a. What was your place of residence before displacement?
  - b. Reason for displacement?
  - c. Are you living in Camp/Host family/ own accommodation?
  - d. What is the duration of stay here?
7. How many are you in this household? (State number) \_\_\_\_\_
8. How many children do you have? (State number) \_\_\_\_\_
9. How many are aged between 6 to 59 months (i.e. 6 months to less than 5 years)
10. Has any of your children aged 6-59 months received anti-malaria treatment in the last 3 weeks? If yes, child concerned is no longer eligible(sample other children)

#### Questions for each eligible child (circle all that apply)

11. Child age \_\_\_\_\_ (months)
12. Sex    Female                      Male
13. Has child been ill with fever in the last three (3) months? Yes                      No
14. If yes how long ago \_\_\_\_\_ (days) or \_\_\_\_\_ (weeks if greater than 7 days)
15. Any other symptoms? Headache                      vomiting                      diarrhea                      abdominal pain                      cough

16. Has he/she been given antimalarial treatment?      Yes    No
17. If yes when was treatment given?(days)\_\_\_\_\_
18. What treatment was given? (name drug)\_\_\_\_\_

**Risk Factors for Malaria**

**Recent travel**

19. Did selected child travel out of home any time in the last month? Yes      No      if No skip to que 21
20. If yes for how long did he/she travel?(days)\_\_\_\_\_

**Environment**

21. Is house located within 20m from breeding sites?(circle all that apply)
- Stagnant water   pond   blocked drainage   gutters   farmland   bush
- Others (Please specify) \_\_\_\_\_

**Use of other mosquito preventive measures**

22. Have you used any preventive measures against mosquito bites in the last one month? (Circle all that apply)
- Insecticide spray    Mosquito repellent    Mosquito coil    Herbal preparation
- Window nets    Door net    bed net Long Lasting Insecticide Nets (LLIN)
- Other measure to prevent mosquitoes? (Please specify) \_\_\_\_\_
23. Did anybody come from the government or foreign organization to spray the walls of your house with insecticide (IRS)?    Yes    No
24. If yes how long ago? (months)\_\_\_\_\_
25. How many times was it done? \_\_\_\_\_

**LLIN use/durability**

26. Do you own a mosquito net in this household? Yes    No      if yes continue; if no skip to que 51
27. Is it a LLIN? (show picture)    Yes    No      If no skip to question 51
28. If yes, how many does your household have? \_\_\_\_\_
29. Where did you get it? (Circle all that apply)
- Hospital during Antenatal    Primary Health Center    Government hospital
- Private Hospital    NGO/Mission Clinic

Malaria program      Net distribution campaign      Mosque/Church  
 Pharmacy/Patent Medicine Store      Shop/Supermarket      Open market  
 Other (specify) \_\_\_\_\_

30. Did you buy or pay for it?      Yes      No

31. If yes, how much did you pay for it? \_\_\_\_\_

32. Who usually sleeps under the net?(circle all that apply)      Mother      Father  
 Child others (please specify)\_\_\_\_\_

33. Did this child sleep under it last night?      Yes      No

34. If no, why didn't he/she sleep under it last night? (Circle all that apply) No mosquitoes  
 too hot difficult to hang      don't like smell      feel closed in  
 net too old or torn      net too dirty      net not available last night(washing)  
 Others(specify)\_\_\_\_\_

35. Has he/she (index child) been sleeping under net every night for last 2 weeks?      Yes  
 No

36. If no why? \_\_\_\_\_

37. Did he/she (index child) sleep under net every night in last 1 month? Yes      No

38. If no, why? \_\_\_\_\_

No mosquitoes      too hot      difficult to hang      don't like smell      feel 'closed in'  
 Or constrained      net too old or torn      net too dirty      net not available last night  
 (washing) feel LLIN chemicals are unsafe      LLIN provokes coughing  
 Others (specify) \_\_\_\_\_

39. How long have you had it? (months)\_\_\_\_\_

40. How long have you been using it?(days if less than 1 month) \_\_\_\_\_  
 (months)\_\_\_\_\_

41. Is it hanged?(observe)      Yes      No

42. Does the LLIN have holes? (observe)      Yes      No

43. If yes, how many holes does the LLIN have?(observe)\_\_\_\_\_ (number)

44. Is any hole as large as a child's fist? Yes      No

45. Have you ever washed it?      Yes      No

46. If yes, how many times since use? \_\_\_\_\_ (number)

47. How did you dry it?      in sun      in shade

48. Have you ever re-treated it? Yes      No

49. How many times? \_\_\_\_\_(number)
50. Were you informed on how to use it properly?      Yes    No
51. Why doesn't your household have any LLIN? (Select all that apply)
- No need    Too hot    Cost    Not useful    Not comfortable to use    don't like the chemicals    don't like smell    No place to hang net    No mosquitoes have window netting
- Others (specify) \_\_\_\_\_

**Wealth index**

52. What is the main source of drinking water for members of your household?
- Piped water: Public tap/standpipe    piped to yard/plot    Piped into dwelling  
 Borehole:    hand pump    piped to yard/plot    Piped into dwelling  
 Dug well:    protected well                                  unprotected well  
 Surface water: River    Pond    Stream  
 Rainwater  
 Purchased water: Tanker truck                          Water peddler    Bottled water    Water    sachet    (pure water) others (specify) \_\_\_\_\_

53. What kind of toilet facility do members of your household usually use?
- Flush toilet:** piped sewer system    flush to septic tank    flush to pit latrine  
**Pit latrine:** Ventilated improved pit latrine    pit latrine with slab    pit    latrine    without slab/open pit  
 Bucket toilet  
**No facility**    bush/field    Others (specify) \_\_\_\_\_

54. Does your household have any of the following items which are in good working order: (circle all that apply)
- Electricity?    Radio?    Television?    Mobile telephone?    Non-mobile telephone?  
 Refrigerator?    Cable TV?    Generating set?    Air conditioner?    Computer?    Electric iron?    Fan?

55. What type of fuel does your household mainly use for cooking? (select most appropriate)
- Electricity    cooking gas    kerosene    coal    charcoal wood                          agricultural crop
- Others (specify) \_\_\_\_\_

56. Main material of the floor of the household ( record observation)
- Natural floor:** earth/sand/mud  
**Rudimentary floor:** wood/ planks  
**Finished floor:** parquet or polished wood    floor mat, linoleum, vinyl    ceramic tiles  
 Concrete,    cement    carpet
- Others (specify) \_\_\_\_\_

57. Main material of Roof (record observation.)

Natural roofing: thatch/palm leaf

Rudimentary roofing; palm/bamboo/mats wood planks tarpaulin plastic

Finished roofing: Zinc/Metal wood ceramic tiles concrete, cement asbestos sheets

Other (specify) \_\_\_\_\_

58. Main material of the outside walls of the house household. (record observation)

Natural walls: mud and sticks cane/palm/trunks straw, thatch mats

Rudimentary walls: mud bricks plywood, reused wood cardboard, plastic

Finished walls: cement or stone blocks/ bricks Wood planks/shingles

Other (specify) \_\_\_\_\_

59. How many rooms do you have in your house? (Total) \_\_\_\_\_

60. How many rooms are used for sleeping in your household? \_\_\_\_\_

61. What is the income of the breadwinner in the household? \_\_\_\_\_

62. Does your child have any symptoms of illness today? If yes (please specify)

Fever vomiting headache stomach pain diarrhea cough

**Thank you for your time**

### **Clinical measurements**

Temperature \_\_\_\_\_<sup>0</sup>C Weight (Kg) \_\_\_\_\_ Mid-upper arm circumference (cm) \_\_\_\_\_

### **Test Result**

63. RDT Positive \_\_\_\_\_ Negative \_\_\_\_\_

**Appendix 2**

**CONSENT FORM**

**Consent to participate in research on the Use-effectiveness of Long Lasting Insecticide Treated Nets in the prevention of Malaria**

My name is Joan Ejembi and I am a Masters Student from Ahmadu Bello University Zaria. I am conducting a study on the effectiveness of the Long Lasting Insecticide Treated Bed nets (LLIN) in the prevention of malaria. This is to assess the LLIN intervention and help improve the program. In the course of this interview we will ask questions about your household and will do a finger prick for blood to test for malaria in your children between 6 to 59 months. If the malaria test is positive your child will be offered treatment. The equipment used in taking the blood is clean, completely safe, has never been used before and will be discarded after use on each participant.

This study will take about 30 minutes of your time. Please note that your participation is voluntary and you can withdraw at any time however, we hope you will participate as your view is important. There is no risk to you or your child participating in this study other than the discomfort felt from the finger prick.

All the information you provide and the test results will be confidential.

Do you have any questions you would like to ask me?

Do I have your permission to continue?

Please demonstrate your approval by appending your name, signature and date to the form.

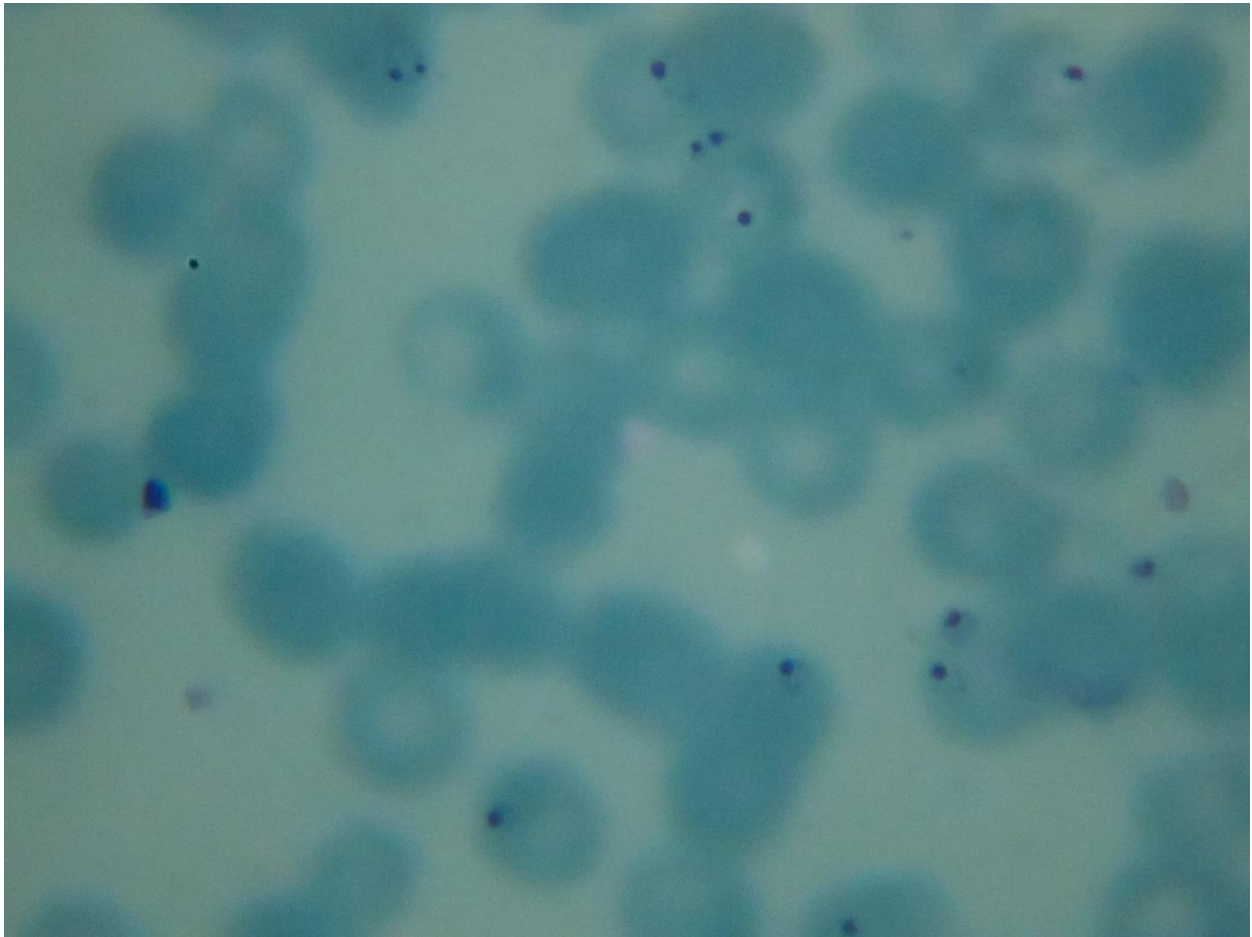
Thank you for your time.

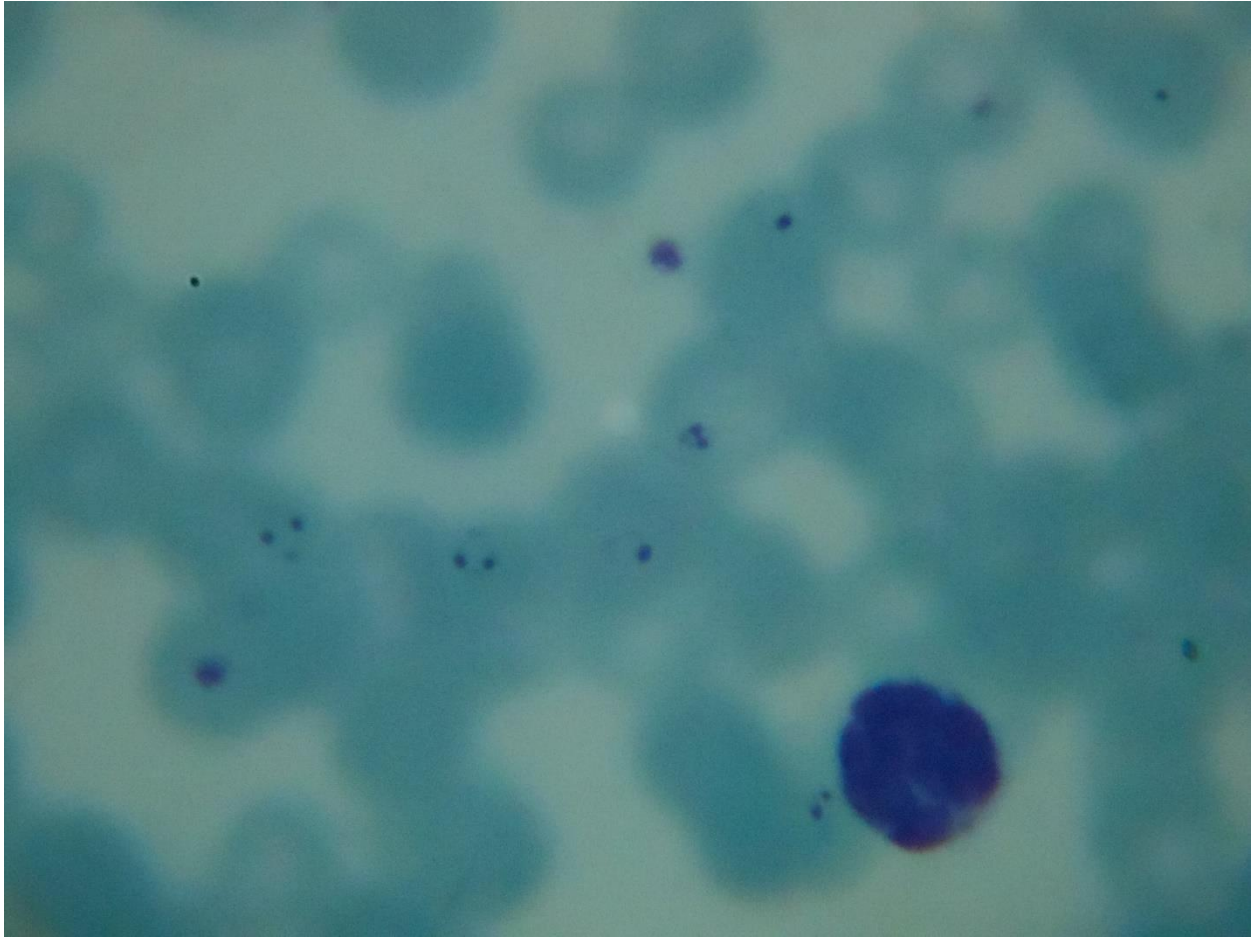
Interviewer Name \_\_\_\_\_ Signature \_\_\_\_\_ Date \_\_\_\_\_

Respondent Name \_\_\_\_\_ Signature \_\_\_\_\_  
Date \_\_\_\_\_

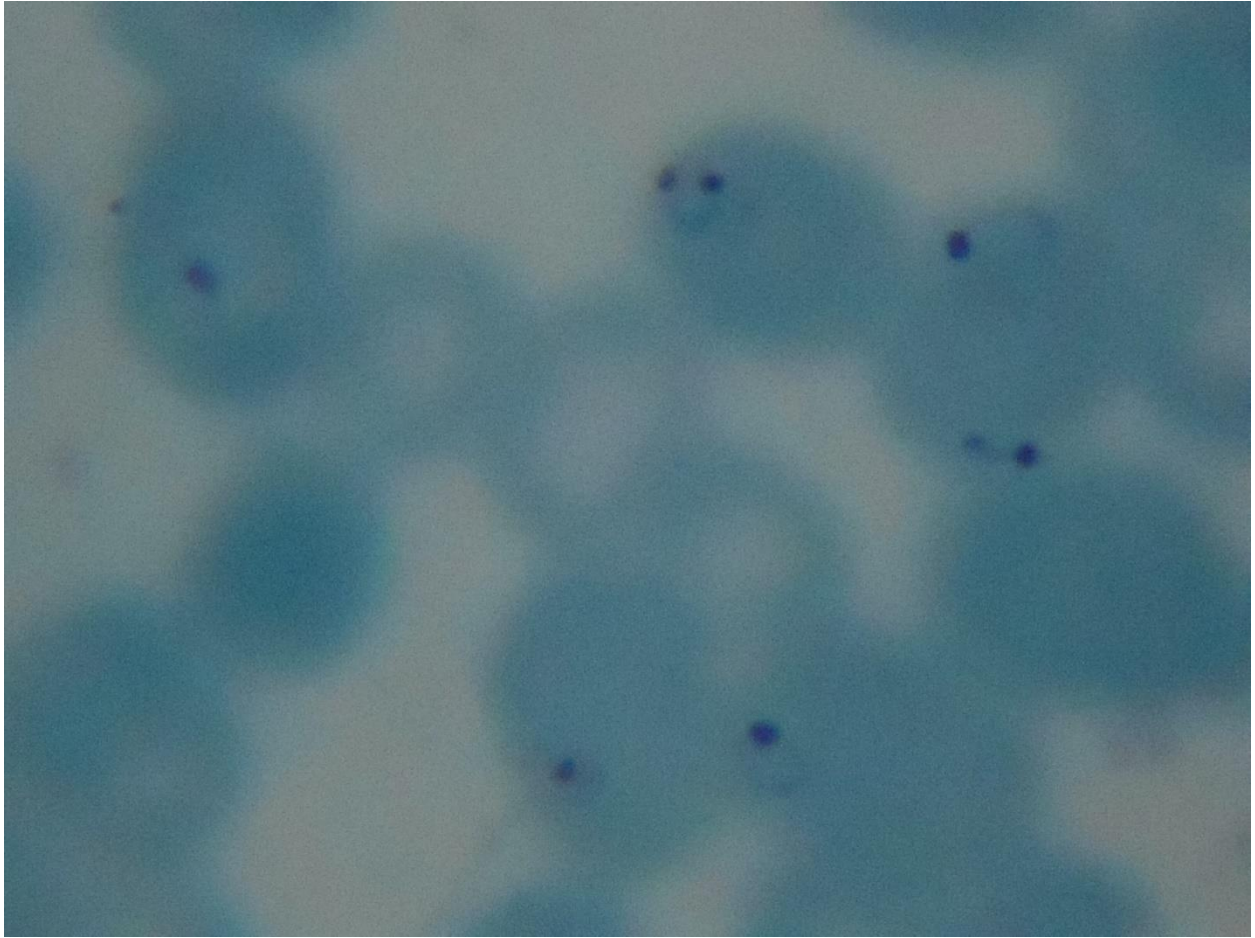
### Appendix 3

#### Micrograph of parasitised RBC 1









**Appendix 4**  
**Ethical Clearance**



**FEDERAL CAPITAL TERRITORY**  
**HEALTH RESEARCH ETHICS COMMITTEE**

Research Unit, Room 10, Block A Annex, HHSS  
FCT Secretariat No. 1 Kapital Street Area II, Garki, Abuja - Nigeria

Name of Principal Investigator: Dr. Ejembi Joan  
Address of Principal Investigator: Dept. of Med. Microbiology, ABUTH, Zaria, Kaduna State.  
Date of receipt of valid application: 10/02/2016

**Notice of Research Approval**  
Protocol Approval Number: FHREC/2016/01/10/22-02-16

**Study Title: Comparative Study on the Use-Effectiveness of Long Lasting Insecticide Treated Nets in the Prevention of Malaria**

This is to certify that the FCT Health Research Ethics Committee (FCT HREC) has approved the research described in the above stated protocol.

Approval Date: - 22/02/2016  
Expiration Date: - 21/02/2017

Note that no activity related to this research may be conducted outside of these dates. Only the FCT HREC approved informed consent forms may be used when written informed consent is required. They must carry FCT HREC assigned protocol approval number and duration of approval of the study.


The National Code of Health Research Ethics requires you to comply with all institutional guidelines, rules and regulations, and with the tenets of the code. The FCT HREC reserves the right to conduct compliance visit to your research site without prior notification.

**Modifications:** Subsequent changes are not permitted in this research without prior approval by the FCT HREC.

**Problems:** All adverse events or unexpected side effects arising from this project must be reported promptly to FCT HREC.

**Renewal:** This approval is valid until the expiration date. If you are continuing your project beyond the expiration date, endeavor to submit your annual report to FCT HREC early, and request for renewal of your approval to avoid disruption of your project.

**Closure of Study:** At the end of the project, a copy of the final report of the research should be forwarded to FCT HREC for record purposes, and to enable us close the project.

  
Desmond Emereonyeokwe  
For: Secretary, FCT HREC  
February 22, 2016

