MOSQUITO AVOIDANCE PRACTICES AND CORRELATES AMONG CARE-GIVERS OF UNDER-FIVE CHILDREN AT SOMOLU LOCAL GOVERNMENT AREA, LAGOS STATE.

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CERTIFICATION

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DEDICATION

To God, my help in ages past, my hope for years to come and my exceeding great reward.

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ABSTRACT

Malaria control efforts currently lay emphasis on reducing transmission by limiting human-vector contact. Meanwhile, Mosquito-Avoidance Practices (MAPs) have been shown to be sub-optimal in urban areas especially among under-five Children (U-5C) resulting in high child morbidity and mortality. More studies have been carried out on MAPs in rural areas leaving urban areas understudied. This study was therefore designed to investigate MAPs among care-givers of U-5C living in Somolu, an urban Local Government Area (LGA) in Lagos State.

A cross-sectional survey involving 394 female care-givers of U-5C selected using the Lot Quality Technique sampling method was conducted. The LGA was stratified into three based on the level of planning and drainage using Geographic Information System: well-planned well drained stratum (S1), well planned poorly drained stratum (S2) and unplanned and poorly drained stratum (S3). Data were collected using a semi-structured, interviewer-administered questionnaire, which elicited information on socio-economic characteristics, number of times U-5C had suspected malaria in the preceeding year, MAPs, bednet ownership and usage. Principal component analysis was used to calculate the household wealth index by listing household assets owned and categorized into five quintiles (poorest, second, third, fourth and richest quintiles). Data were analysed using descriptive statistics and Chi-square test at p=0.05.

Age of respondents was 33.6±7.7 years. The proportion that earned ≥₦60,000 monthly in all strata were: S1-5.1%, S2-5.3% and S3-4.3% while those with tertiary education were: S1-78.0%, S2-10.2% and S3-11.9%. Malaria transmission was attributed mostly to mosquito bites in all strata: S1-58.3%, S2-56.1% and S3-61.4%. The proportion of U-5C who had two episodes of suspected malaria in the preceeding year by strata were: S1-40.1%, S2-38.6% and S3-30.0%. The proportions who mentioned the mosquito net as a MAP by strata were: S1-59.3%, S2-80.7% and S3-64.3%. The most reported MAP among U-5C was bednet: S1-64.4%, S2-68.4% and S3-62.9%. Other MAPs reported included: spraying insecticide: S1-20.5%, S2-26.3% and S3-17.1%, shutting door after sunset: S1-9.6%, S2-10.5% and S3-11.4%, and clearing surroundings: S1-2.9%, S2-5.3% and S3-2.9%. Ownership of bednet was: S1-76.0%, S2-75.4% and S3-68.6% and out of these, S1-73.1%, S2-70.7% and S3-

72.4%, reported that their child slept under the net the night before the survey. The MAPs across strata were not significantly different. Overall, 22.4% were in the richest quintile comprising: S1-79.5%, S2-9.1% and S3-11.4%. Majority of the respondents used just a single measure to prevent mosquito bite: S1-86.5%, S2-84.2% and S3-90.0%. Monthly earning ≥₦60,000, being in the richest wealth quintile, having tertiary education and knowing mosquito breeding site to be stagnant water were significantly associated with the use of multiple MAPs.

The most common mosquito-avoidance practice among care-givers of under-five children was the use of bednet and this did not differ by level of planning and drainage of the study site. Therefore, strategies to improve and sustain the use of bednet and promote the use of other effective mosquito-avoidance practices should be encouraged.

Keywords: Malaria control, Mosquito-avoidance practices, Care-givers, Under-five children
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LIST OF ACRONYMS

CDC:	Centers for Disease Control and Prevention
FMoH:	Federal Ministry of Health
IRS:	Indoor Residual Spraying
ITN:	Insecticide Treated Net
LGA:	Local Government Area
LLIN:	Long-Lasting Insecticide-treated Net
NMIS:	Nigeria Malaria Indicator Survey
NDHS:	Nigeria Demographic and Health Survey
NIAID:	National Institute of Allergy and Infectious Diseases
S1:	Well planned, well drained stratum
S2:	Well planned, not well drained stratum
S3:	Not well planned, not well drained stratum
SPSS:	Statistical Package for the Social Sciences
UNICEF:	United Nations Children's Fund
USA:	United States of America
WHO:	World Health Organisation

CHAPTER ONE

INTRODUCTION

1.1 Background of the study

Malaria remains an overwhelming global health problem. It is a disease known to be associated with poverty and underdevelopment, and is a major scourge in the vast majority of tropical and subtropical regions of the world, particularly in the tropical regions (Breman *et al*., 2004; Delenasaw *et al*., 2010). Annually, an estimated 216 million clinical cases and 650,000 deaths occur worldwide from malaria (WHO, 2012). The mortality levels are greatest in sub-Saharan Africa, where children under 5 years of age account for 90% of all deaths due to malaria (Breman, Alilio, Mills, 2004). Malaria is the fourth leading cause of death of children under the age of five years in developing countries (WHO, 2009). Though the under-five deaths have declined from 12.0 million in 1990 to 7.6 million in 2010 globally, it is unequally distributed with India and Nigeria together accounting for a third of under-five deaths worldwide (WHO, 2011).

Malaria is caused by the *Plasmodium* parasite and transmitted through the bite of an infective female *Anopheles* mosquito. The majority of malaria infections are caused by *Plasmodium falciparum*, the most dangerous of the four human malaria parasites. Other parasites are *Plasmodium vivax, Plasmodium ovale*, and *Plasmodium malariae.* High malaria transmission intensity, limited access to adequate treatment, increasing parasite resistance to affordable and safe medicines; increasing vectors' resistance to widely used insecticides, delayed care-seeking and inappropriate treatment at home or community level, are some major causes for this deleterious situation (Hopkins *et al*., 2007; Ajayi *et al*., 2008).

Symptoms and signs of malaria which include headache, nausea and vomiting experienced by patients infected with *Plasmodium falciparum* are usually more severe than other malarial infections and there is a greater tendency towards the development of delirium, haemolytic jaundice and anaemia. This type of malaria is the most difficult to control, it causes severe disease and the mortality rate is much greater than in other forms (Africa Malaria Report, 2003; Cox *et al*., 2005; Hughes and Kelly, 2006). Young children and pregnant women are the population groups at highest risk, because of low immunity. Severe malaria in young children could present with such life-threatening complications as severe anaemia, respiratory

distress, repeated convulsions and unconsciousness. Severe malaria can develop from uncomplicated malaria in a few hours, especially if the malaria has not been properly treated or is caused by a drug-resistant parasite. Severe malaria accounts for a third of all childhood deaths in Nigeria (Omole *et al*., 2007; FMoH, 2008). Children who survive cerebral malaria may develop neurological abnormalities like deafness, blindness, speech disorders, epilepsy and learning disabilities which persist in a few children with significant impairment in their development and education (WHO, 2000). Due to the high burden of malaria among pregnant women and children under the age of five years, targeting women in the reproductive age group and under-five children to deal with the disease has recently been widely recognized (WHO, 2000; Omole *et al*., 2007).

In Nigeria, a child will be sick of malaria between 2 and 4 times in one year. The financial loss due to malaria annually is estimated to be about ₦132 billion in form of treatment, cost, prevention and loss of man-hours among others. Transmission of malaria occurs throughout the year with the intensity higher in the southern parts of the country because of the longer rainy season that favours the breeding of mosquitoes. The mosquito species that commonly transmit malaria are *Anopheles gambiae*, *Anopheles funestus* and *Anopheles arabiensis* (Awolola *et al*., 2005).

According to World Health Organisation (2005), malaria control programmes should promote the use of preventive measures to reduce malaria transmission. Malaria control requires an integrated approach, comprising prevention (including vector control) and treatment with effective antimalarial agents. Common measures include use of long-lasting insecticidal nets or other insecticide-treated products and indoor residual spraying. The use of insecticide-treated nets is currently considered one of the most cost-effective methods of malaria prevention in highly endemic areas. The use of insecticide-treated nets (ITNs) or long-lasting insecticidal nets (LLINs) is the main method of malaria prevention employed in Nigeria. Free distribution of (LLINs) is conducted through mass campaigns, routine distribution in public health facilities, Faith-Based Organisations (FBOs), and Non-Governmental Organisations (NGOs) with the goal of achieving universal access for the at-risk population of children under age five and pregnant women.(FMOH, 2008). Universal access to LLINs among children under age five is 29% (Nigerian Malaria Indicator Survey, 2010).

Regular use of ITNs by all those at risk of malaria infection is a key component of the national malaria control strategy. Controlled community trials conducted across different epidemiological settings provide strong evidence on the effectiveness of insecticide-treated mosquito nets against malaria infections resulting in marked reduction of all-cause mortality among preschool children in most trials. Regular use of ITNs by pregnant women has also been shown to reduce the risk of maternal anaemia, placental malaria, and low birth weight and peri natal mortality. (Gamble *et al*., 2007).

Poor perception and knowledge of malaria control are among the factors likely to influence use of ITNs. According to Nebe *et al*., (2000), in south-western Nigeria, overwork, sunlight, excessive sex and noise as well as witchcraft were among the perceived causes of malaria. Such erroneous perception of malaria as 'ordinary fever' that is caused by too much work or 'too much sun' have been reported across a wide range of cultural sub-groups in Nigeria, and believed to significantly influence treatment-seeking behaviour and attitude to preventive measure. It has been acknowledged that local socio-cultural factors affect women's perceptions of causes and modes of transmission of the disease, health seeking behaviour and practices of malaria prevention measures (Comoro *et al*., 2003). Identifying such misconceptions for the purpose of designing appropriate educational interventions could lead to improvement in treatment-seeking and preventive practices as shown by the report of an educational intervention in Northern Nigeria (Chirdan *et al*., 2008).

Currently, the Nigerian malaria control programme emphasizes the behavioural change communication strategies as an integral part of the mass ITN distribution campaigns. (FMoH, 2008). Understanding the local perceptions and practices could be of immense relevance to such interventions that seek to enhance community's potential to adopt and sustain the use of ITNs. Arogundade *et al*., (2011) reported that misconceptions about prevention and causes of malaria have an impact on net usage even when one is available.

Arogundade *et al*.,(2011) in Nigeria did a study which revealed that 40.3% of the respondents use insecticide spray every night to prevent malaria while 4.4% use mosquito repellent cream, 23.8% clear bushes around house, 25.5% sleep under insecticide treated net, 23.4% use mosquito coil and 26.2% destroy places where mosquitoes breed. Andrzejewski (2005) carried out a study in Ghana in which participants agreed that malaria could be prevented and

several mentioned measures through which mosquitoes can be avoided like the use of mosquito coils, sprays, window screen as well as mosquito nets.

1.2 Problem Statement

Most malaria deaths occur in African children causing 16% of deaths due to all causes (Breman *et al*., 2004). In Nigeria, the under-five mortality and infant mortality rates are 138 and 86 per 1000 respectively (UNICEF, 2007) which are still high compared to other countries. About 85% of malaria deaths occur in children under the age of five, mostly in Africa.

Despite the well-known benefits of ITNs and the efforts of the Nigerian Government to promote this intervention, many families and individuals at risk in the country do not own or use them (WHO,2008). Several national surveys have shown persistently low levels of ownership and use of insecticide-treated nets. The proportion of Nigerian households that owned at least one insecticide-treated nets (ITN) was 2.2% in 2003 and 8% in 2008 while the proportion of under-five children that used ITN during the same periods were 1.2% and 5.5% respectively(National Population Commission 2003, 2008). Indoor Residual Spraying (IRS) on the other hand is a community-based intervention and has only been introduced in some parts of Lagos State by the Lagos State Government. There is also the ever increasing population of Lagos State leading to an increase in waste produced which encourages indiscriminate dumping serving as mosquito breeding sites. Most communities in Lagos State have houses with water logged canals which also serve as mosquito breeding sites. Most of these houses are also overcrowded leading to poor ventilation which could lead poor ventilation which might prevent the occupants from using ITNs (due to heat produced) as well as leading them to open windows leading to movement of mosquitoes into the rooms.

1.3 Justification of study

Although there are research findings that have shown that environmental, behavioural and socio-economic factors are associated with ability to avoid mosquitoes and malaria infection prevention (Macintyre *et al*., 2002), there is a dearth of information on mosquito avoidance practices particularly in the community setting.

Mosquitoes transmit the malaria parasite and hence, protecting humans from mosquito bite would go a long way in reducing malaria burden. There are so many mosquito avoidance measures practiced by community members which include: use of Insecticide Treated Nets (ITNs), mosquito coils, environmental management, aerosols, fan, screening of windows and doors, covering with cloth and so on. One needs to know the reasons for the preference of the mosquito avoidance measure and how effective it is. There is also the need to know whether knowledge of mosquito as the vector of malaria is a factor in the choice of mosquito avoidance measure being practiced.

Lagos State is surrounded by water and some parts of Somolu Local Government are also surrounded by water leading to breeding of mosquitoes all year round which makes mosquito avoidance among the residents a priority especially among the under-five children who are most vulnerable.

1.4 Significance of study

This study seeks to investigate the various practices adopted to avoid mosquito bite, the effectiveness of such measures, their belief about what causes malaria and reasons for the disparity between mosquito net ownership and usage. The results obtained will be useful to both the professional and policy makers as a baseline to intensify the development of an acceptable intervention and community based programme activities with regards to the health needs related to the socio-economic status of the inhabitants.

1.5 Research questions

1. What do the care-givers of under-five children know about the cause, transmission and prevention of malaria?
2. What is the association between knowledge of malaria and mosquito avoidance measures?
3. What are the factors that influence the use of mosquito avoidance practices among care-givers of under-five children?
4. What is LLINs ownership status and usage pattern among under-five children?

1.6 Objectives of the study

1.6.1 General objective

To assess the mosquito avoidance practices among care-givers of under-five children in Somolu Local Government Area of Lagos State Nigeria.

1.6.2 Specific objectives

The specific objectives were to:

1. assess the knowledge of care-givers on cause, transmission and prevention of malaria.
2. determine the mosquito avoidance practices among care-givers of under-five children.
3. identify the factors that influence the use of mosquito avoidance practices of care-givers of under five-children.
4. determine LLINs ownership and usage pattern among under-five children.

Operational definition of terms

Mosquito avoidance practice:

In this study, this refers to any measure taken to prevent mosquito from biting the child or to prevent the 'noise' of the mosquito from disturbing night sleep.

Household:

A household refers to a group of people living in the same building and eating from the same pot as well as recognizing one individual as the head. The occupants have a direct access to the outside of the building through a common door and they may be a single family, one person living alone, two or more families living together or any other group of related or unrelated persons who share living arrangements (Sullivan and Steven, 2003, United States Census Bureau, 2012).

Care-giver:

In this study, this refers to any female adult who is responsible for the care of a child and therefore is approached for information needed for the study.

Under-five Child:

A child in this study refers to a person between the age of 0 and 59 months (under-5 years).

Febrile illness:

In this study, this refers to any illness relating accompanied by temperature $\geq 37.5^{o}$ C or which care-giver reported fever in the last 48 hours.

CHAPTER TWO

LITERATURE REVIEW

2.1 Epidemiology of Malaria

Malaria is endemic in 109 countries and mainly transmitted to humans through the bite of an infected female mosquito of the genus *Anopheles*. It may also be transmitted through transfusion of infected blood, and from an infected pregnant woman to her unborn child. All vertebrates, both human and animal can be infected with malaria parasites. Humans are generally host to four types of malaria including *P. falciparum, P. vivax, P.ovale,* and *P. malariae. P.falciparum* is most common and virulent. It multiplies most rapidly and can clog small blood vessels, resulting in dangerous complications such as cerebral malaria. Due to repeated attacks of malaria, many semi-immune people in high risk areas of the tropics may carry disease parasites without being ill. However, because they are yet to develop immunity for malaria, children below five years of age are particularly vulnerable to the disease. Malaria in pregnancy contributes to neonatal and maternal mortality, and causes low birth weight infants. (NIAID, 2000).

Approximately half of the world's population is at risk of malaria. Most malaria cases and deaths occur in sub-Saharan Africa. In 2011, 99 countries and territories had ongoing malaria transmission. Country- level burden estimates available for 2010 show that an estimated 80% of malaria deaths occur in just 14 countries and about 80% of cases occur in 17 countries, Together, the Democratic Republic of Congo and Nigeria account for over 40% of the estimated total of malaria deaths globally (WHO,2013). Specific population risk groups include: young children, non-immune pregnant women, semi-immune pregnant women, semi-immune HIV-infected pregnant women, people with HIV/AIDS, international travellers from non-endemic areas and immigrants from endemic areas and their children (WHO, 2013).

Africa bears the brunt of the malaria burden, accounting for 90% of global malaria morbidity and mortality (RBM/WHO, 2001).It is estimated that one in every twenty (20) children dies from malaria before the age of five years. In Africa, mortality risks have increased significantly over the past decades, coupled with the spread of drug resistance, particularly of chloroquine. Overall, malaria is responsible for 15% loss in all disability-adjusted life years (DALYs) in Africa. The disease accounts for at least 1.3% reduction in Africa's economic growth annually-with approximately US$ 12 billion annual losses both as a direct and

indirect cost of the disease (Gallup and Sachs, 2001). The extremely high burden of the disease is attributed to two main factors.

Firstly, both *P.falciparum,* the most dangerous type of malaria, and *Anopheles gambiae,* the most efficient vector of malaria transmission predominate most climatic zones of Africa, with high transmission rates in vast areas. Poor populations particularly in rural areas carry the overwhelming burden of the disease-they often cannot access effective treatment due to inadequate infrastructure and limited resources especially since malaria control is based on prompt diagnosis, appropriate drug treatment, protection of high-risk groups, and control of the mosquito vector. Optimism that mosquito- borne diseases such as malaria, dengue, and filariasis can be effectively controlled or even eradicated with inexpensive drugs, vaccines, or insecticides has been sorely tested. Today, the impact of drug is becoming debatable, vaccine development is slow, and mosquitoes are becoming increasingly resistant to insecticides, including those used to treat bed nets (Scoot *et al.,* 2002).

The impressive body of work published by the World Health Organization(WHO) on the global burdens of disease consistently single out the African continent as a region deserving particular attention for future health investment (Snow, Trape and Marsh, 2001.). Some of the important factors that might have contributed to the increasing malaria burden in these African settings include: drug resistance, more frequent exposure of non-immune populations, emergence of HIV/AIDS, climate and environment changes, and breakdown of control programmes (Africa Malaria Report, 2003).

2.1.1 Epidemiology of Malaria in Nigeria

Nigeria, situated between latitudes 4^{o} 16 and 13^{o}53' north and longitudes 2^{o} 40' and 14^{o} 41' east, has a suitable climate for malaria transmission throughout the country. The only exception is the area South of Jos in Plateau State where some mountain peaks reach 1600 meters and the altitude of settlements lies between 1200 and 1400 meters. This area can be considered to be of low or very low malaria risk. The five ecological strata from South to North define vector species dominance, seasonality and intensity of malaria transmission: mangrove swamps, rain forest, guinea-, Sudan-, and Sahel-savannah. Accordingly, the duration of the transmission season decreases from South to North from perennial in most of the South to only 3 months or less in the border region with Chad (NMCP, 2008).

The dominant species of malaria parasites in Nigeria is *Plasmodium falciparum* (>95%) with *P. ovale* and *P. malariae* playing a minor role with the latter being quite common as a double

infection in children. Dominant vector species are *Anopheles gambiae s.l.* and the *A. funestus* group with some other species playing a minor or local role: *A. moucheti, A. nili, A pharaoensis, A. coustani, A. hancocki and A. longipalpis*. Within the *Anopheles gambiae* complex, *A. coluzzi* is the dominant species with *A. arabiensis* being found more often in the North and *A. melas* only in the mangrove coastal region. It can be estimated that 30% of the population live in areas of high to very high transmission intensity and 67% in the moderate transmission zone. Malaria's economic impact is enormous with about one hundred and thirty-two billion naira (₦132 billion) lost to malaria annually in form of treatment costs, prevention, loss of man hours and so on (NMCP, 2008). Malaria is still a major cause of morbidity and mortality in Nigeria. Along with two other countries, India and Democratic Republic of Congo, Nigeria accounted for over 40% of the estimated total of malaria cases and deaths globally in 2010 (WHO, 2012). Nigeria has a large population at risk of malaria. However, children under five years of age and pregnant women are the most vulnerable to illness and death from malaria infection in Nigeria. Malaria has been reported to account for 60% of outpatient visits and 30% of hospitalizations among children under five years of age in Nigeria (MIS, 2010).

Nigeria was one of the countries included in the World Health Organization's first large – scale multilateral initiative for malaria control between 1955 and 1969.The initiative, known as the Malaria Eradication Programme, relied on massive indoor residual spraying of di-chloro-diphenyl-trichloroethane (DDT) (Alilio *et al*., 2004.).

Over the years, the strategies for malaria control have evolved. In 2000, Nigeria joined a league of other African countries to sign the declaration and Plan of Action to halve the burden of the disease by the year 2010 through: prompt diagnosis and treatment with effective medicines, distribution of Insecticide Treated Nets (ITNs) to achieve coverage of populations at risk (especially children under age 5 and pregnant women), indoor residual spraying (IRS) to curtail transmission and prevention of malaria in pregnancy through intermittent preventive treatment. The 2009-2013 National Strategic Plan for Malaria Control (NSPMC) in Nigeria was developed by the National Malaria Control Programme (NMCP), the Roll Back Malaria (RBM) partners, state and Local Government Health Authorities, and other stakeholders. This plan draws from the overall National Health Strategic Plan of the Federal Ministry of Health and addresses developmental priorities such as the RBM and the Millennium Development Goals (MDGs). The goal of the plan is to reduce by 50 percent, the malaria-related morbidity and mortality in Nigeria by 2013 and to minimize the

socioeconomic impact of the disease. The overall objectives for 2009-2013 are: to nationally scale up for impact (SUFI) a package of interventions, which include appropriate measures to promote positive behaviour change, prevention, and treatment of malaria and to sustain and consolidate these efforts in the context of a strengthened health system, and to create the basis for the future elimination of malaria in the country (Malaria Indicator Survey, 2010).

2.2 The Life Cycle of the Malaria Parasite

The majority of infections in Africa are caused by *Plasmodium falciparum*, the most dangerous of the four human malaria parasites. Other parasites are *Plasmodium vivax*, *Plasmodium ovale*, and *Plasmodium malariae. Plasmodium falciparum* occurs throughout tropical Africa and in parts of Asia, the Western pacific, South and Central America, Haiti and the Dominican Republic; *Plasmodium vivax* is almost absent from Africa but is the predominant malaria parasite in Asia and South and Central America; *Plasmodium malariae* is found worldwide but has a patchy distribution; *Plasmodium ovale* occurs mainly in tropical West Africa and rarely in the Western Pacific (Haslett *et al*., 2002.).

The life-cycle of Malaria parasites is complex and passes through two hosts: human and *Anopheles* species. The life cycle is divided into three different phases- one in the mosquito (the sporogonic cycle) and two in the human host: the erythrocytic cycle (in human blood cells) and the exo-erythrocytic cycle (outside the blood cells) (WHO, 2003).

If the right stages of the parasite (the male and female gametocytes) are ingested by the mosquito when she takes a bloodmeal, they will form male and female gametes within the mosquito's stomach (midgut). The gametes unite to form the zygote, (called ookinete). The ookinete penetrates the wall of the midgut and becomes a round oocyst. Inside the oocyst, the nucleus divides repeatedly, with the formation of a large number of sporozoites and enlargement of the oocyst. When the sporozoites are fully formed, the oocyst bursts, releasing the sporozoites into the mosquito's body cavity (haemocoel). The sporozoites migrate to the salivary glands. The time necessary for the development of the sporozoites varies with temperature and to a smaller extent with the species of the malaria parasite and with humidity, but generally, it is about 8-15 days (WHO, 2003).

The sporozoites (the infective stage of *Plasmodium spp*.) are injected with saliva when the mosquito next feeds. The parasites enter the person's blood system and migrate to the liver cells where they multiply. Over a period of 7-12 days, the parasite multiplies until the infected liver cell bursts. Then the parasites (merozoites) are released into the bloodstream

and invade the red blood cell where they multiply again. The infected red cells are destroyed, the parasites invade fresh red cells and the cycle is repeated. A female mosquito takes a blood meal so that her eggs mature; since she lays several batches of eggs during her lifetime, she will have several opportunities to transmit malaria (WHO, 2003). The optimum conditions for transmission are high humidity and an ambient temperature between 20^{o} and 30^{o} C. The behavior of man also plays an important role in the epidemiology of malaria. There should be a human reservoir of viable gametocytes to transmit the infection. In areas of high transmission rates, infants and young children are more susceptible to malaria than the more immune older children and adults. Hence the importance of reducing the number of cases with malaria in any area cannot be overemphasized. The more malaria sufferers there are in any area, the greater the likelihood of mosquitoes spreading malaria to other persons in the area (WHO, 2003; CDC, 2004).

2.3 Malaria vectors in Africa

The most deadly disease caused by insects in tropical Africa is malaria and is transmitted by several species of the *Anopheles* genus. These species include mainly: *An. gambiae, An. funestus, An. nili, An. moucheti* and *An. Arabiensis*.

All mosquitoes must have water in which to complete their lifecycle. The water can range in quality from melted snow water to sewage effluent and it can be in any container imaginable. The type of water in which the mosquito larvae is found can be an aid to the identification of which species it may be. Each species therefore has unique environmental requirements for the maintenance of its lifecycle (Awolola *et al.*, 2004).

2.3.1 *Anopheles gambiae*

An. gambiae breed mostly in small water collections of stagnant and muddy seepage and rainwater with partial or full sunlight. The species avoid polluted water. Vegetation can be absent or present. Larvae occur among floating or emerging vegetation. *An. gambiae* is highly antropophilic (preferring biting humans to animals) and endophilic (rests mostly indoors) and has the highest sporozoite carriage rate compared to other species. With these characteristic features, *An. gambiae* is the best malaria vector in most part of Africa. This species is a complex of several members including: *An. coluzzi, An. melas, An. meru, An. quadruanulatus,* etc. Some members of this complex like *An. coluzzi* are grouped into two

molecular variants now referred as molecular forms 'M' and 'S' with strong evidence of reproductive isolation between the two forms (Wondji *et al*., 2002).

2.3.2 Anopheles *funestus*

An. funestus prefers large bodies of fresh water marshes with full or partial sunlight. Species from *An. funestus* group can only be differentiated by minor morphological characteristics, and by recently developed Polymerase Chain Reaction (PCR) assays (Cohuet *et al*., 2003).

2.3.3 *Anopheles nili*

An. nili s.l. has a wide distribution in tropical Africa and is the main vector along some rivers. Four species have been recently described within the *An. nili* complex depending on variations in morphology, biology and genetics: *An. nili, An. carnevalei, An. ovengensis n.spp*. and *An. somalicus*, the first three being malaria vectors. These four species can be identified by a PCR test (Awono-Ambene *et al*., 2004).

2.3.4 *Anopheles moucheti*

Mosquitoes belonging to the *An. moucheti* group are forest mosquitoes. Three "subspecies" have been described based on morphological characteristics: *An. moucheti moucheti, An. moucheti nigeriensis* and *An. moucheti beryoetsi.* Despite the fact that species from *An. nili* and *An. moucheti* complexes are major vectors, with inoculation rates reaching 100 infective bites per person and per year, there are few data on their distribution and binomics throughout Africa, and almost nothing is known on their genetics and their relationships with *Plasmodium spp.* (Nkondjio *et al*., 2003).

2.4 Signs and symptoms of malaria in children

Among young children, fever is the most common symptom of malaria (UNICEF, 2006). Malaria is an acute febrile illness. In a non-immune individual, symptoms appear seven days or more (usually 10-15 days) after the infective mosquito bite. The first symptoms- fever, headache, chills and vomiting may be mild and difficult to recognize as malaria. If not treated within 24 hours, *P. falciparum* may progress to severe illness often leading to death. Children with severe malaria frequently develop one or more of the following symptoms: severe anaemia, respiratory distress in relation to metabolic acidosis, or cerebral malaria. In adults, multi-organ involvement is also frequent. In malaria endemic areas, persons may develop partial immunity, allowing asymptomatic infections to occur (WHO, 2013).

General signs of malaria in children include: not able to drink or breastfeed (in the case of a child still breastfeeding), vomiting everything, recent history of convulsion, lethargic or unconscious state and inability to sit or stand up (Kundu, 2005).

Features of severe malaria in children include: cerebral malaria (unrousable coma), severe normocytic anaemia, renal failure, pulmonary oedema, hypoglycemia, circulatory collapse or shock, spontaneous bleeding/ disseminated intravascular coagulopathy, repeated generalized convulsions, macroscopic haemoglobinuria. Other manifestations include: prostration, extreme weakness, hyperparasitemia, jaundice and hyperpyrexia (Kundu, 2005).

2.5 Mosquito avoidance

There are a number of measures that people use to avoid contact with mosquitoes in homes or other buildings. They include:

2.5.1 Environmental management

This aims to modify the environment in order to deprive the vector population of its requirement for survival (mainly breeding, resting and feeding), thus reducing human-vector contact and transmission risks.

When such measures bring about lasting or permanent changes on land, water or vegetation, they are referred to as environmental modification (e.g. filling, adding an aerator to decorative ponds and water gardens to keep the surface water agitated, drainage, planting water-loving trees such as eucalyptus trees in swampy areas and closing or covering breeding sites). When such measures have a temporary effect and need to be repeated, they are known as environmental manipulation (e.g. water-level fluctuation, intermittent irrigation, flushing, changing water salinity, clearing vegetation in streams, and irrigation canals) (WHO, 2002).

Mosquito breeding should be avoided by killing larvae with larvicides and by environmental sanitation. In preventing breeding by larvicides, adding fish that eat mosquito larvae and pupae, oil works by spreading it over the water surface as a continuous film and thus preventing the larva from breathing. Oil can therefore only be used in open water. Where there is vegetation, emulsions or pellets should be used. The ability of oil to spread is enhanced by dilution with thinner oil such as vegetable oil or kerosene. Stomach poisons such as Paris green, are effective only against larvae, which feed on the water surface. Temephos (Abate) granules can be applied on water once monthly and are relatively non-toxic to humans, animals and fish (Carter *et al*., 2004).

According to Carter *et al.*, (2004), environmental sanitation is an effective and cheap form of control. It is used to prevent breeding at village level by self-help projects such as:

- Draining water holes, ditches and any accumulation of water,
- Clearing bush and grass along water banks,
- Collecting and disposing of all containers likely to hold water,
- Emptying water containers once a week,
- Covering water containers with lids or larvicides such as a few drops of oil; and,
- Clearing the bush and replacing it with cultivation

2.5.2 Insecticide-Treated Nets (ITNs)

Insecticide treated nets, besides diagnosis of malaria cases and treatment with effective medicines and indoor residual spraying (to reduce and eliminate malaria transmission), is the recommended primary intervention for effective malaria control which must be scaled up if countries are to move towards achieving the United Nations Millennium Development Goals by 2015 (WHO, 2006).

An insecticide-treated net is a mosquito net that repels, disables and/or kills mosquitoes coming into contact with the insecticide on the netting material. There are two categories of ITNs: conventionally treated nets and long-lasting insecticidal nets:

- A conventionally treated net is a mosquito net that has been treated by dipping in a WHO recommended insecticide. To ensure its continued insecticidal effect, the net should be re-treated after three washes, or at least once a year.
- A long-lasting insecticidal net is a factory-treated mosquito net made with netting material that has insecticide incorporated within or bound around the fibres. The net must retain its effective biological activity without retreatment for at least 20 WHO standard washes under laboratory conditions and three years of recommended use under field conditions (WHO, 2006).

All mosquito nets act as a physical barrier, preventing access by vector mosquitoes and thus providing personal protection against mosquito to the individual(s) using the nets. Pyrethroid insecticides, which are used to treat nets, have an excito-repellent effect that adds a chemical barrier to the physical one, further reducing human-vector contact and increasing the protective efficacy of the mosquito nets. Most commonly, the insecticide kills the malaria vectors that come into contact with the ITN. By reducing the vector population in this way,

ITNs when used by a majority of the target population, provide protection for all the people in the community, including those who do not themselves sleep under nets (WHO, 2002). A recent study carried out by Killeen *et al*., (2007), has shown that relatively modest coverage (around 60%) of all adults and children can achieve equitable community-wide benefits of reduction of malaria cases, ITNs thus work in this case as a vector control intervention for reducing malaria transmission. The study's findings also suggests that in high-transmission areas where most of the malaria burden occurs in children under the age of five years, and assuming that this population group can be effectively targeted with LLINs, the use of LLINs is 4-5 times cheaper than IRS, which cannot be targeted to children only.

The use of Insecticide-treated Nets to protect children from malaria parasite transmission is one of the main strategies recommended by the Roll Back Malaria (RBM) partnership. A major objective of the RBM campaign is to have 80% of pregnant women and children aged under-five sleep under ITN by 2010 (WHO, 2005).

Use of ITNs is one of the most cost-effective interventions against malaria. In a recent analysis of the cost of five ITN and two Indoor Residual Spraying programmes in Africa, LLINs were found to be significantly cheaper to use than conventionally treated nets. The costs per death averted and per DALY averted with LLINs lasting 3 years were less than half the comparable costs incurred in using conventional ITNs. The Annual cost per LLIN averaged US$ 2.10 (range 1.48-2.64); this is equivalent to US$ 1.05 per person protected per year, compared with US$ 3.60 for IRS (calculated for the whole population) (WHO, 2007).

ITNs have been shown to reduce all-cause mortality among children < 5 years by approximately 20%. This translates to the prevention of almost 0.5 million deaths each year in Africa south of the Sahara. ITNs also protect against the development of anaemia in both pregnant and young children, the groups at highest risk from malarial and malarial anaemia. This recent development from Insecticide Treated Nets that need to be retreated to long-lasting, wash resistant nets which will remain effective for up to four years has proven to be more effective (WHO, 2010).

For successful use of Long Lasting Insecticide treated Nets (ITNs), at least, some of the vectors should bite at hours when and where people are in bed and the people should be willing to use bed nets (WHO, 2006).

Nigeria adopted two strategies for the distribution of LLINs in the 2009-2013 NSPMC 'catch-up' and 'keep up' distribution campaign. The catch-up phase of the distribution is to speedily expand ownership of the nets through mass LLIN campaigns for universal coverage,

and the keep-up phase is to continue the coverage achieved during the catch up through regular distribution of LLINs. The catch-up strategy involved each household being entitled to two nets through house-to-house distribution and this is meant to deliver over 63 million nets by the year 2010. Other LLIN distribution campaigns include government programmes that have distributed millions of LLINs to increase net coverage levels. Global Fund Malaria Grants have also allowed distribution of more than 4 million nets in 18 states between 2007 and 2009 (Malaria Indicator Survey, 2010).

According to Baume, Marin, Shafritz, Alilio, Somashekhar and Payes (2005), since the baseline survey in 2000 in Nigeria, there has been significant increase in awareness of ITN, ownership, equity of ITNs across socio-economic segments and between urban and rural areas, and in the number of nets per-owning household. Within net-owning households, the youngest children are given preference for sleeping under a net. Although there has been a great increase in awareness of ITNs from 7% in 2000 to 60% in 2004, the level of awareness is quite low. Nigeria is lower than all other countries surveyed except Ethiopia (47%) where ITN promotion has only recently begun on a large scale. Nigeria (along with Ethiopia) has the lowest proportion of households that own nets. Among countries surveyed, Nigeria has by far the lowest proportion of nets that have ever been treated. Nigeria also has some of the greatest variation among sites (that is, within the country) in terms of net coverage and use. There is also a special problem in Nigeria in which nets owned are not being used (NDHS, 2008). In the Nigeria Malaria Indicator Survey, ownership of ITNs in the urban areas was 33% while that of the rural areas is 45%. In all households surveyed, the proportion of under-five children who slept under an ITN a night before the survey was 29% while the proportion of under-five children in households with at least one ITN was 58.8% (NMIS, 2010).

2.5.2.1 Factors affecting bed net use

A study carried out by Jimee *et al.,* (2010) showed that of the women surveyed in his study, and 49.7% slept in the same ITN as their child who is under five years of age. Also, he discovered that women's use of mosquito net was associated with malaria knowledge, woman's school attendance and household sprayed with insecticide in the past 12 months.33.5% of children under-five slept under an ITN the night prior to the survey. Similarly, woman's use of ITNs, knowing nets could prevent malaria as well as receiving malaria messages, mother having attended school were associated with child's ITN use.

Soleimani *et al*., (2012) in their survey in Iran however reported after having carried out a clinical trial using educational intervention that there was an increase in the proportion of households who used ITNs the previous night following the educational program. Therefore, educational status was an important predictor of insecticide-treated net usage and therefore concluded that education should be considered in planning and decision-making in any campaign of ITNs.

Adongo *et al*., (2005) reported that in Africa, people do not recognize the connection between fever, convulsions and malaria. Attributing the cause of malaria to several diverse factors beside the mosquito has implications for the adoption and use of malaria control strategies, and might make it difficult to convince mothers to accept ITN as a control measure for malaria. It was also reported that the main motivation for buying and using ITNs was because of protecting general mosquito nuisance.

De La Cruz *et al*., (2006) in their study on malaria prevention behaviors discovered that the factors closely associated with bed net use include region of residence, greater food security and caregivers' beliefs about symptoms, causation and age groups most vulnerable to malaria. Ninety percent of respondents who sleep under mosquito net felt that sleeping under a net was preventive against malaria. About twenty-one percent (20.6%) of users of bed net thought overworking caused malaria. They then concluded that greater knowledge about malaria does not translate into improved bed net use.

Allasane reported that among net owners, the rate of net usage was 47.8%. The study also revealed that ownership of LLIN was influenced by the presence of children aged below five years. Respondents reported mosquitoes, the sun and fever as main cause of malaria in children (Allasane, 2011).

Arogundade *et al.,* (2011) in a study in Nigeria showed that nearly three in ten of the caregivers that knew that mosquito bite is a cause of malaria, and knew the correct ways of preventing malaria owned and used a net. Of the issue of misconception about causes and prevention of malaria, almost one-quarter of the respondents who did not have any misconception (either about causes or prevention of malaria) owned and used a net. Similarly, caregivers with some misconception about causes of malaria are about 25% less likely to own and use a net. In this case, misconceptions about causes and prevention of malaria are risk factors for malaria. Caregivers with the correct knowledge of prevention of

malaria are about 18 percent more likely to own and use a net compared with their counterparts who do not own a net. Also, the study revealed that caregivers' age is associated with ownership and use of ITN with respondents in age group 25 to 29 years being more likely to own and use a net compared with those 30 years and above. Ownership and use of n*et al*so increased with educational attainment with only 45 percent of those with primary education owning and using a net while those with secondary education are about 77 percent more likely to own and use a net. Examples of misconception mentioned include lack of sleep, drinking too much alcohol, witchcraft/juju, working too hard and eating too much palm/groundnut oil.

In a study carried out in Cote d'Ivoire by Allasane, it was found out that age, educational attainment level, locality of residence and geo political zones are determinants of bed net use. The knowledge of ITN was high, with the information mainly given in hospitals and broadcasted by television and radio. Measures against mosquitoes were associated to socio economic position. Use of bed nets, were often cited by the least poor, whereas chasing away mosquitoes through smoke by burning plants (e.g. plant leaves) was reported by the poorer groups. ITNs, insecticide sprays and fumigating coils were also listed as measures against mosquitoes. The advantages for the use of ITNs mentioned include protection against mosquitoes (68.4%) and malaria (33.1%). The better-off groups reported more often protection against malaria and other insects as an advantage of ITNs. One fifth of the households and significantly poorer households stated that ITNs were expensive; less than 1% of households thought that ITNs were not efficient. The most widely reported negative effect or inconvenience arising from ITNs use was heat, followed by suffocation and unpleasant smell (Allasane, 2011).

According to a study carried out by Tchinda *et al*., (2012), education of individuals was significantly associated with increased net use and this is related to the fact that through school education, people acquire biomedical knowledge on malaria, especially its transmission consequences of the disease and preventive methods. Educated individuals are well prepared to integrate messages about the benefits of ITNs and adhere to its use. Of the households surveyed, 59.7 percent own a net with 42.6% having slept under a net. Looking at the age and sex-related use of net, the highest proportion of individuals using the net the previous night was recorded in adults aged 25-49 years, followed by children aged below 5 years, while the lowest proportion was recorded among school-aged children and adolescents aged 5-24 years. For sex, females above 14 and less than 50 years tend to use nets more than

men. Other factors associated with net use were: children below five years, individuals with secondary and university education and unemployed persons or employed or retired ones had between 2-3 fold increase in net use compared to students. Additionally, houses allowing easy access to mosquitoes and environment favourable to mosquito proliferation were all associated with increased net use.

Matovu *et al*., (2008) and Wiseman *et al*., (2006) carried out studies which showed that differences in mosquito net ownership have been associated with malaria knowledge, women's education, occupation and marital status. Similarly, malaria knowledge, women's age, higher educational attainments have been reported to be important determinants of mosquito net usage.

According to a study carried out by Adeyemi *et al*., (2007) in Osun State Nigeria, there was low awareness (41.1%) and very low use of insecticide -treated bed nets among the study population. The reasons for the low use prevalence as provided by this study included non-availability, not being sure of the efficacy of ITNs compared to other vector control methods, high cost of purchase, not comfortable sleeping under ITNs especially during heat period, finding it cumbersome mounting ITNs every night and some of the pregnant women even believe that it is for children use. This study found a low awareness and very low use prevalence of ITNs among the pregnant population therefore concluding that health education on the use of ITNs should be intensified since this pregnant population are the mothers of under five children. Of the study population, 58.9 % have never heard about ITNs while 16% of those that had heard actually sleep inside the net while 89.8% did not.

According to a study carried out by Child Survival and Health Grants Program (2004), the motivating factors for use of mosquito net include: to prevent mosquito bite, disease prevention, malaria prevention, improved sleeping, to protect child health, reduced medical costs and avoidance of fever while the de-motivating factor mentioned is the unpleasant smell. The primary reason for non-use of mosquito nets is cost.

Baume *et al*., (2005) carried out a study on five African countries in which they found out that 60.3% of the respondents were aware of treated nets in Nigeria while in Senegal, 97.3% were aware, in Zambia, 88.3%, Ghana, 91.4% and in Ethiopia, 46.6%. The percentage number of households owning a net in Nigeria is 26.7%, Senegal; 56.1%, Zambia; 50.0%, Ghana; 38.1% and Ethiopia, 25.3%. The percentage number of children in all households

sleeping under a net in Nigeria is 10.3% while in Senegal, 35.4% were aware, in Zambia, 24.6%, Ghana, 25.3% and in Ethiopia, 12.9%. Of the households with net, the percentage number of children sleeping under a mosquito net in Nigeria is 35.8%, Senegal; 60.1%, Zambia; 50.1%, Ghana; 68.1% and Ethiopia, 49.5%.

In a study by Keating *et al*., (2008), mosquito net use was low with only 6.3% of children less than five year reported to have slept under a bed net the night before the survey. Less than one-fourth (21.7%) of the respondents knew that ITNs reduced the risk of malaria parasite transmission. Information on ITNs was most commonly obtained at the clinic or hospital (52.0%) and from community health workers (41.0%). One –fourth (27.0%) reported hearing at least one message about ITNs on the radio in the last six months, and hardly anyone (1.0%) reported hearing or reading ITN messages on the television or in the newspaper. Of the children less than 5 years of age, two-thirds (65%) had a fever or convulsion in the two weeks preceding the survey.

Pettifor *et al*.,(2008) and Wiseman *et al*.,(2007) carried out studies which showed that differences in mosquito net ownership have been associated with malaria knowledge, women's education, occupation and marital status. Similarly, malaria knowledge, women's age, higher educational attainments have been reported to be important determinants of mosquito net usage. However, according to studies by Alaii *et al*., (2003) in Kenya and De La Cruz *et al.*, (2006) in Ghana, greater malaria knowledge, education and wealth are not determinants of net use.

Garcia-Basteiro *et al*., (2011) found that there was a decline of around 32% in the proportion of households that owned at least one net between 2008 and 2009. The proportion of households (with at least one child under five years of age) owning at least one bed net regardless of whether it was an ITN or not, dropped from 97% in 2008 to 65% in 2009, representing a 32% decrease in eighteen months. This lower use of bed nets in 2009 coincided with a marked decrease in ownership (the proportion of households which had at least one ITN dropped more than 35%). The reasons for this decline remain unclear. There is speculation that some nets were taken to be given away or sold. Also, nets may also have been discarded because they were physically damaged or because people thought that they would receive new replacement nets free-of-charge again through a similar mass campaign. Sixty-one percent of the children under five years of age who were analyzed slept under a bed net. Higher household bed net ownership was associated with knowing how malaria was prevented and transmitted, having the house sprayed in the previous 12 months, having fewer

children under five in the household, and children being sick at some point in the previous 14 days. Higher bed net use in children less than 5 years was associated with being sick at some point in the last 14 days prior to the survey, living in an urban area and the year in which the survey took place. They therefore concluded that knowledge about malaria was an important determinant of bed net ownership.

2.5.3 Indoor Residual Spraying

Indoor Residual Spraying (IRS) is a standardized and well established control method for mosquitoes. It has been used widely in Africa; its use has been more limited to the margins of malaria distribution in southern Africa and to epidemic-prone countries often at a higher altitudes. Unfortunately, it is underutilized in sub- Saharan Africa (WHO Global Malaria programme 2010). WHO has recently proposed extending its range in Africa (Bachou *et al*., 2006).

It is the practice of spraying insecticides on the interior walls of homes in malaria affected areas. After feeding, many mosquitoes rest on a nearby surface while digesting the blood meal, so, if the walls of dwellings have been coated with insecticides, the resting mosquitoes will be killed before they can bite another victim. The primary effects of IRS towards curtailing malaria transmission are to reduce the lifespan of vector mosquitoes so that they can no longer transmit malaria parasites from one person to another and to reduce the density of the vector mosquitoes. The first pesticide used for IRS was di-chloro-diphenyl-trichloroethane (DDT).

IRS can kill a mosquito anytime it enters a house for a blood meal, which it typically does every 2-3 days, so that few will survive the approximately 12 days that are required for malaria parasite to complete part of their life cycle in the vector mosquito, if the houses they visit are properly sprayed. In practice, the effectiveness of IRS depends on adherence to application procedure, efficacy of the insecticide, public acceptance of spraying, and availability of well-maintained equipment, adequately trained spraying personnel, efficient supervision and strong financial support. The size of the operational area depends on local circumstances and is influenced by the distribution of malaria and malaria vectors, the distance from important breeding sites, the flight range of the vectors and demographic features (WHO, 2006).

Generally, all internal walls and ceilings of the building are treated. Residual effects depend on porosity of the surface (shorter on mud walls) and exposure to sunlight. Four classes of

chemical insecticides- organochlorines, organophosphates, carbamates and pyrethroids are still the mainstay of vector control programmes. Use of pyrethroid insecticides has, however, increased and that of the organochlorines and some of the more toxic organophosphate compounds has decreased in recent years. Selection of insecticide depends on cost, efficacy and availability. Water- dispersible powders are generally used, applied with a hand operated pressurized sprayer. Frequency of spraying will vary from once to twice yearly according to seasonality of vector breeding, transmission of malaria and residual effect of insecticide (Conteh *et al*., 2004).

For a successful Indoor Residual Spraying (IRS) procedure, the predominant species of mosquito in the region should be indoor resting ones i.e. endophilic, houses should have walls and ceilings, most malaria infections should be acquired indoors i.e. the mosquitoes should be endophagic, people should have permanent homesteads, they should be willing to accept spraying and there should be the ability to organize the delivery of spraying on time to all malaria areas including information on number and location of houses to be sprayed (WHO, 2006).

IRS is regarded as one of the key vector control interventions in Nigeria today. It is part of the Integrated Vector Management measures and it is limited to spraying conducted by the government, private and non-governmental organizations. According to the malaria operational plan, spraying should be focused on areas with a short transmission where conducting IRS could make local elimination feasible, in areas where the use of LLINs is difficult and the use is slow and in areas where IRS may have a greater use such as in municipalities that are densely populated. The goal of the IRS plan is to scale up IRS to cover 7 million households by 2013 or achieve 20% coverage nationwide and so far, there is IRS coverage of 0.5% in the urban areas and 0.8% in the rural areas (Malaria Operational Plan 2013). However, pilot trials have been carried out in some States and these are: Akwa Ibom, Anambra, Bauchi, Gombe,Jigawa, Kano, Lagos, Plateau, Rivers, Borno, Adamawa and Ogun State using Lambdacyhalothrin, Alpha Cypermethrin, Bifenthrin, Deltamethrin and Bendiocarb. The success of the intervention made a WHO consultant to recommend the scaling up of the intervention in the country (Okwa, 2013, Malaria Operational Plan 2013).

2.5.4 Integrated Vector Management

Vector control is among the key strategies that are widely promoted by the World Health Organisation (WHO) and the Roll Back Malaria Partnership (RBM) for prevention and reduction of malaria (RBM, 2008; WHO, 2006). The other strategies include: early diagnosis and prompt treatment of malaria cases, mainly using Artemisinin-based Chemotherapies (ACTs), and intermittent preventive treatment in pregnancy (RBM, 2008). WHO recommends the use of appropriate combinations of non-chemical and chemical methods of malaria control in the context of Integrated Vector Management (IVM) (WHO, 2004).

The National Malaria Control Programme's Strategic Plan 2009-2013 calls for Integrated Vector Management strategy which includes universal access to Long- Lasting Insecticide-treated Nets, increase in Indoor Residual Spraying in targeted areas where LLINs alone are not reducing malaria transmission, reduction of mosquito-breeding in urban and peri- urban areas and the use of larvicides, predators or growth inhibitors for larval control (Malaria Operational Plan 2013). In a bid to redefine its long term vector control strategies in Nigeria, the National Malaria Control Programme integrated Larval Source Management (LSM) as a component of IVM. Pilot larviciding has been carried out in five locations in Nigeria (Rivers, Nasarrawa, Ogun, Lagos and Jigawa states) and is sparingly implemented in Lagos and Rivers States with low coverage.

An IVM approach is pragmatic in that it offers a menu of vector control methods which can be applied in various combinations to suit different ecological and socio economic settings. Besides, by using a range of different methods (such as Indoor Residual Spraying, Long-Lasting Insecticide-treated Nets, other Insecticide-impregnated materials, Insect traps, chemical larvicides, environmental modification or manipulation, topical repellants and polystyrene beads) , it is possible to effectively target vectors at different stages in their life cycle, for instance, as larvae and pupae in mosquito breeding habitats, or at certain times during the host-seeking and resting behavior of adult mosquitoes (Townson *et al*., 2005). On the other hand, reliance on only one vector control method is, in the long term, usually unsustainable for a variety of reasons, most notably insecticide resistance and adverse health and environmental impacts in the case of chemical control (WHO, 2004).

According to WHO (2008), IVM is a rational decision-making process for the optimal use of resources for vector control. This current paradigm of IVM identifies several key elements for successful implementation of the approach and they include: integration of non-chemical and chemical vector control methods and their integration with other disease-control

measures; evidence-based decision making using methods based on sound knowledge of factors influencing local vector biology, disease transmission and morbidity, capacity building including development of adequate human resources, training and career structures at national and local level to manage IVM programmes; strengthening collaboration within the health sector and with other public and private sectors whose actions and policies might have important implications for vector control; engaging local communities and other stakeholders, and, creating a public health regulatory and legislative framework to reinforce IVM (Beier *et al.*, 2008).

Other methods of vector control include using ovitraps, space spray, biological control agents and the recent introduction of safer vector control agents such as insect growth regulators, biocontrol agents, and natural plant products have yet to gain the needed scale of utility for vector control (Raghavendra *et al*., 2011).

2.6 Knowledge of Child hood malaria

2.6.1 Knowledge of the symptoms of malaria

Mothers' or caregivers' ability to recognize childhood malaria-related morbidity is crucial as about 90% of malaria cases are treated at home in Africa and several studies indicate that knowledge, attitudes and practices (KAP) of caregivers towards childhood malaria could influence response to signs of the disease (Sanjana *et al*., 2006). Moreover, lack of knowledge and misconceptions of caregivers about the transmission and treatment of malaria may also affect malaria control interventions in general and jeopardize effective malaria treatment and home malaria management in particular.

In a study carried out by Yewhalaw *et al*., (2010) in Ethiopia, 92.2% of the respondents mentioned malaria as the most common childhood illness and most frequent health concern, also, most of the caregivers correctly associated the typical clinical manifestations with malaria attacks; fever was the most common (73.6%) symptom mentioned followed by shivering (64.3%), headache (37.4%), thirst (17.3%) and vomiting (16.7%). Loss of consciousness was least mentioned as symptom or clinical manifestation of malaria.

According to a study carried out by Wakgari and Ahmed (2009) in rural Ethiopia, most of the mothers knew the symptoms of malaria with fever (97%) topping the list with shivering and chills (94.2%), headache (72.1%) and back pain (60.8%) were considered as the most frequent symptoms associated with malaria. It was also apparent that most of the mothers were able to recognize multiple symptoms of malaria, and the majority reported two or more

symptoms, with 91.9% citing both fever and shivering/chills. About 28% recognized fever, shivering, headache, back pain and loss of appetite, while 24% reported fever, shivering/chills, headache and back pain but didn't mention loss of appetite.

2.6.2 Knowledge of cause of malaria

De La Cruz *et al.,* (2006) in their study on malaria reported that the common beliefs held by the respondents include: malaria is caused by staying in the sun for too long, working close to the fire causes malaria, overworking oneself causes malaria, malaria is caused by spiritual reasons, other beliefs include: clearing bushes around the house, mosquito coil, covering the body and disturbing mosquito hiding place is protective against malaria.

Jimee *et al.,* (2010) carried out a study in which 73.8% of the women had heard of malaria, only 43.6% stated that fever was a symptom, 34.6% mentioned mosquitoes as a cause and 39.7% named at least one danger sign of malaria. 55.1% lived in a household with at least one mosquito net. Seventy-seven percent stated mosquito bite as the cause of malaria, while 22.4% stated staying in the sun too long and 3.0% stated witchcraft as the cause of malaria.

According to a study carried out by Child Survival and Health Grants Program (2004), the reported causes of malaria include: mosquito bites, witchcraft, intravenous drug use, blood transfusion, injection and sharing razor blades. Although not as common, there is some understanding of the connection between illness and nutrition. Women associated lack of vitamins with malaria.

Yewhalaw *et al.,* (2010) reported that the incorrect causes of malaria mentioned by the respondents include exposure to sun, eating contaminated food, bad spirits, dirty and stagnant water, too much work and God's punishment.

Andrzejewski (2005) carried out a study in Ghana in which participants cited malaria as one of the most serious illnesses among babies and children. Yet when queried about the causes of malaria, there was certainly no consensus among participants. Participants cited many aetiological routes to malaria in children- including eating unripe mangoes, playing in the sun, and eating starchy foods- in addition to the mosquito.

2.6.3 Knowledge of malaria transmission

According to a study carried out by Wakgari and Ahmed (2009) in rural Ethiopia, 81% of the mothers of under-five children said that malaria can be transmitted from one person to another. About 60% of the women perceived that malaria is transmitted by mosquitoes, followed by a response that incriminated sleeping together (38.7%) with a malaria patient as a cause of the disease. Other respondents also mentioned breathing from malaria patient (16.9%) and exposure to swampy areas and cold weather as a (4.9%) cause for malaria. Nearly 1% of the respondents who reported the transmissibility of malaria did not know how it is transmitted. Some of the women also believe that malaria thrives during fasting when people do not get breakfast or food on time. Other mothers related the disease to relatively drier months of the year in which food is surplus. In a study by Yewhalaw *et al*., (2010) in Ethiopia, nearly 4% of the caregivers responded that they do not know the route of malaria transmission while 83.7% mentioned mosquito bite as the mode of malaria transmission and 2.4% of the respondents saying that sharing utensils with patients can transmit the disease.

Keating *et al.,* (2008) carried out a study in Kenya in which 68.1% of the respondents cited that mosquitoes are responsible for transmission. However, 47.0% incorrectly cited that contaminated water was a major cause and 14.5% reported that unhygienic surroundings caused malaria. More educated respondents cited that mosquitoes cause malaria.

Yared *et al*., (2007) carried out a study in Ethiopia in which about forty-eight percent of the study participants were aware that malaria can be transmitted by mosquito bites. Thirty percent of the respondents were aware that mosquitoes carry disease causing micro-organism, 95% were aware that mosquito bite during the night, and 61% were aware that mosquitoes rest at dark places inside the house.

2.6.4 Knowledge of malaria prevention

According to a study carried out by Child Survival and Health Grants Program, (2004), sixty-three percent of the household had a mosquito net in the home while stratification by mothers' age revealed that young mothers (under 25 years of age) are more likely to have a mosquito net compared to older mothers (25 years of age and older), of which only 54.9 per cent have a net.

In a study in Ethiopia by Yewhalaw *et al.,* (2010), the majority (91%) of the caregivers believed that childhood malaria is preventable and the use of mosquito nets was the most

frequently mentioned malaria preventive method while other less reported preventive methods were indoor residual spraying (16.5%).

Yared *et al.*, (2007) carried out a study in Ethiopia in which sleeping under a mosquito net and eliminating mosquito breeding sites were identified by 58% and 522% of the respondents respectively. The biomedically incorrect aetiological beliefs about malaria prevention mentioned in a study in Ghana by Andrzejewski (2005) include: giving the child purgative every three months, heating children's food, not giving children mangoes to eat, neither oily food, giving the child traditional herbs to drink occasionally, giving the child a drink made from boiled pineapple drink, removing cobwebs in our homes and preventing children from roaming in the sun. They suggested that comprehensive behavioural change and communication is required to improve the knowledge of the mode of malaria transmission and its preventive and control measures.

Macintyre *et al*., (2002) in Kenya reported that environmental, behavioural and socio-economic factors are associated with ability to avoid mosquitoes and prevention of malaria attack. The wealthy and educated households often live in clean environment and are able to afford better mosquito-bite preventive measures, and good medical attention when afflicted with malaria. While the major victims are usually the poor, less privileged and economic downtrodden people who often have no access to clean environment, and most times have no means of acquiring better mosquito- bite preventive measures and no access to modern treatment.

Arogundade *et al*.,(2011) in Nigeria did a study which revealed that 40.3% of the respondents use insecticide spray every night to prevent malaria while 4.4% use mosquito repellent cream, 23.8% clear bushes around house, 25.5% sleep under insecticide treated net, 23.4% use mosquito coil and 26.2% destroy places where mosquitoes breed. Andrzejewski (2005) carried out a study in Ghana in which participants agreed that malaria could be prevented and several mentioned measures through which mosquitoes can be avoided like the use of mosquito coils, sprays, window screen as well as mosquito nets.

CHAPTER THREE

METHODOLOGY

3.1 Description of Study Area

Somolu Local Government is one of the twenty local government areas in Lagos State(see Appendix F for Lagos State map). It lies on the North of Lagos city. It has eight (8) administrative wards and it is politically segmented into two constituencies- Somolu (Orile – Somolu) and Bariga. The Local Government is densely populated and it has as its boundary on the north, Bariga Local Council Development Area (LCDA), on the south, Shiro Street, on the East by Ikorodu road from Fadeyi to Anthony bus stop and on the West by Abule-Ijesha canal through Johnson Street to Ajidagan Canal. It is predominantly an Ijebu settlement with some Ilajes and Ijaws along the shoreline of the lagoon. There are also other tribes due to the influx of people into the State. Major communities within the Local Government include: Ilaje, Gbagada, Obanikoro, Igbo-Igunu, Pedro, Orile Bariga, Abule-Okuta and Akoka. There are several markets within the Local Government and these include Adebayo Market, Rufai, Fafunke, Ashogbon, Adaranijo, Irepodun Plank Market and Abbattoir (See Appendix G for Somolu Local Government Area map). There are several industries and banks within the Local Government.

Within the Local Government are six (6) Primary Healthcare Centres (PHC) which are: Akoka PHC, Bajulaiye PHC, Wright Memorial PHC, Ashogbon Health Centre, CMS Health Centre and Mafowoku PHC. The Akoka Primary Healthcare Centre and Ashogbon Health Centre carry out labour and delivery services and also run in-patient and out-patient services. Mass distribution of Insecticide Treated Nets was last done in the year 2011 but pregnant women who visit the Primary Healthcare Centres for Ante Natal Care Services are given ITNs. The two rounds of National Immunisation Plus Days (NIPDs) were done in the months of February and March 2013. There was capacity building of voluntary health workers, Health Workers and Community Health Promoters in the Local Government in the month of February, 2013. A cascade training for Health Workers was done on Child Welfare. Maternal and New born Child Health week came up in May, 2013.

There is also the Somolu General Hospital. Notable private Medical Centres include Ladilak Medical Centre, R Jolad Hospital at New Garage, Medol Consultant Clinic by Famous Bus stop, Oshuntuyi Medical Centre at Obanikoro and Jon Ken Hospital at Akoka.

As at the last census (2006), the population was 602,673 and it has an area of 12km^2. It is part of the Ikeja Administrative Division and it is largely a high density area comprising Gbagada Phase 1 and II, Akoka, Bariga, Somolu, Pedro, Igbo-igunnu and others. It is a residential suburb of Lagos. Within Somolu Local Government are University of Lagos, Akoka Teachers' Training College (Fed.) and several secondary and primary schools owned by missionaries, private and public. It is a major nerve center for commercial printing activities in Lagos. The major occupations of the residents are trading and fishing (due to the presence of the lagoon) and this is why it has as its logo a paddle and canoe. It has also as its local activity, leather handicrafts. Because of its enormous population, it has attracted huge commercial and industrial activities.

Along the Oshodi-Oworonshoki express through Bariga and several major streets within Somolu Local Government are located several industrial and commercial enterprises for example Zinox Computer Factory, Odua International Market among others. Gbagada Phase I and II are government layout that is built up to compare with Government Reserved Areas in Lagos State. Somolu also enjoys coastline along Lagos Lagoon with great potentials to accommodate Holiday Resorts and Recreational facilities that will be attractive to tourists. A large part of the Local Government has large canals and pot holes which serve as mosquito breeding sites. Most of the houses are built closely together due to over population leaving no place for vegetation except for few houses with flowers planted in them for decoration purposes. Generally, Lagos State has two climatic seasons: Dry (November-March) and Wet(April-October) and this is what is experienced in Somolu Local Government Area.

Residents of the Local Government Area rely on municipal water supply while some have bore-holes dug in their compound for water supply. The available mass media to the residents are majorly television, radio and daily newspapers

3.2 Study Design

Cross sectional study design was used to select female care-givers with at least one child below the age of five. The study captured both predictor and outcome variables at the same time.

3.3 Study Population

The study population consisted of caregivers who have at least one child below the age of five years.

3.3.1 Inclusion criteria

The inclusion criteria used were: caregivers

- with at least a child below the age of five (5) years
- who had been resident in the community for at least a year
- who gave their consent

3.3.2 Exclusion criteria

Those excluded from the study were

- visitors and
- those who did not give their consent.

3.4 Sample size determination

The sample size was calculated using the formula for a single proportion i.e. the Leslie Kish formula(Kish, 1965) considering the assumption of 95% confidence interval and 5% margin error and prevalence of use of ITNs among under-five children in South-western Nigeria as 28.8% (MIS, 2010).

$$N = \frac{Z\alpha^2 pq}{d^2}$$

Where:

N= sample size

Z= standard normal deviate at 95% precision= 1.96

d= margin of error at 5%.

P= prevalence of use of ITNs as 28.8% in south-western Nigeria (MIS, 2010)

$$\text{Therefore, } N = \frac{1.96 \times 1.96 \times 0.712 \times 0.288}{0.05 \times 0.05}$$

n= 315

Adjusting for non-response rate of 20%,

$$N = \frac{n \times 100}{100 - r}$$

Therefore, 100/100-20 × 315= 100/80 × 315 = 394

A minimum sample size of **394** was calculated.

3.5 Sampling technique

The WHO Lot Quality Technique sampling method (WHO, 1996) was used to select a minimum of 394 care-givers of under-five children from the study site.

The study site was stratified into 3 strata based on the level of planning and drainage observed across the study site using the Geographic information System (GIS, see Appendix F). This helped to control for the environmental and topographical variation that is assumed to influence mosquito ecology. The 3 strata were:

Stratum1: planned, well drained. In this stratum, the streets were planned with a very good road network with no pot holes and no open drainages system.

Stratum 2: Planned, poorly drained. In this stratum, the streets had a good road network system with the streets linking each other, however, there were open drainage systems revealing the litter filled drains.

Stratum 3: Unplanned poorly drained. Here, the road network was bad with pot holes serving as mosquito breeding sites as well as presence of blocked and water logged drainage systems.

The area was divided into grid cells based on dimension 1.5cm by 1.5cm.

Stratum 1 occupied 93 grid cells, Stratum 2: 40 grid cells and Stratum 3: 44 grid cells, Total= 177 grid cells.

To determine the proportionate sample size per stratum, for

Stratum 1: (93/177) X 394 = minimum of 207 care-givers

Stratum 2: (40/177) X 394 = minimum of 89 care-givers

Stratum 3: (44/177) X 394 = minimum of 98 care-givers.

The number of grids to sample in each stratum was selected proportionately and the sample size was shared proportionately among the 3 strata.

The sample size determined for each stratum was divided by the number of grid cells selected for each stratum to determine the number of care-givers to be studied per grid. A coin was tossed at each grid with head up signalling that data collection should start from the right of each grid and tail up signalling that all houses on the left with care-givers of under-five children is sampled till the number of households in each grid was achieved. In households with more than one eligible care-giver, the random sampling method was used to select the care-giver to be interviewed.

3.6 Data collection procedure

A semi-structured, pre-tested questionnaire was administered to care-givers with at least one child under the age of five by trained research assistants who had sufficient information about the research and the area. To obtain high quality data, the selection and training of research assistants is the first step. As a result, the selection and training of the research assistants was very thorough. Each had a minimum of Secondary School leaving Certificate and they were thoroughly trained on the research and all were fluent in both English Language and Yoruba language. Their reading knowledge as well as speaking ability in both languages was tested. Maturity, responsibility, a friendly and respectful attitude, appropriate appearance and demeanour, attention to detail and an interest in the survey were qualities that the selected research assistants exhibited.

Demonstration interview was conducted by the Investigator who was also the supervisor to show how a good and efficient interview is conducted. To ensure inter-observer agreement, the supervisor also conducted periodic spot-check re-interviews for each research assistant as well as observing each research assistant interview respondents at least once. There was also close supervision of research assistants and editing of completed interviews to ensure that accurate and complete data were collected (quality assurance). Information such as the care-givers' socio-demographic data as well as mosquito-avoidance-practice and ownership and usage of LLINs was elicited.

3.7 Validity and Reliability

3.7.1 Validity

Validity is the ability of a test or an instrument to measure what the investigator wants to measure and was censured by the following steps:

1. The questionnaire was adapted from the study of Macintyre *et al*., (2002) in Kenya.
2. The draft instrument was given to peer and professional review.
3. Content validity was further ensured through the incorporation of the preliminary output of the pretest.
4. There was also close supervision of research assistants to ensure quality assurance.

3.7.2 Reliability of the Instrument

Reliability is the accuracy or precision of a research-measuring instrument. The questionnaire was reviewed for quality and consistency. The questionnaire was translated into Yoruba by a Yoruba language expert while another Yoruba language expert translated it back to English language. The instrument was pre-tested to ascertain suitability and appropriateness to field situations. During pre-test, it was determined whether the questions were clear and simple enough for participants' comprehension and the trend in the response of participants and the time it took to administer the questionnaire was determined. At the end of the pre-test, items that were not easily understood were reframed and those that were found to be irrelevant were removed. The data from the pre-test were analysed using descriptive statistics and Chi-square test at p=0.05.

3.8 Data storage

Data was collected through paper questionnaires. All data collected from the study were cleaned before data entry and stored on PCs, external hard drives and USB drives. Hard copies of the questionnaires were stored in cabinets.

3.9 Data analysis

Data from the questionnaires were entered into SPSS, checked for consistency and analysed using SPSS 15.0 statistical software (SPSS Inc. USA). The outcome variables measured included: mosquito avoidance measures practised, the practice of multiple mosquito avoidance measures and use of mosquito nets. Independent variables included: socio-

demographic characteristics of the care-givers as well as their knowledge of signs and symptoms of malaria and its preventive measures.

To construct the wealth index, each of the household assets owned was assigned a weight (factor score) generated through Principal Component Analysis and the resulting asset scores are standardized in relation to a standard normal distribution with a mean of zero and standard deviation of one. Each household was then assigned a score for each asset and the scores were summed for each household. Individuals were ranked according to the total score of the household in which they resided. The sample was then divided into quintiles from one (lowest) to five (highest) (Gwatkin *et al.*, 2000).

Descriptive statistics such as frequencies and means were used to summarize the data. Association was established using Chi-square test and a p- value =0.05 was considered statistically significant.

3.10 Ethical Considerations

The study was approved by the Nigerian Institute of Medical Research Institutional Review Board (Project Number: **IRB/13/214** See appendix E). Prior to data collection, permission was sought from Somolu Local Government. Verbal and written informed consent (see Appendix A and B) was obtained from all respondents before interview commenced.

Confidentiality of data: The questionnaire was identified with numbers, and every data collected from the participants was safely locked and protected from those not involved in the research.

Beneficence/ Non maleficence: The interviews were conducted in a friendly manner that enabled participants to express what they feel about malaria, the measures they employed to prevent their children from being bitten by mosquitoes and their perceived cause of malaria. Participants would tend to benefit when interventions proposed from the results of the study are included in policies enacted and also through interacting with the research assistants who had earlier been trained on the purpose of the research, they heard the correct information on malaria and its prevention.

Voluntariness: The participants were free to decide whether or not to take part in the study. An informed consent form was attached to the questionnaire, which anyone approached to

participate in the study carefully read through with the aid of a research assistant and voluntarily decided to participate or not after understanding all the procedures involved in the study. Also, the participant was free to withdraw from the study when he / she wish to. There was no penalty attached for not participating in the study.

CHAPTER FOUR

RESULTS

4.1 Socio-demographic characteristics of the care-givers

The socio-demographic characteristics of the care-givers are summarized in Table 4.1. Three hundred and ninety-four care-givers were interviewed. The results are presented based on the stratification of the Local Government. Stratum 1 being the well planned, well drained stratum, stratum 2, well planned not well drained stratum and stratum 3, the unplanned and not well drained stratum. The mean age of the respondents was 34 ± 7.7 years. Their ages were grouped into five with the modal age group for strata 1 and 2 being 30-39 while for stratum 3, the modal age group was 20-29. In all strata, there were more Christians than Muslims. Christians were 124(59.9%), 56 (63.2%) and 59(60.0%) in stratum1, 2 and 3, respectively. In all the strata, more of the respondents [89(42.9%), 61(68.4%), and 64(65.7%) in stratum 1, 2 and 3, respectively] reported that their monthly earning was difficult to say. In stratum 1, more of the respondents 84(40.4%), lived in room and parlour accommodation type, so also in stratum 2, 39(43.9%) while in stratum 3, more of the respondents lived in a room apartment, 41(41.4%). In all strata, more of the respondents 183(88.1%) stratum 1, 78(87.7%) stratum 2, and 85(87.1%) stratum 3 lived in rented apartments. Majority of the respondents were from households with density between 3-5 persons per room [stratum 1=131(63.5%), stratum 2= 67(75.4%) and stratum 3=67(68.6%)]. More care-givers had just one under-five child [124(59.9%), 55(61.4%) and 67(68.6%)] in strata 1, 2 and 3, respectively as compared with those with 2 or more under-five children.

Table 4.1: Socio-demographic characteristics of the care-givers. N= 394

Characteristic	S1 n(%) N= 207	S2 n(%) N=89	S3 n(%) N=98	Total n (%) N=394
Age group				
<20	8(3.8)	0(0)	0(0)	8(2.0)
20-29	56(27.2)	12(14.0)	22(22.9)	90(22.8)
30-39	107(51.9)	56(63.2)	15(15.4)	178(45.1)
40-49	27(13.1)	17(19.3)	20(20.0)	64(16.2)
>49	8(3.8)	3(3.5)	6(5.7)	17(4.3)
χ^2= 12.721, df= 8, p = 0.122				
Marital status				
Currently married	182(87.8)	86(96.5)	95(96.5)	363(92.1)
Others	25(12.2)	3(3.5)	3(3.5)	31(7.9)
χ^2= 4.186, df= 2, p = 0.123				
Occupation				
Unemployed	45(21.5)	16(17.5)	13(12.9)	74(18.8)
Student	25(11.9)	8(8.8)	10(10.0)	43(10.9)
Artisan	21(10.3)	6(7.0)	10(10.0)	37(9.4)
Trader	102(49.4)	58(64.9)	62(62.9)	222(56.3)
Civil servant	14(7.1)	2(1.8)	4(4.3)	20(5.1)
χ^2= 9.530, df= 8, p = 0.300				
Educational status				
No formal Education	15(7.4)	6(7.0)	4(4.3)	25(6.3)
Primary	19(9.3)	6(7.0)	13(12.9)	38(9.6)
Secondary	111(53.8)	58(64.9)	62(62.9)	231(58.6)
Tertiary	61(29.5)	19(21.1)	20(20.0)	100(25.4)
χ^2= 6.339, df= 6, p = 0.386				
Wealth Quintile				
Lowest	43(20.8)	12(14.0)	20(20.0)	75(19.0)
Second	36(17.3)	27(29.8)	24(24.3)	87(22.1)
Middle	38(18.3)	27(29.8)	20(20.0)	85(21.6)
Fourth	44(21.2)	11(12.3)	21(21.4)	76(19.3)
Highest	46(22.4)	12(14.0)	14(14.3)	72(18.3)
χ^2=13.897, df= 8, p = 0.084				

4.2. Signs and Symptoms of malaria as reported by respondents according to location

Figure 4.1 shows the response of the care-givers on questions relating to the signs and symptoms of malaria which they observed in their children. Headache was the most reported symptom in stratum 1,102(32.7%) and 3, 18(25.75%) while in stratum 2, both headache and loss of appetite had the same proportion; 16(28.1%). Other symptoms reported include: chills and rigours, vomiting, skin rash, headache, stomach ache, loss of appetite, diarrhoea, paleness of eyes and weakness of child.

4.3 Number of times child had febrile illness suspected to be malaria

A higher proportion of the care-givers of the under-five children in Stratum 1 reported that 83(40%) of their under-five children had febrile illness suspected to be malaria two times or more in the last one year while in stratum 2, 44(49%) and 3, 45(45.7%), more of the respondents reported that their under-five children had febrile illness suspected to be malaria just once in the last one year as shown in Table 4.2.

4.4 Mosquito breeding sites as reported by respondents

A summary of mosquito breeding sites as reported by the caregivers is shown in Table 4.3. In all strata, over 60% mentioned stagnant water as being mosquito breeding site. This was followed by gutters and ditches: s1, 61(29.5%), s2, 34(38.6%) and s3,41(41.4%). Other mosquito sites mentioned include: uncovered water containers, waste containers, dredges from construction site and broad leaves of plants and weeds.

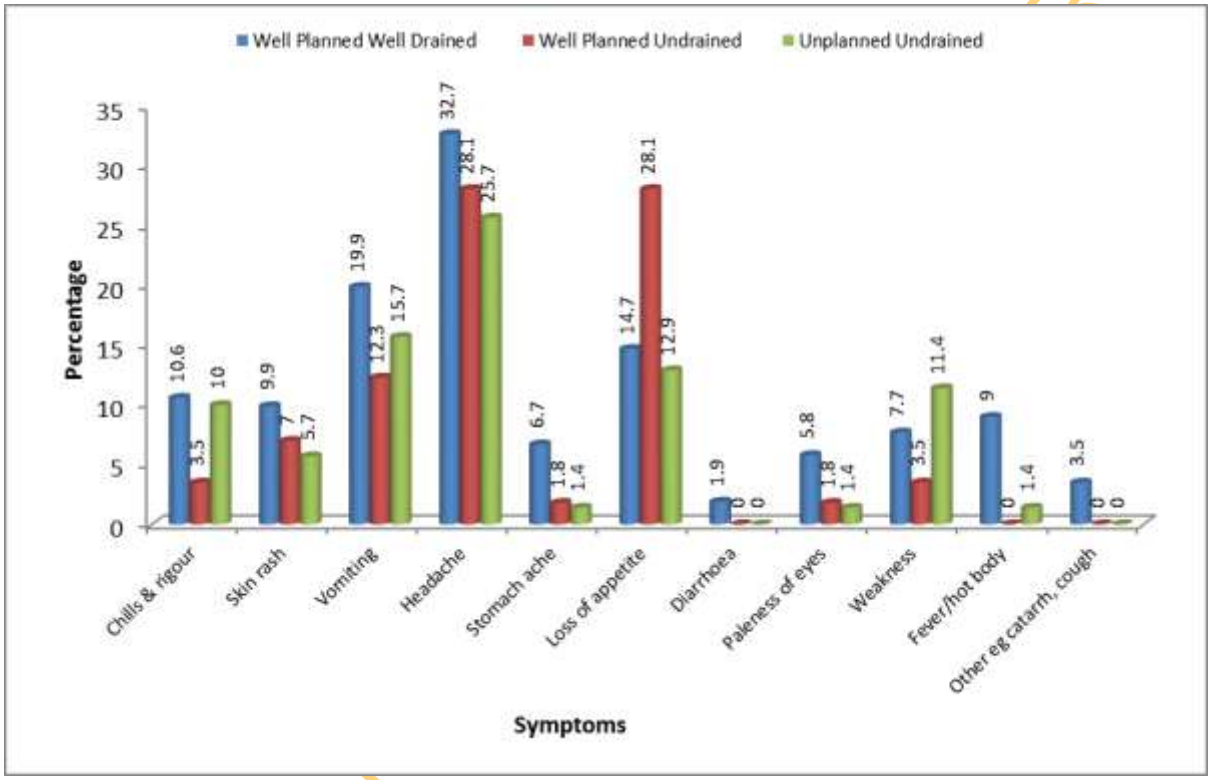

Fig. 4.1: Signs and Symptoms of Malaria as Reported by Respondents

Note: Multiple responses

Table 4.2: Number of times child had febrile illness suspected to be malaria in the last one year.

Variable	Strata		
	Well planned, well drained	**Well planned, not well drained**	**Unplanned, not well drained**
	N=207	**N=89**	**N=98**
	n (%)	n (%)	n (%)
How many times did your under-five child have febrile illness suspected to be malaria in the last year?			
None	46(22.1)	11(12.3)	24(24.3)
Once	78(37.8)	44(49.1)	45(45.7)
2 times or more	83(40.1)	34(38.6)	29(30.0)

Table 4.3: Mosquito breeding sites as reported by respondents

	S1 n(%)	S2 n(%)	S3 n(%)	χ^2	df	p-value
Stagnant water	126(60.9)	54(71.9)	78(80)	10.460	2	0.005*
Uncovered water container	19(9.0)	8(8.8)	3(2.9)	2.973	2	0.226
Gutters and ditches	61(29.5)	34(38.6)	41(41.4)	5.738	2	0.057
Waste containers	11(5.4)	3(3.5)	1(1.4)	2.29	2	0.032*
Dredges from construction site	13(6.1)	0(0)	4(4.3)	3.847	2	0.146
Broad leaves of plants and weeds	7(3.5)	5(5.3)	0(0)	3.215	2	0.200

***significant at 5% level of significance

Note: multiple responses

4.5 Cause of malaria as reported by respondents

A summary of cause(s) of malaria reported by the care-givers is shown in Figure 4.2. The proportion of the respondents who reported that the cause of malaria is mosquito bite were 234(75%), 50(87.7%), 59(84.3%) in Stratum 1, 2 and 3, respectively and those who mentioned malaria parasite were: 7(2.2%), 1(1.8%) and 0(0%) in strata 1, 2, and 3 respectively. Apart from mosquito bite, other causes mentioned include: standing under the sun, eating bad food, stress, excessive heat, wind or cold, dirty surrounding, drinking dirty water.

4.5.1 Cause of malaria by care-giver's knowledge of mosquito breeding site

There was no significant difference in the causes reported across the 3 strata. A significant association existed between mentioning stagnant water as mosquitoes' breeding site and reporting malaria parasite as cause of malaria (χ^2= 9.683,p= 0.002). There was also found a significant association between gutters and ditches as mosquito breeding site and reporting dirty surrounding as a cause of malaria (χ^2= 7.758,p= 0.005). A summary of the result is shown in Table 4.4.

4.5.2 Relationship between care-giver's location and knowledge of cause of malaria

As shown in Table 4.5, there was a significant association between the caregivers' location and their knowledge of the cause of malaria as mosquito bite. A significant association was also found between mentioning eating bad food as a cause of malaria and location of care-givers (χ^2= 7.758,p= 0.005)

4.6 Knowledge of malaria transmission among care-givers of under-five children

Figure 4.3 presents the care-givers' knowledge of how malaria is transmitted. Mosquito bite also had the highest proportion in all the 3 Strata. No significant association was found between location and the knowledge of transmission of malaria as mosquito bite. (χ^2 =5.385, p = 0.250). In Stratum 1, 58.3% reported that mosquito bite transmits malaria while in Strata 2 and 3, 56.1% and 61.4%, respectively reported mosquito bite to be responsible for the transmission of malaria respectively.

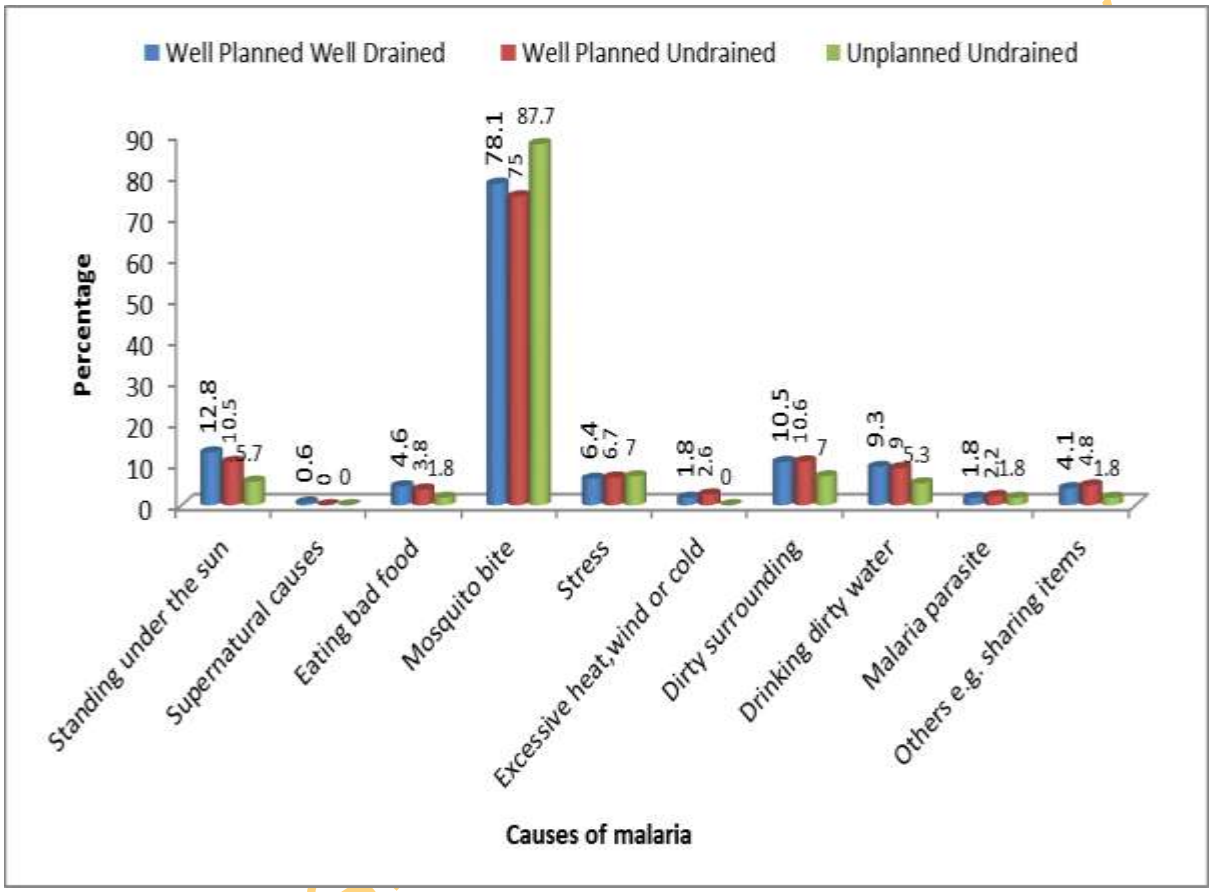

Fig. 4.2: Causes of Malaria as Reported by Respondents

Note: Multiple responses

Table 4.4: Cause of malaria by care-giver's knowledge of mosquito breeding site

Mosquitoes breeding site	Cause of malaria					
Stagnant water	**Malaria parasite**					
	Yes	**No**	**Total**	χ^2	**df**	**p-value**
	n (%)	**n (%)**	**N (%)**			
Yes	3(8.6)	32(91.4)	35(100)	9.683	1	0.002*
No	5(1.2)	354(98.8)	359(100)			
Gutters and ditches	**Dirty surrounding**					
	Yes	**No**	**Total**	χ^2	**df**	**p-value**
	n (%)	**n (%)**	**N(%)**			
Yes	13(16.4)	98(83.6)	111(100)	7.758	1	0.005*
No	8(7.7)	97(92.3)	105(100)			

***** significant at 5% level of significance

Table 4.5: Relationship between care-giver's location and knowledge of cause of malaria

Cause	Stratum 1 n(%)	Stratum 2 n(%)	Stratum 3 n(%)	$\chi 2$	df	p-value
Mosquito bite	155(75.0)	78(87.7)	83(84.3)	6.409	2	0.041*
Supernatural causes	1(0.6)	0(0)	0(0)	0.818	2	0.664
Standing under the sun	26(12.8)	9(10.5)	6(5.7)	2.909	2	0.234
Dirty surrounding	22(10.6)	6(7.0)	13(12.9)	1.153	2	0.562
Stress	14(6.7)	6(7.0)	4(4.3)	0.617	2	0.734
Drinking dirty water	19(9.0)	5(5.3)	14(14.3)	3.190	2	0.203
Eating bad food	8(3.8)	2(1.8)	10(10.0)	6.162	2	0.046*
Malaria parasite	5(2.2)	2(1.8)	0(0)	1.160	2	0.447

* significant at 5% level of significance

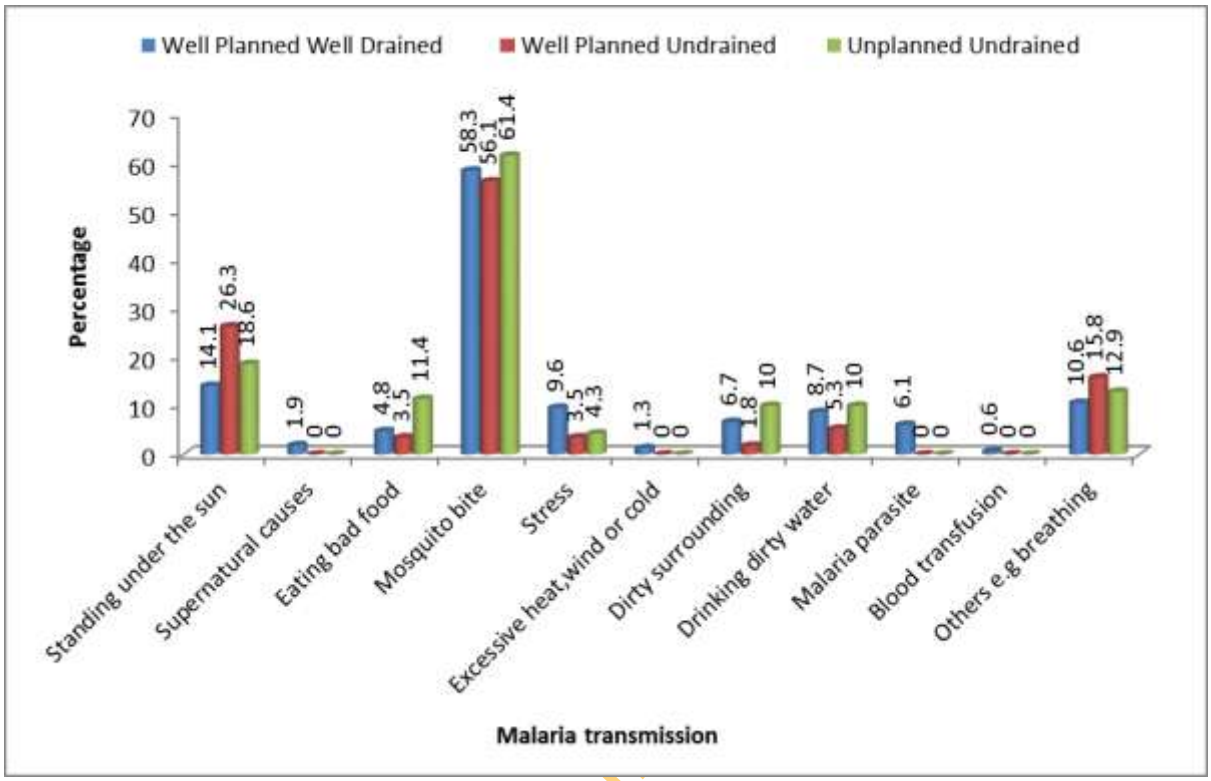

Fig. 4.3: Transmission Mode of Malaria as mentioned by the Respondents

Note: Multiple responses

4.7 Knowledge of preventive measures against malaria among respondents

The preventive measures against malaria which the respondents mentioned include: mosquito net, eating balanced diet, taking anti malarial drug, spraying insecticide, indoor residual spraying (only in Stratum 1), use of window and door screen and clearing bushes and surroundings. However, mosquito net had the highest proportion across Strata with 185(59.3%), 46 (80.7%) and 45(64.3%) in Strata 1, 2 and 3, respectively.

Figure 4.4 shows a summary of the preventive measures reported.

4.7.1 Knowledge of mosquito net as a malaria preventive measure according to respondents' characteristics

Age had a significant association with those who reported knowing mosquito net as a preventive measure against malaria (χ^2 = 10.153, p= 0.006). However, a significant association was found to exist between wealth quintile (χ^2= 9.964,p= 0.041), occupation (χ^2= 16.421,p= 0.003) and those who reported knowing anti-malarial drugs as a preventive measure against malaria. Table 4.6 presents knowledge of mosquito net as a malaria preventive measure in relationship with the respondents' characteristics.

4.7.2 Knowledge of anti-malarial drugs as a malaria preventive measure according to respondents' characteristics

No significant association was found to exist between age (χ^2 = 0.792, p= 0.673). However, a significant association was found to exist between wealth quintile (χ^2= 9.964,p= 0.041), occupation (χ^2= 16.421,p= 0.003) and those who reported knowing anti-malarial drugs as a preventive measure against malaria. Table 4.7 presents knowledge of anti-malarial drugs as malaria preventive measure in relationship with the respondents' characteristics.

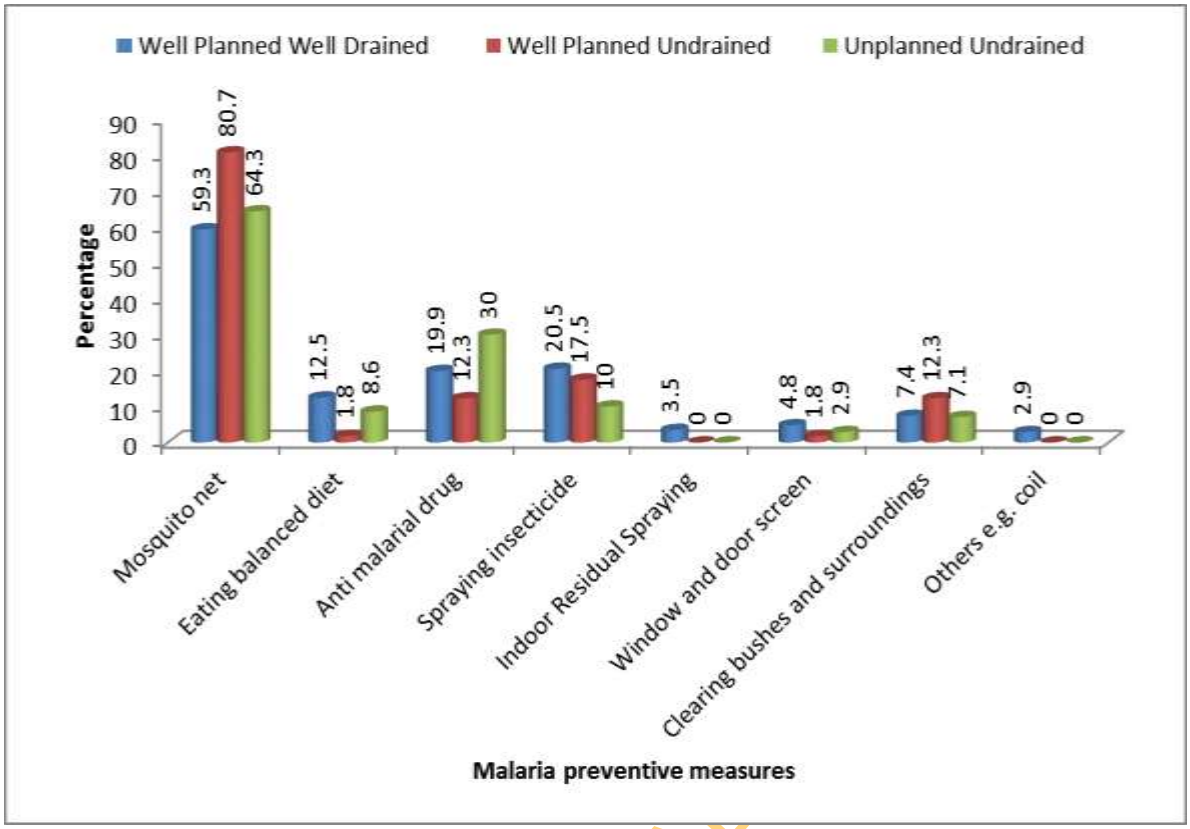

Fig. 4.4: Knowledge of Malaria Preventive Measures as Reported by The Respondents

Note: Multiple responses

Table 4.6: Knowledge of mosquito net as a malaria preventive measure according to respondents' characteristics.

Characteristic	Mosquito net					
Age	**Yes n(%) N=248**	**No n(%)N=146**	**Total n(%) N=394**	χ^2	**df**	**p-value**
≤24	12(38.2)	19(61.8)	31(100)	10.153	2	0.006*
25-34	137(66.5)	69(33.5)	206(100)			
≥35	99(62.9)	58(37.1)	157(100)			
Wealth quintile	**N=248**	**N=147**	**N=394**	6.191	4	0.185
Poorest quintile	47(59.8)	32(40.2)	79(100)			
Second quintile	51(64.8)	28(35.2)	79(100)			
Third quintile	57(72.7)	22(27.3)	79(100)			
Fourth quintile	49(61.4)	30(38.6)	79(100)			
Richest quintile	44(55.7)	35(44.3)	79(100)			
Occupation	**N=249**	**N=155**	**N=394**	3.769	4	0.438
Unemployed	48(60. 5)	31(39.5)	79(100)			
Student	30(61.2)	14(38.8)	44(100)			
Trader	141(66.4)	72(33.6)	213(100)			
Artisan	23(58.1)	16(41.9)	39(100)			
Civil servant	11(50.0)	12(50.0)	23(100)			

***significant at 5% level of significance

Table 4.7: Knowledge of anti-malarial drugs as a malaria preventive measure according to respondents' characteristics

Characteristic		**Anti-malaria drugs**				
Age	**Yes n(%) N=80**	**No n(%) N=314**	**Total n(%) N=394**	χ^2	**df**	**p-value**
≤24	4(14.7)	26(85.3)	30(100)	0.792	2	0.673
25-34	44(21.3)	162(78.7)	206(100)			
≥35	32(20.6)	125(79.4)	157(100)			
Wealth quintile	**N=81**	**N=313**	**N=394**	9.964	4	0.041*
Poorest quintile	18(23.0)	61(77.0)	79(100)			
Second quintile	9(11.4)	70(88.6)	79(100)			
Third quintile	13(15.9)	66(84.1)	79(100)			
Fourth quintile	18(23.9)	60(76.1)	78(100)			
Richest quintile	22(28.4)	56(71.6)	79(100)			
Occupation	**N=82**	**N=312**	**N=394**	16.421	4	0.003*
Unemployed	16(19.8)	63(80.2)	79(100)			
Student	17(38.8)	26(61.2)	43(100)			
Trader	35(16.2)	178(83.8)	213(100)			
Artisan	6(16.3)	33(83.7)	39(100)			
Civil servant	8(34.6)	16(65.4)	24(100)			

***** significant at 5% level of significance

4.7.3 Knowledge of spraying of insecticides as a malaria preventive measure according to respondents' characteristics

No significant association was found to exist between age (χ^2 = 1.471, p= 0.479), wealth quintile (χ^2 = 4.135, p= 0.388), occupation (χ^2 = 5. 433, p= 0.246) and those who reported knowing that spraying of insecticides is as a preventive measure against malaria. Table 4.8 presents knowledge of spraying of insecticides as a malaria preventive measure in relationship with the respondents' characteristics.

4.7.4 Knowledge of window and door screen as a malaria preventive measure according to respondents' characteristics

No significant association was found to exist between age (χ^2 = 2.160, p= 0.340), wealth quintile (χ^2 = 4.135, p= 0.388), occupation (χ^2 = 4.424, p= 0.352) and those who reported knowing that window and door screen is a preventive measure against malaria. Table 4.9 presents the relationship between knowledge of window and door screen as a malaria preventive measure and the respondents' characteristics.

4.7.5 Knowledge of clearing of bushes and surroundings as a malaria preventive measure according to respondents' characteristics

No significant association was found to exist between age (χ^2 = 2.424, p= 0.298), wealth quintile (χ^2 = 2.436, p= 0.656), occupation (χ^2 = 3.824, p= 0.430) and those who reported knowing that clearing of bushes and surroundings is a preventive measure against malaria. Table 4.10 presents the relationship between knowledge of clearing of bushes and surroundings as a malaria preventive measure and the respondents' characteristics.

4.8: Knowledge of spraying of insecticides as a malaria preventive measure according to respondents' characteristics

Characteristic	spraying of insecticides(aerosol)					
Age	**Yes n(%) N=172**	**No n(%) N=246**	**Total n(%) N=394**	χ^2	**df**	**p-value**
≤24	7(23.5)	23(76.5)	30(100)	1.471	2	0.479
25-34	40(19.6)	166(80.4)	206(100)			
≥35	125(16.0)	59(84.0)	157(100)			
Wealth quintile	**N=74**	**N=320**	**N=394**	4.135	4	0.388
Poorest quintile	15(18.4)	64(81.6)	79(100)			
Second quintile	15(19.3)	64(80.7)	79(100)			
Third quintile	12(14.8)	67(85.2)	79(100)			
Fourth quintile	12(14.8)	67(85.2)	79(100)			
Richest quintile	20(25.0)	59(75.0)	79(100)			
Occupation	**N=73**	**N=321**	**N=394**	5.433	4	0.246
Unemployed	14(17.4)	65(82.6)	79(100)			
Student	9(20.4)	35(75.6)	44(100)			
Trader	37(17.4)	176(82.6)	213(100)			
Artisan	5(14.0)	34(86.0)	39(100)			
Civil servant	8(34.6)	15(65.4)	23(100			

Table 4.9: Knowledge of window and door screen as a malaria preventive measure according to respondents' characteristics

Characteristic	window and door screen					
Age	**Yes n(%) N=16**	**No n(%) N=378**	**Total n(%) N=394**	χ^2	**df**	**p-value**
≤24	3(8.8)	27(91.2)	30(100)	2.160	2	0.340
25-34	7(23.5)	199(76.50	206(100)			
≥35	6(4.0)	151(96)	157(100)			
Wealth quintile	**N=17**	**N=377**	**N=394**	4.135	4	0.388
Poorest quintile	1(1.1)	78(98.9)	79(100)			
Second quintile	5(5.7)	74(94.3)	79(100)			
Third quintile	3(3.4)	76(96.6)	79(100)			
Fourth quintile	3(3.4)	76(96.6)	78(100)			
Richest quintile	5(6.8)	74(93.2)	79(100)			
Occupation	**N=17**	**N=377**	**N=394**	4.424	4	0.352
Unemployed	2(2.3)	77(97.7)	79(100)			
Student	2(4.1)	42(95.9)	44(100)			
Trader	8(3.8)	201(96.2)	209(100)			
Artisan	2(4.7)	37(95.3)	39(100)			
Civil servant	3(11.5)	20(88.5)	23(100)			

Table 4.10: Knowledge of clearing of bushes and surroundings as a malaria preventive measure according to respondents' characteristics

Characteristic	clearing of bushes and surroundings					
Age	**Yes n(%) N=32**	**No n(%) N=362**	**Total n(%) N=394**	χ^2	**df**	**p-value**
≤24	3(8.8)	27(91.2)	30(100)	2.424	2	0.298
25-34	13(6.1)	193(93.9)				
≥35	16(10.3)	141(89.7)				
Wealth quintile	**N=31**	**N=360**	**N=394**	2.436	4	0.656
Poorest quintile	5(5.7)	74(94.3)	79(100)			
Second quintile	7(9.1)	72(90.9)	79(100)			
Third quintile	5(6.8)	74(93.2)	79(100)			
Fourth quintile	9(11.4)	70(88.6)	78(100)			
Richest quintile	5(16.8)	74(83.2)	79(100)			
Occupation	**N=33**	**N=361**	**N=394**	3.824	4	0.430
Unemployed	4(4.7)	75(95.3)	79(100)			
Student	3(6.1)	41(93.9)	44(100)			
Trader	19(8.9)	194(91.1)	209(100)			
Artisan	3(7.0)	36(93.0)	39(100)			
Civil servant	4(15.4)	19(84.6)	23(100)			

4.8 Mosquito avoidance practices

Figure 5 presents the measures the respondents mentioned they adopt to prevent their children from being bitten by mosquitoes. Across strata, mosquito net was the mosquito avoidance measure with the highest proportion among the respondents, 147(64.4%) in stratum 1, 61(68.4%) in stratum 2 and 62(64.7%) in stratum 3. The least mentioned mosquito avoidance measure in all strata is burning of repellent plants with just 1(0.24%) in stratum 1 with none reporting its use in both strata 2 and 3.

4.8.1 Factors influencing choice of mosquito avoidance practices

The respondents were asked the factors influencing the measure they use to prevent mosquito bite in their under-five children and what informed their choice.

Of the respondents, 77(37.3%), 23(26.3%) and 41(42.1%) in stratum 1, 2 and 3, respectively reported that the health worker advised them to adopt the mosquito avoidance measure while 65(31.4%), 33(36.8%) and 28(28.1%) mentioned the media as influencing their mosquito avoidance measure. The least mentioned factor is the availability of the mosquito avoidance measure; 3(1.3%), 0(0%) and 1(1.4%) in stratum 1, 2 and 3, respectively.
A summary of their response is given in Table 4.11.

4.8.2 Factors associated with bed net use as a mosquito avoidance practice

As shown in Table 4.12, there was no significant association between location ($\chi^2 = 0.46$, $p = 0.795$), monthly earning ($\chi^2 = 6.124$, $p = 0.190$), wealth quintile ($\chi^2 = 12.336$, $p = 0.15$) and the use of mosquito net. However, there was a significant association between its effectiveness ($\chi^2 = 7.081$, $p = 0.008$), its ease of use ($\chi^2 = 12.458$, $p = 0.000$), and its affordability ($\chi^2 = 9.209$, $p = 0.002$).

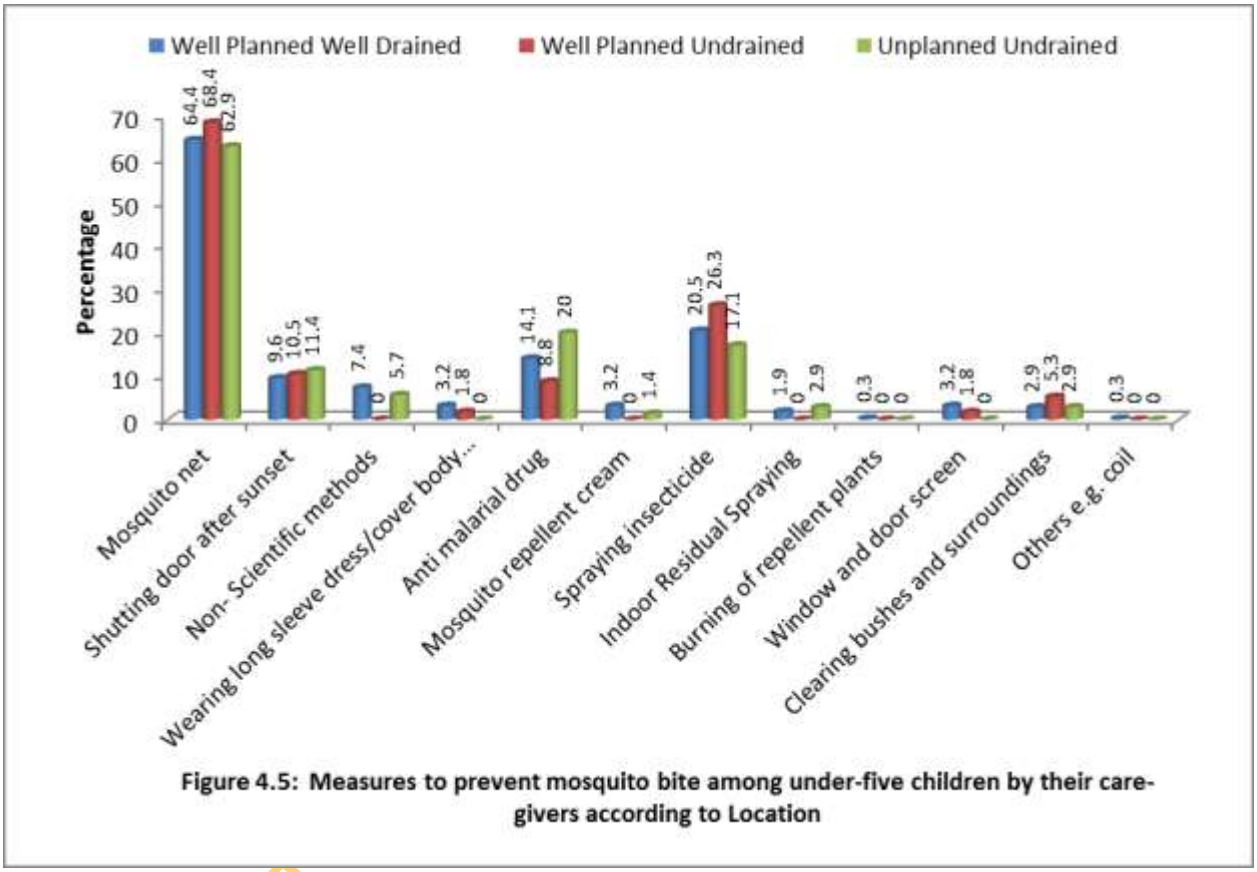

Figure 4.5: Measures to prevent mosquito bite among under-five children by their care-givers according to Location

Fig. 4.5: Mosquito Avoidance Practices As Mentioned By The Respondents

Note: Multiple responses

Table 4.11: Factors mentioned that influenced the choice of mosquito avoidance practice N=394

*What informed choice of preventive measure	Well planned, well drained stratum n (%)	Well planned, not well drained stratum	Not planned, not well drained stratum	χ^2	df	p-value
Affordability	21(10.3)	15(14.0)	11(11.3)	1.374	2	0.503
Media	65(31.4)	33(36.8)	28(28.1)	0.660	2	0.719
Perceived Effectiveness	30(14.4)	19(21.1)	10(10.0)	3.103	2	0.212
Health worker	77(37.3)	23(26.3)	41(42.1)	6.494	2	0.039
Friends/neighbour	11(5.1)	0(0)	6(5.7)	3.172	2	0.205
Readily available	3(1.3)	0(0)	1(1.4)	0.766	2	0.682
Easy to use at home	7(3.2)	2(1.8)	1(1.4)	0.915	2	0.633
Total	207	89	98			

***Multiple responses**

Table 4.12: Factors associated with bed net use as mosquito avoidance practice

Characteristic	Bed net					
	Yes	**No**	**Total**	χ^2	**df**	**p-value**
Location	**N=256**	**N=138**	**N=394**			
	n (%)	**n (%)**	**n (%)**			
Stratum 1	133(64.4)	74(35.6)	207(100)	0.795	2	0.460
Stratum 2	61(68.4)	28(31.6)	89(100)			
Stratum 3	62(62.9)	36(37.1)	98(100)			
	Yes	**No**	**Total**			
	N=256	**N=139**	**N=394**			
Monthly earning	**n (%)**	**n (%)**	**N (%)**	6.124	4	0.190
Difficult to say	135(23.0)	62 (77.0)	197 (100)			
≤₦20,000	72 (63.2)	42(36.8)	114(100)			
₦21,000-₦40,000	30(63.0)	18(37.0)	48(100)			
₦41,000-₦60,000	7(42.1)	9(57.9)	16 (100)			
≥₦61,000	12(59.1)	8(40.9)	20(100)			
	Yes	**No**	**Total**	χ^2	**df**	**p-value**
It is effective	**N=254**	**N=140**	**N=394**			
	n (%)	**n (%)**	**N (%)**			
Yes	29(50.0)	30(50.0)	59(100)	7.081	1	0.008*
No	225(67.2)	110(32.8)	335(100)			
	Yes	**No**	**Total**			
It is easy to use	**N=253**	**N=143**	**N=394**			
	n (%)	**n (%)**	**N (%)**	12.458	1	0.000*
Yes	1(16.7)	11(83.3)	12(100)			
No	252(66.0)	130(34.0)	382(100)			

*significant at 5% level of significance

4.8.3 Factors associated with shutting door after sunset as a mosquito avoidance practice

There was no significant association between the respondents' location and monthly earning and shutting of door after sunset as shown in Table 4.13. There was also no significant association between the effectiveness (χ^2 = 0.510, p = 0.475) and ease of use of shutting of door and window (χ^2 = 1.374, p = 0.241) and its use. However, there was a significant association between the health worker's advice and the influence of friends and neighbours and shutting of door after sunset (χ^2 = 6.438, p = 0.011, χ^2 = 9.273, p = 0.002) respectively.

4.8.4 Factors associated with the use of mosquito repellent cream as a mosquito avoidance practice

As shown in Table 4.14, there was a significant association between the respondents' monthly earning (χ^2 = 11.773, p = 0.019) and the use of mosquito repellent cream. However, there was no significant association between the respondents' location, the effectiveness of mosquito repellent cream, the ease of use and its use as a mosquito avoidance practice.

4.8.5 Factors associated with the use of aerosol as a mosquito avoidance practice

There existed a significant relationship between the perceived effectiveness and ease of use of aerosols and its use as a mosquito avoidance practice as shown in Table 4.15. There was however no significant association between the respondents' location, monthly earning and the use of aerosol as mosquito avoidance practice. A significant association was also found to exist between those who reported that the health workers and the media influenced their adopting aerosol as a mosquito avoidance measure and its use (χ^2= 6.331, p=0.012, χ^2= 15.092, p=0.000) respectively.

Table 4.13: Factors associated with shutting door and window after sunset as a mosquito avoidance practice

Characteristic	Shutting door after sunset					
	Yes	**No**	**Total**	χ^2	**df**	**p-value**
Location	**N=40**	**N=354**	**N=394**			
	n (%)	**n (%)**	**n (%)**			
Stratum 1	20(9.6)	187(90.4)	207(100)	0.227	2	0.893
Stratum 2	9(10.5)	80(89.5)	89(100)			
Stratum 3	11(11.4)	87(88.6)	98(100)			
	Yes	**No**	**Total**			
	N=39	**N=356**	**N=394**			
Monthly earning	**n (%)**	**n (%)**	**N (%)**	7.040	4	0.134
Difficult to say	14(7.3)	183(92.7)	197 (100)			
≤₦20,000	12(10.4)	102(89.6)	114(100)			
₦21,000-₦40,000	8(16.7)	40(83.3)	48(100)			
₦41,000-₦60,000	3(21.1)	13(78.9)	16 (100)			
≥₦61,000	2(9.1)	18(90.9)	20(100)			
	Yes	**No**	**Total**	χ^2	**df**	**p-value**
It is effective	**N=39**	**N=355**	**N=394**			
	n (%)	**n (%)**	**N (%)**			
Yes	7(12.5)	51(87.5)	58(100)	0.510	1	0.475
No	32(9.6)	304(90.4)	336(100)			
	Yes	**No**	**Total**			
It is easy to use	**N=39**	**N=355**	**N=394**			
	n (%)	**n (%)**	**N (%)**	1.374	1	0.241
Yes	0(0)	11(100)	11(100)			
No	39(10.3)	344(89.7)	383(100)			

Table 4.14: Factors associated with the use of mosquito repellent cream as a mosquito avoidance practice

Characteristic	Mosquito repellent cream					
	Yes	**No**	**Total**	χ^2	**df**	**p-value**
Location	**N=8**	**N=386**	**N=394**			
	n (%)	**n (%)**	**n (%)**			
Stratum 1	7(3.2)	200(96.8)	207(100)	2.422	2	0.298
Stratum 2	0(0.0)	89(100)	89(100)			
Stratum 3	1(1.4)	97(98.6)	98(100)			
	Yes	**No**	**Total**			
	N=10	**N=384**	**N=394**			
Monthly earning	**n (%)**	**n (%)**	**N (%)**	11.773	4	0.019*
Difficult to say	2(0.9)	195(99.1)	197 (100)			
≤₦20,000	5(4.8)	109(95.2)	114(100)			
₦21,000-₦40,000	0(0)	48(100.0)	48(100)			
₦41,000-₦60,000	2(10.5)	14(89.5)	16 (100)			
≥₦61,000	1(0.9)	19(99.1)	20(100)			
	Yes	**No**	**Total**	χ^2	**df**	**p-value**
It is effective	**N=10**	**N=384**	**N=394**			
	n (%)	**n (%)**	**N (%)**			
Yes	1(1.6)	57(98.4)	58(100)	0.510	1	0.475
No	9(2.7)	327(97.3)	336(100)			
	Yes	**No**	**Total**			
It is easy to use	**N=10**	**N=384**	**N=394**			
	n (%)	**n (%)**	**N (%)**	1.374	1	0.241
Yes	0(0)	11(100)	11(100)			
No	10(2.6)	373(97.4)	383(100)			

*significant at 5% level of significance

Table 4.15: Factors associated with the use of aerosol as a mosquito avoidance measure

Characteristic	Aerosol(spraying of insecticides)					
	Yes	**No**	**Total**	χ^2	**df**	**p-value**
Location	**N=82**	**N=312**	**N=394**			
	n (%)	**n (%)**	**n (%)**			
Stratum 1	42(20.5)	165(79.5)	207(100)	1.639	2	0.441
Stratum 2	23(26.3)	66(73.7)	89(100)			
Stratum 3	17(17.1)	81(82.9)	98(100)			
	Yes	**No**	**Total**			
	N=81	**N=313**	**N=394**			
Monthly earning	**n (%)**	**n (%)**	**N (%)**	9.085	4	0.059
Difficult to say	32(16.4)	165(83.6)	197 (100)			
≤₦20,000	27 (24.0)	87(97.6)	114(100)			
₦21,000-₦40,000	10(20.4)	38(79.6)	48(100)			
₦41,000-₦60,000	4(26.3)	12(73.7)	16 (100)			
≥₦61,000	8(40.9)	12(86.4)	20(100)			
	Yes	**No**	**Total**	χ^2	**df**	**p-value**
It is effective	**N=82**	**N=312**	**N=394**			
	n (%)	**n (%)**	**N (%)**			
Yes	31(53.1)	28(46.9)	58(100)	47.853	1	0.000*
No	51(15.2)	284(84.8)	336(100)			
	Yes	**No**	**Total**			
It is easy to use	**N=82**	**N=312**	**N=394**			
	n (%)	**n (%)**	**N (%)**	15.894	1	0.000*
Yes	8(66.7)	4(33.3)	11(100)			
No	74(19.4)	308(80.6)	383(100)			

***significant at 5% level of significance

4.8.6 Factors associated with the use of window and door screen as a mosquito avoidance measure

There was no significant association between the respondents' location, monthly earning and use of window and door screen as shown in Table 4.16. However, a statistical association existed between the effectiveness of window and door screen, its ease of use and friends and neighbour's influence and its use (χ^2 = 47.853, p = 0.000, χ^2 = 15.894, p = 0.000, χ^2 = 4.818, p = 0.028 respectively.

4.8.7 Factors associated with clearing bushes and surroundings as a mosquito avoidance practice

No significant association was found between the respondents' location, the effectiveness of clearing of bushes and surroundings, the ease at which it is done and clearing of bushes and surroundings as a mosquito avoidance practice. There was a significant association between the respondents' monthly earning and clearing bushes and surroundings as a mosquito avoidance practice. There was also a significant association between mentioning dirty surrounding (χ^2 = 5.047, p = 0.025) as a cause of malaria and clearing bushes and surroundings as a mosquito avoidance practice as shown in Table 4.17.

4.8.8 Multiple mosquito avoidance practices among care-givers of under- five children

Multiple mosquito avoidance practices among care-givers of under- five children refer to the practice of at least two of the following measures: mosquito net, mosquito repellent cream, spraying insecticide (aerosol), indoor residual spraying, use of window and door screen and clearing of bushes and surroundings. Overall, about 85.0% of the respondents practice just one of the measures listed above while about 15.0% practised two or more of the measures.

4.8.9 Relationship between Socio demographic characteristics and the use of multiple mosquito avoidance practices

The relationship between the socio demographic characteristics of the care-givers of under-five children and their use of multiple mosquito avoidance practices is shown in Table 4.18. There was no significant relationship between location and use of multiple mosquito avoidance practices, however, there was a significant relationship between monthly earning, education and the use of multiple mosquito avoidance practices.

Table 4.16: Factors associated with the use of window and door screen as a mosquito avoidance measure

Characteristic	Window and door screen					
	Yes	**No**	**Total**	χ^2	**df**	**p-value**
Location	**N=9**	**N=385**	**N=394**			
	n (%)	**n (%)**	**n (%)**			
Stratum 1	7(3.2)	200(96.8)	207(100)	2.556	2	0.279
Stratum 2	2(1.8)	87(98.2)	89(100)			
Stratum 3	0(0.0)	98(100.0)	98(100)			
	Yes	**No**	**Total**			
	N=31	**N=363**	**N=394**			
Monthly earning	**n (%)**	**n (%)**	**N (%)**	13.125	4	0.011*
Difficult to say	3(1.4)	194(98.6)	197 (100)			
≤₦20,000	3 (2.4)	111(97.6)	114(100)			
₦21,000-₦40,000	10(20.4)	38(79.6)	48(100)			
₦41,000-₦60,000	2(3.7)	14(963.)	16 (100)			
≥₦61,000	13(13.6)	7(86.4)	20(100)			
	Yes	**No**	**Total**	χ^2	**df**	**p-value**
It is effective	**N=82**	**N=312**	**N=394**			
	n (%)	**n (%)**	**N (%)**			
Yes	4(6.3)	52(93.8)	56(100)	47.853	1	0.000*
No	6(1.9)	332(98.1)	338(100)			
	Yes	**No**	**Total**			
It is easy to use	**N=82**	**N=312**	**N=394**			
	n (%)	**n (%)**	**N (%)**	15.894	1	0.000*
Yes	1(8.3)	10(91.7)	11(100)			
No	9(2.3)	374(97.3)	383(100)			

***significant at 5% level of significance**

Table 4.17: Factors associated with clearing bushes and surroundings as a mosquito avoidance practice

Characteristic	Clearing bushes and surroundings					
	Yes	**No**	**Total**	χ^2	**df**	**p-value**
Location	**N=14**	**N=380**	**N=394**			
	n (%)	**n (%)**	**n (%)**			
Stratum 1	6(2.9)	201(97.1)	207(100)	0.913	2	0.634
Stratum 2	5(5.3)	84(94.7)	89(100)			
Stratum 3	3(2.9)	95(97.1)	98(100)			
	Yes	**No**	**Total**			
	N=14	**N=381**	**N=394**			
Monthly earning	**n (%)**	**n (%)**	**N (%)**	12.238	4	0.016*
Difficult to say	5(2.3)	192(97.7)	197 (100)			
≤₦20,000	3 (2.4)	111(97.6)	114(100)			
₦21,000-₦40,000	1(1.9)	47(98.1)	48(100)			
₦41,000-₦60,000	2(10.5)	14(89.5)	16 (100)			
≥₦61,000	3(13.6)	17(86.4)	20(100)			
	Yes	**No**	**Total**	χ^2	**df**	**p-value**
It is effective	**N=13**	**N=381**	**N=394**			
	n (%)	**n (%)**	**N (%)**			
Yes	2(3.1)	56(96.9)	58(100)	0.001	1	0.975
No	11(3.2)	325(96.8)	336(100)			
	Yes	**No**	**Total**			
It is easy to use	**N=13**	**N=381**	**N=394**			
	n (%)	**n (%)**	**N (%)**	0.406	1	0.524
Yes	0(0.0)	11(100.0)	11(100)			
No	13(3.3)	370(96.7)	383(100)			

*significant at 5% level of significance

Table 4.18: Relationship between Socio demographic characteristics and multiple mosquito avoidance practices

Variable	Use of multiple mosquito avoidance practices					
	Yes	**No**	**Total**	χ^2	**df**	**p-value**
Location						
Stratum 1	42(20.4)	164(27.6)	206(79.6)	0.977	2	0.614
Stratum 2	9(10.1)	80(89.9)	89(100)			
Stratum 3	7(7. 1)	91(92. 9)	98(100)			
Monthly earning						
Less than ₦20,000	20(17.9)	92(82.1)	112(100)	20.558	4	0.000*
₦21,000-₦40,000	8(16.7)	40(83.3)	48(100)			
₦41,000-₦60,000	3(17.7)	14(82.3)	17(100)			
₦60,000 and above	9(45)	11(55)	20(100)			
Difficult to say	18(9.1)	179(90.9)	197(100)			
Wealth quintile				11.536	4	0.021*
Lowest quintile	8(10.1)	71(89.9)	79(100)			
Second quintile	5(6.3)	74(93.7)	79(100)			
Third quintile	12(15.2)	67(84.8)	79(100)			
Fourth quintile	14(17.9)	64(82.1)	78(100)			
Highest quintile	19(24.1)	60(75.9)	79(100)			
Education						
None	5(20.0)	20(80.0)	25(100)	12.252	3	0.007*
Primary	7(18.4)	31(81.6)	38(100)			
Secondary	21(9.1)	210(90.9)	231(100)			
Tertiary	25(25)	75(75)	100(100)			

*significant at 5% level of significance

4.9 Mosquito net ownership and their source

Table 4.19 shows the mosquito net ownership status of the respondents as well as how they obtained the net. Acquisition of mosquito nets was mainly from the health facility in the 3 Strata with 146 (62.1%) of the respondents in Stratum 1 having their nets from the health facility and 27(62.8%) and 32(66.7%) of the respondents in Strata 2 and 3, respectively reporting likewise. This was followed by distribution by Local Government officials in s1, (26%), s2, (35%) and s3, (27.1%).

4.10 Mosquito net usage

More than 70% of the respondents in each stratum mentioned they had their under-five children sleep under the net a night before the survey. In stratum 1, 151 (73.1%), stratum 2, 63(70.7%) and stratum 3, 69 (70.2%). (Fig. 4.6).

4.11 Relationship between care-givers' characteristics and bed net usage among under-five children

The relationship between caregivers' characteristics and bed net use among under-five children (the night before the survey) is given in Table 4.20. There was a significant relationship between monthly earning and occupation of caregiver and bed net usage among under-five children. A significant association was also found to exist between the type of house lived in, the number of times the child had febrile illness suspected to be malaria and bed net usage among under-five children.

4.12 Reasons why under-five child did not sleep under the net the previous night before the survey

For the children who did not sleep under the net the night before the survey, the reasons given by the respondents in the 3 strata include: the net generates heat, the child cannot sleep alone, the net is meant only for adults, the child reacts to the net or it causes itching in the child and lack of space to hang it in the room. However, majority in each stratum mentioned the issue of heat generated by the net 41%, 58% and 57% in Stratum 1, 2 and 3, respectively.

Figure 4.7 shows a summary of the reasons reported.

Table 4.19: Mosquito net ownership and their source

Variable	Strata			
	Well planned, well drained n (%)	Well planned, not well drained n (%)	Not planned, not well drained n(%)	Total
Do you have mosquito net?	**N=206**	**N =89**	**N =98**	
Yes	157(76.0)	67(75.4)	67(68.6)	291
No	49(24)	22(24.6)	31(31.4)	102
***Which type do you have?**				
Untreated net	14(8.9)	5(7.0)	6(8.3)	25
Retreatable net	55(35.0)	14(20.9)	10(14.6)	79
Long-Lasting Insecticide treated Net	85(54.4)	45(67.1)	53(79.2)	183
***How did you acquire it?**				
At health facility	98(62.1)	42(62.8)	45(66.7)	185
Distribution by LG Officials	41(26.0)	23(35.0)	8(12.5)	72
Bought it	27(17.0)	14(35.0)	18(27.1)	59

Note: *multiple responses

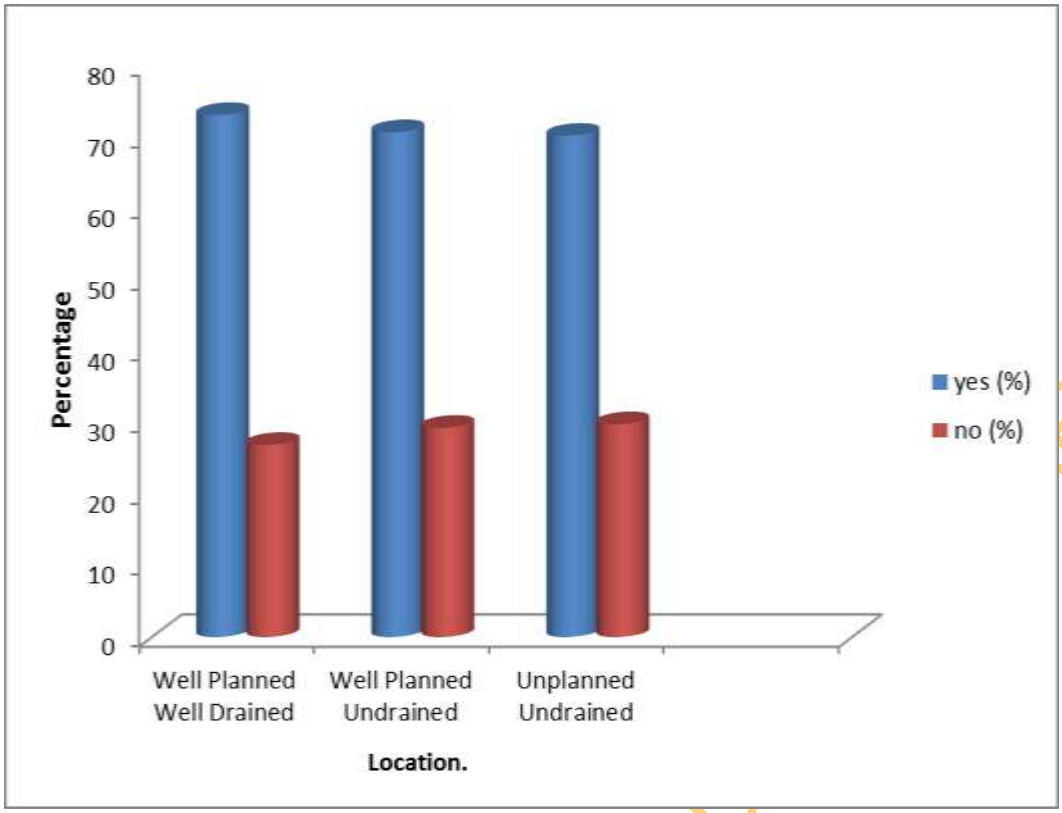

Fig. 4.6: Proportion of Under-Five Children Who Slept Under a Bednet a Night before The Survey.

Table 4.20: Relationship between care-givers' characteristics and bednet usage among under-five children. N =283(number of respondents with bed net)

Variable	Child sleep under a bed net last night					
Occupation	**Yes**	**No**	**Total**	χ^2	**df**	**p-value**
	n (%)	**n (%)**	**N (%)**			
Unemployed	49(88.3)	6(11.7)	55(100)	19.606	4	0.001*
Student	23(89.3)	3(10.7)	26(100)			
Trader	113(68.3)	52(31.7)	165(100)			
Artisan	21(64.7)	11(35.3)	32(100)			
Civil servant	7(50.0)	7(50.0)	14(100)			
Type of house				11.726	2	0.003*
One room	81(68.9)	37(31.1)	118(100)			
Room and parlour	91(82.6)	19(17.4)	110(100)			
Self-contained apartment	37(60.9)	24(39.1)	61(100)			
Number of under-five children in the household				6.98	1	0.008*
1	116(67.0)	57(33.0)	173(100.0)			
≥2	93(80.5)	23(19.5)	116(100)			

*significant at 5% level of significance

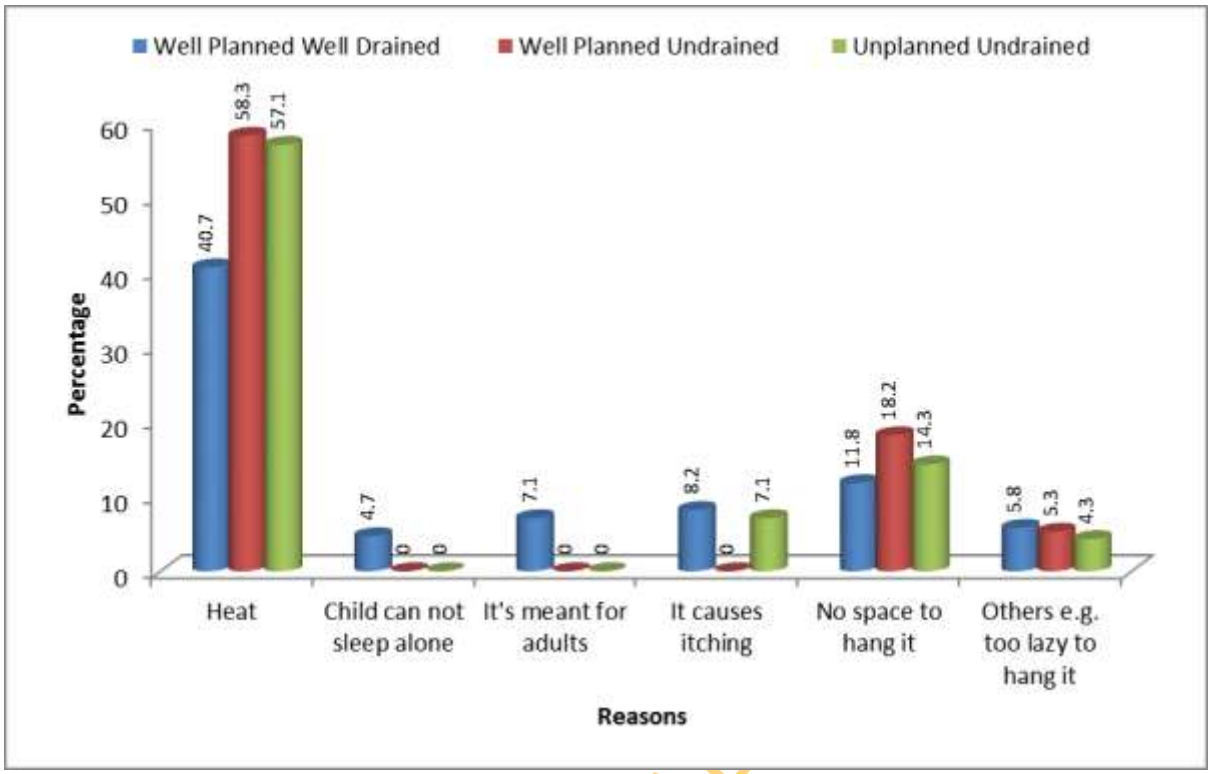

Fig. 4.7: Reasons for under-five Children not Sleeping under a Bednet a Night before the Survey.

4.13 Reasons for not owning a net

For the respondents who reported not owning mosquito nets, a higher proportion in Stratum 1 (32.9%) and Stratum 2 (43.8%) reported that they had net but it was torn, however in stratum 3, 4(25.0%), the unavailability of the net in the market was the main reason given. Table 4.21 shows the various reasons given.

Table 4.21: Reasons given by under-five care-givers for not owning a net

Variable	Strata			
	Well planned, well drained n (%)	**Well planned, not well drained n (%)**	**Not well planned, not well drained n (%)**	**Total**
Reasons				
I can't afford it	6(12.7)	0(0)	6(18.8)	12(11.8)
I don't think it's effective	10(20.3)	7(31.3)	4(12.5)	21(20.6)
It's not available in the market	11(21.5)	6(25.0)	8(25.0)	25(24.5)
I had but it's torn	16(32.9)	10(43.8)	8(25.0)	34(33.3)
Others e.g. I can 't find it	6(12.7)	0(0)	5(18.7)	11(10.8)
Total	49(100)	22(100)	31(100)	102(100)

CHAPTER 5

DISCUSSION, CONCLUSION AND RECOMMENDATIONS

5.1 Discussion

This study showed the various measures care-givers of under-five children adopted to prevent their under-five children from being bitten by mosquitoes.

The various mosquito avoidance practices, knowledge of signs and symptoms, knowledge of malaria, the cause and transmission, knowledge of malaria preventive measures, reported mosquito avoidance practices, factors that influence use of multiple mosquito avoidance practices and insecticide-treated bed nets ownership and usage among under-five children in the study area were determined.

5.1.1 Knowledge of signs and symptoms

Some of the signs and symptoms mentioned include: chills and rigour, headache, loss of appetite, fever, paleness of eyes and weakness in child. It is encouraging that most respondents knew the signs/symptoms of malaria because the correct knowledge of the signs/symptoms would significantly influence the individual's ability to take early and appropriate action to treat malaria at the onset of any of its signs/symptom. It is also worthy of note that none of the respondents mentioned symptoms of severe malaria (such as convulsion and anaemia) and this could be attributed to either effective home management of malaria or that they do not link symptoms of severe malaria with malaria for example, attributing convulsion to witchcraft (Nebe *et al*., 2000). Also, since malaria is endemic in Nigeria, majority of the people are able to know malaria signs. The mentioning of headache, loss of appetite, vomiting, chills and rigour and weakness as the major signs and symptoms of malaria by caregivers were similar to those reported in previous studies in Nigeria, Burkina Faso, Cote D'Ivoire, Uganda, Ethiopia and Cameroon by Okrah, Traore, Pale, Sommerfeld, and Muller, (2002), Adeneye, Jegede, Mafe, and Nwokocha, (2007)and (2013), Deressa and Ali(2009), Njama *et al*., (2009), Malaria Indicator Survey (2010), Allasane *et al.*, (2011), and Nsagha, Njunda, Kamga, Nguedia Assob, Charles, Nsagha, and Njamnshi (2011) and agrees with malaria symptoms in clinical case management. Recognition of symptoms associated with malaria; fever in particular has important implications on child's survival (Alemseged, Tegegn, Haileamlak, and Kasahun, 2008).

The implication of misconceptions about the signs and symptoms of malaria is that malaria patients will be taking inappropriate steps in both the prevention and treatment out of ignorance. Adeneye *et al*., (2013) in a related study have alluded to this. Since diagnosis and treatment of malaria begins at home, a good knowledge of the signs and symptoms is very important in home management of malaria (Allai, 2003).

There was not much discrepancy in the signs and symptoms mentioned by the respondents across strata. This shows that the location's planning and drainage as a measure of community wealth does not affect or determine the interpretation of signs and symptoms observed by the caregivers in their under five children. This could be as a result of the state wide campaign for the distribution of Long Lasting Insecticide-treated Nets (LLINs) which was usually preceded by sensitization and education of the community on malaria in general or due to the health education sessions given during ante- natal care.

5.1.2 Knowledge of cause of malaria among the study participants

Lack of knowledge of the cause of malaria interferes with the ability to take appropriate preventive measures (Yewhalaw *et al*., 2010). Though there were a few misconceptions about the cause of malaria such as standing under the sun, eating bad food and dirty surrounding in this study, more than 70% of the caregivers identified mosquito bite as being the cause of malaria. This may be attributed to the efforts of the Local Government officials who during campaigns, give education on the cause, transmission and prevention of malaria before distributing the LLINs. Incriminating mosquito bites as the 'cause' of malaria may have been accepted even by researchers as can be found in studies carried out by Adongo *et al*., (2005), De La Cruz *et al.,* (2006), Yared *et al.,*(2007), MIS 2010, Arogundade *et al.,* (2011), and Chukwuocha, (2011).

Nsagha *et al.,* (2011) also carried out a study in which their findings on the knowledge of the cause of malaria was confusing and poor with only few knowing the correct cause of malaria to be resulting from mosquito bites. Among the perceived causes of malaria in south-western Nigeria were over work, sunlight, excessive sex, noise as well as witchcraft. Such erroneous perception of the cause of malaria is widespread in Nigeria and it is believed to influence treatment-seeking behavior and attitude to preventive measure (Falade *et al*., 2006). In a study in Ghana by Andrzejewski (2005), it was shown that misconceptions also abound in which participants mentioned a wide array of causes like eating too much starchy food, being born with fever and playing for too long a time as the causes of malaria. A similar study

carried out in Imo State by Iwu *et al.*, (2011) showed that majority of the respondents reported food such as melon soup, fried food, fried groundnuts and oily food as the major cause of malaria followed by lifestyle and then heredity. This is also similar to a study in Uganda by Njama *et al.*, (2003).

Unlike the study carried out by Adeneye in Ogun State (Adeneye *et al.*,2007) and Keating in Haiti (Keating *et al.*,2008) in which there was a significant association between socio-demographic factors like age, education, wealth index, occupation and knowledge of cause of malaria, this study found no significant relationship between knowledge of cause and socio-demographic factors.

5.1.3 Knowledge of malaria transmission among the study participants

It is obvious from the findings of this study that cause and transmission of malaria mean the same thing to the participants as majority of them also reported mosquito bite as being mode of malaria transmission. This knowledge to the layman is acceptable as it shows that majority of the respondents are informed about malaria and its vector ecology. An important issue here is that health educators have been using a not too accurate method in disseminating information on malaria probably because they found it difficult to translate malaria parasite into local language. Even though there could be a synergy between local concept and biomedical malaria during malaria education, its effect may not be immediate but may have long term effect that could encourage appropriate health behavior because issues regarding cause, transmission, recognition of signs and symptoms and treatment have significant input on efforts on prevention (Adongo *et al.*, 2005). This is very important as sensitization on malaria is not just enough but also, there is a need to allow for feedback from the community members after educating them on malaria to know if they understand the message on malaria.

Yewhalaw, (2010) reported that where the role of mosquitoes in malaria is well recognized, the use of Insecticide Treated Nets (ITNs) could be as high as 52%. Despite the various efforts of several organisations and the government in anti-malarial activities, misconceptions as to the transmission of malaria such as malaria being transmitted through standing under the sun, stress, breathing into each other and eating bad food still persists among the respondents. This agrees with the study carried out in Imo State, South east Nigeria (Iwu *et al.*, 2011).

5.1.4 Knowledge of malaria prevention among the study participants

More than half of the respondents knew that mosquito net is a preventive measure against malaria; this was closely followed by taking anti-malarial drug and spraying of insecticide. This is comparable to the result of a similar study conducted in Ghana by De la cruz *et al.*, (2006) which showed that the respondents believed that the best way to prevent malaria is by using ITNs.

The fact that a significant association exists between wealth quintile and knowledge of chemoprophylaxis as a malaria preventive measure in this study could be due to the fact that possession of household assets like cable TV and radio exposes one to information such as malaria prevention messages. The fact that most of the respondents reported some mosquito avoidance measures as malaria prevention strategy is quite encouraging as we can deduce from this that knowledge of mosquito avoidance as a malaria prevention tool could translate to mosquito avoidance not just being a nuisance avoidance tool but because they are trying to protect the children from malaria.

Of the respondents, a very small proportion reported eating balanced diet as a malaria preventive measure and this may be due to the fact that eating balanced diet boosts one's immune system. This is similar to a study carried out in Cambodia in which participants associated lack of vitamins and not enough food with malaria (Child Survival and Health Grants Program, 2006). This differs from the result of the study carried out by Iwu *et al.*, (2011) in Imo State in which not just a few but a large proportion of the respondents reported that avoiding oily food is the way to prevent malaria. Unlike this study, Adeneye *et al.*, (2013) reported that chemical spraying with insecticides was the most mentioned measure mentioned by the respondents in Ogun State followed by use of window/door screens. Dinho, van der Merwe and Ehlers, (2009) in their work in Tanzania had a large percentage of the respondents (43%) not knowing how malaria could be prevented.

5.1.5 Reported mosquito avoidance practices among the study participants

The use of mosquito nets was the most frequently mentioned mosquito avoidance measure. This does not agree with the findings of Omole in Oyo State, Chukwuocha in Imo State and Muhammad in Kano State (Omole, *et al*., 2007; Chukwuocha, *et al*., 2010; Muhammad, *et al*., 2011) in which the use of mosquito coil, aerosol and netted windows were the main mosquito avoidance measures.

This is similar to the study conducted in Ethiopia by Yewhalaw *et al.*, (2011) in which all the respondents reported practicing at least one mosquito avoidance measure. This is contrary to the studies carried out in Cameroon and Kenya in which some respondents did not practice any form of mosquito avoidance and the most commonly practiced preventive measure was environmental sanitation (Nsagha *et al.*, 2011, Macintyre *et al.*, 2002). The result of this study also differs from that of Oyewole and Ibidapo, (2007) in which the use of fan was the most reported mosquito-bite avoidance strategy. It is also different from that obtained by Hlongwana, Zitha Alpheus, Mabusa Aaron and Rajendra, (2011) in South Africa in which most of the respondents used mosquito coils and aerosols and some did not use any measure.

It should be pointed out that the fact that all the respondents practiced mosquito avoidance may not be due to explicit knowledge of transmission but could be due to the term "nuisance avoidance" in which the individual seeks to prevent being bitten or avoid the 'humming sound' so as to sleep peacefully. This however was not explored in this study.

The finding that more than half of the respondents across strata reported using mosquito nets as a mosquito avoidance practice could be due to the State wide free distribution of LLINs and also to the distribution of LLINs to pregnant women during ante natal care. Although health education may be an important factor in the use of mosquito nets, the toxic irritant in the saliva of the mosquito which causes irritation may be the only reason for people to adopt the use of LLINs. It is worthy of note that despite having window and door screen, most of the respondents did not report the use as a form of mosquito avoidance measure with even more reporting shutting the door after sunset.

For there to be sustained reduction in malaria cases, individuals must not only perceive malaria as a problem, but also understand its origin and cause for there to be behavior change (Janz and Becker, 1984). This is the basis of the Health Belief Model (HBM) and it is what drives the Behaviour Change Communication (BCC) programmes in which before an intervention is put in place, there is sensitization of the community on the challenge at hand. In the case of mosquito avoidance, the use of mosquito avoidance measures should be preceded by knowledge of the mosquito as being a carrier of the malaria-causing parasite.

5.1.6 Reported use of multiple mosquito avoidance practices among the study participants

Few studies have been carried out to determine the use of multiple mosquito avoidance practices (Macintyre *et al.*, 2002) . In this study, a care-giver is said to practice multiple

mosquito avoidance measures if she uses at least two of the following measures: mosquito net, mosquito repellent cream, spraying of insecticide (aerosol), indoor residual spraying, use of window and door screen and clearing bushes and surroundings.

A very low proportion (13%) engaged in multiple mosquito avoidance. This is contrary to the findings of Oyewole and Ibidapo in which about 67% of the participants adopted multiple mosquito avoidance measures though it was not stated whether there was LLINs campaign or not (Oyewole and Ibidapo, 2007). We could believe that more of the respondents adopt one mosquito avoidance measure because the measure is effective. There was no significant association between location and the use of multiple mosquito avoidance measures. This is contrary to the findings of Macintyre in which there was a significant association between location and use of multiple mosquito-avoidance behavior (Macintyre *et al.*, 2002). However, this study corroborates the findings of Macintyre *et al.*, (2002) in which significant association existed between education, monthly earning, wealth quintile, education and the use of multiple mosquito avoidance measure. This can be explained in that those who are better educated and who earn well and have more expensive household items are usually exposed to more information and can also afford to get more mosquito avoidance measures.

5.1.7 Ownership of Long Lasting Insecticide-treated Nets (LLINs)

Ownership of LLINs is relatively high (above 60%) but not as high as the targeted coverage (80%) recommended by WHO. Ownership of LLINs is expected to be higher since a large proportion did not have to buy it but were given free of charge at either the Local Government or Primary Health care centres. It is however higher than the percentage (20%) of households with at least one net in the South west (MIS, 2010).

Majority of the respondents got their mosquito nets at the health facility during routine distribution at ANC followed by distribution during mass campaign by the Local Government officials. About 70% of the care-givers own more than one net and this is irrespective of the stratum to which they are. However, this study showed higher proportion of possession when compared with studies conducted in Nigeria and Ethiopia (Yared *et al.*, 2007, MIS, 2010). Some who do not have it reported that it is not available in the market, some also said they cannot afford it others said they had but it is torn while some said they do not think it is effective.

5.1.8 Mosquito net usage

Long Lasting Insecticide-treated nets (LLINs) are not just for individual and family protection, but also for community protection and they are more broadly applicable geographically than mere location/ ecology specific measures directed towards larvae (Beier *et al*., 2008). The community-wide use of LLINs helps in reducing the vector population and shortens the mean mosquito lifespan which will result to a reduction of the malaria sporozoite rate because few mosquitoes will survive long enough for the sporogonic cycle to be completed (WHO, 2006). In a study of under-five children in rural Kenya, the consistent use of ITNs was reported to reduce malaria transmission by up to 90% and prevent as much as 44% of all-cause mortality (Fegan, Noor, Akhwale, 2007).

In this study, more than 70% of the respondents had their child sleep under a net a night before the survey. This is quite encouraging but does not meet the target that by the year 2010, at least 80% of children less than five years of age and currently pregnant women should sleep under LLIN (NMCP, 2008).

The proportion of LLINs use among under-five children in this study is higher than in other studies conducted in Nigeria and Africa (MIS, 2010, WHO, 2010). For those whose children did not sleep under a net, the major reason given is the fact that it generates heat. This was followed by their not having space to hang it. Other reasons given include: it causes itching in their children and a little percentage feel that it is meant for adults. Factors like heat, absence of mosquitoes, LLINs preventing free air movement and difficulty hanging the nets are some of the reasons given in a study in Ethiopia (Yared *et al.*, 2008).

Findings from a similar study in Nigeria reported other factors that are adversely associated with the use of bednets and these are: education, geopolitical zone and misconception about causes and prevention of malaria (Arogundade *et al*. 2011). The findings of this study disagree with that of Chukwuocha in which cost, the perception that its use is harmful especially to pregnant women and its non-availability were the major reported constraints to its use (Chukwuocha *et al.*, 2010). In another study in Osun State, the reasons given for not sleeping inside bednets are: not comfortable sleeping inside net, not knowing where to get net, the high cost of purchase of net, not being sure of its efficacy and preference for insecticide sprays (Adeyemi *et al.*, 2007).

Several studies suggest that owning a radio, household's desire for mosquito avoidance and correct knowledge of malaria transmission was associated with LLIN use (Opiyo *et al*., 2007;

Wiseman *et al.*, 2007; Biadgilign *et al*., 2012). Other studies have reported that education, wealth and a good knowledge of malaria transmission are not determinants of net use (Alaii *et al.*, 2003, De la cruz *et al.*, 2006, Eisele *et al*., 2009) but in this study, socio economic factors like caregivers' monthly income, occupation, the type of accommodation inhabited were significantly associated with use of LLIN by the children.

Correct knowledge of mosquito transmission route, mosquito avoidance through spraying aerosol and the use of window and doorscreen were significantly associated with the use of bednet and this reinforces the findings of De la cruz in Ghana (De la cruz *et al.*, 2006).

Of note especially is the association between accommodation type and use of bed net by the under- five children, children who live in a one room apartment may be unfortunate in that there may be just a bed (on which the parents sleep) while the children sleep on the floor. The perception of bed nets as a nuisance avoidance mechanism has great implication for its intended purpose as this means that it would be used mainly by adults instead of children because adults are easily disturbed by the humming sound of the mosquito and also that they need a good night sleep so as to prepare for the next day work (Adongo *et al.*, 2005). Allai in her study in Kenya reported that the use of bed nets was seasonal and was only meant for adults not children (Allai, 2003). The importance of use of bed nets especially by the vulnerable groups: women and children have to be included in the information to be disseminated during campaigns.

During campaigns and dissemination of information on malaria through social or mass media, emphasis should be laid on the importance of having children below the age of five ad pregnant women sleep under bed net due to their suppressed immune system. Priority should be given to these two groups when decision is to be made as who gets to sleep under the bed net.

5.2 Limitations

A major limitation of this study is that the there was mass distribution of LLINs in the Local Government and this could have raised the use of LLINs among the study participants. Recall bias could also have occurred when the respondents were asked the number of times their under-five child had febrile illness suspected to be malaria in the preceeding year. Another limitation is that most of the caregivers that participated demanded for money and materials. However, this challenge was addressed through the provision of more information and assurance.

5.3 Conclusion

In conclusion, this study showed that care-givers are knowledgeable on the cause, transmission and prevention of malaria.

This study also showed that care-givers of under-five children are actively engaged in mosquito avoidance practices which include use of Long Lasting Insecticide-treated Nets, spraying aerosols, use of window and door screen and shutting door after sunset and the resultant effect is the relatively low episodes of febrile illness suspected to be malaria among the children. This can be said to be as a result of the relatively high use of Long Lasting Insecticide treated Nets.

The study also demonstrates that socio-economic factors such as monthly earning and occupation influence the adoption of mosquito avoidance practices. The ease of use of the mosquito avoidance practice and its effectiveness are also factors that influence the uptake of mosquito avoidance practices.

Care-givers of under-five children use Long Lasting Insecticide treated Nets (availability of LLINs through free distribution by the Local Government or during Ante-Natal Care visits) to protect their under-five children and this is irrespective of the location of the care-givers.

The most common mosquito-avoidance practice among care-givers of under-five children was the use of bednet and this did not differ by level of planning and drainage of the study site. Therefore, strategies to improve and sustain the use of bednet and promote the use of other effective mosquito-avoidance practices should be encouraged.

5.4 Recommendations

1. How mosquitoes transmit malaria should form the core of the message of public health education so as to correct erroneous belief people still hold on to as to the cause and transmission of malaria.
2. Provision of Long Lasting Insecticide treatred Nets by the government should be sustained as affordability and perceived effectiveness are some of the reasons for use of the mosquito net.
3. During free distribution of bed nets, sensitisation of the importance of its use especially by the vulnerable groups i.e. pregnant women and children should be emphasised.
4. Health education should carry messages that enlighten on the likely places mosquitoes can breed such as uncovered water containers and broad leaves of plants and weeds.

5.5 Suggestions for further Research

To make evidence-based decision as regards putting forth an intervention that would be of wide acceptability and also accomplish the intention of the policy makers, so much research has to be carried out to be environment-specific since different environments require adaptation of research findings to suit what obtains therein. From this work, the following are suggested areas of further research:

1. Comparison of mosquito-avoidance-practices among rural dwellers, urban slum dwellers and urban dwellers.
2. Comparison of adherence to ITNs use between two communities: a randomized controlled trial.
3. Mosquito-avoidance: nuisance avoidance or a malaria prevention tool.

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APPENDIX A:

QUESTIONNAIRE ON 'COMMUNITY PRACTICES AGAINST MOSQUITO BITES AMONG CARE-GIVERS OF UNDER-FIVE CHILDREN IN SOMOLU LOCAL GOVERNMENT, LAGOS STATE'.

CONSENT FORM FOR CARE-GIVERS

Dear ma,

I am Ojo Oreoluwa O., a post graduate student of The Department of Epidemiology and Medical Statistics, Faculty of Public Health, University of Ibadan.

I am carrying out a study on the above-named topic to gather knowledge to help in combating malaria in children under the age of five years.

Please, answer the under listed questions with all sincerity as your response will go a long way in proffering solutions to malaria prevention among children under five years of age.

May I add that the information given will be treated strictly as confidential and would be used strictly for academic purpose. To ensure confidentiality, the questionnaires will carry no names or identifiers but serial numbers will be used for proper data processing.

If you have any questions to ask concerning this project, please contact me on this telephone number 08106311489.

Thank you for your co-operation.

....

Signature Date

APPENDIX B:

IWE IBEERE LORI 'ASA ATI ISE NIPA DIDENA KI EFON MAA JE AWON OMODE TI WON TII JU ODUN MARUN LO LAARIN AWON OLUTOJU AWON OMO WON YII NI IJOBA IBILE SOMOLU TI ILU EKO'.

IWE IBUWOLU FUN OLUTOJU AWON OMODE NAA

Arabinrin owon,

Oruko mi ni Ojo Oreoluwa, akeko imo ijinle ni eka ti Epidemiology and Medical Statistics, Faculty of Public Health, University of Ibadan.

Mon se ayewo imo ijinle lati ni oye nipa ati doju ija ko aisan iba larin awon omode ti oti ju odun marun.

Ejowo, eba mi fi otito inu dahun awon ibeere ti owa ninu iwe yii lati le ran wa lowo lati fi opin si aarun iba larin awon omo ti oti ju odun marun lo.

Gbobgo ohun ti eba ko sinu iwe yii ni afe lo fun eko imo ijinle nikan, ao ni gba oruko yin, ao kan fi awon atoka lori iwe naa lati le fi se ise waa.

Ti eba ni ibeere Kankan lori ise yii, e pe wa si ori ago yii 08106311489.

Adupe pupo fun ifowosowopo yin.

....

Ami ibuwolu Date

APPENDIX C:

Q. No……

QUESTIONNAIRE ON 'MOSQUITO-AVOIDANCE-PRACTICES AND CORELLATES AMONG CARE-GIVERS OF UNDER-FIVE CHILDREN AT SOMOLU LOCAL GOVERNMENT AREA, LAGOS STATE'.

SECTION A: SOCIO-DEMOGRAHIC DATA

S/N	Questions	Responses and Codes	Response
1	How old were you at your last birthday?	Age in completed years.....	
2	What is your Religion?	Christianity.....1 Islam.....2 Traditional Religion.....3 Others (specify) 4	
3	What is your marital status?	Never married.....1 Married.....2 Divorced.....3 Separated.....4 Widowed.....5	
4	How many people do you have in your household?		
5	How many of these people are under five years?		
6	What is your occupation?	Unemployed.....1 Student.....2 Housewife.....3 Farming.....4 Petty trading.....5 Large scale Business.....6 Artisan.....7 Fisherman.....8 Junior civil servant.....9 Senior civil servant.....10 Professional.....11 Other (please specify).....12	
7	How much do you earn monthly?	Less than ₦20,000.....1 ₦21,000-₦40,000 .....2 ₦41,000-₦60,000.....3 ₦61,000 and above.....4 Difficult to say.....5	
8	What type of accommodation do you live in with your household?	One room apartment.....1 A room and parlour.....2 Self- contained apartment.....3 A flat.....4 Bungalow.....5 Duplex.....6 Other(pls,specify)	
9	Is the house you live in owned by you or rented?	Owned.....1 Rented.....2	

10	(Interviewer observes) Type of wall of house	Concrete.....1 Mud.....2 Wood.....3 Others(pls,specify).....4	
11	Type of floor of house	Concrete.....1 Mud.....2 Wood.....3 Tile/ Terrazzo.....4 Others(pls,specify).....5	
12	Type of ceiling of house	Asbestoes.....1 Plastic.....2 Wood.....3 Mud.....4 Palmfrond.....5 None.....6 Others(pls,specify).....7	

13	What is your highest level of education?	None.....1 Quranic.....2 Primary.....3 Secondary.....4 Tertiary.....5 Other (please specify) 6						
14	Does your household have any of the following items (in working condition)?	**Item**	**Yes (1)**	**No(2)**	**Item**	**Yes (1)**	**No(2)**	
		Fridge			Washing machine			
		Radio			GSM phone			
		Television			Generator			
		Video			Gas/electric cooker			
		Satellite dish			Motorcycle			
		Fan			Car			
		Kerosene stove			Electric grinding machine			
		Goats/ sheep			Poultry			
15	Where do you get water for domestic use?(multiple response allowed)	River/stream.....1 Spring.....2 Deep well.....3 Bore hole.....4 Water tanker/ water seller.....5 Public tap.....6 Other(specify).....7						
16	How do you dispose your refuse?(multiple response allowed)	Open ground.....1 Dustbin in the house collected by refuse man.....2 Burning in the house.....3 Throw in gutter.....4 Throw in streams.....5 Other(specify).....6						

17	How do you dispose faeces?(multiple response allowed)	Use water cistern.....1	
		Refuse dump.....2	
		Nylon bags and throw in the gutter refuse dump.....3	
		Pit latrine.....4	
		Open ground/bush.....5	
		Other(specify).....6	

SECTION B : RESPONDENT'S KNOWLEDGE OF MALARIA AND PREVENTION OF MOSQUITO BITES

18	What is the most common childhood illness here?		
19	In your opinion, what are the things you will notice in your under five child that tells you he/she has malaria?(multiple response allowed)	Chills and rigours.....1	
		Skin rash 2	
		Vomiting 3	
		Headache.....4	
		Stomach ache 5	
		Loss of appetite.....6	
		Raised body temperature 7	
		Diarrhoea 8	
		Paleness of eyes 9	
		Child weak/not playing.....10	
		Fever/hot body.....11	
		Others(pls,specify).....12	
20	What do you think causes malaria?(multiple response allowed)	Standing under the sun.....1	
		Supernatural causes.....2	
		Eating bad food.....3	
		Mosquito bite.....4	
		Stress.....5	
		Excessive heat, wind or cold.....6	
		Dirty surrounding.....7	
		Drinking dirty water.....8	
		Malaria parasite.....9	
		Other(pls,specify).....10	
21	How does malaria get to a person? Multiple response allowed(if mosquito bite is not mentioned, skip to Section C)	Standing under the sun.....1	
		Supernatural causes.....2	
		Eating bad food.....3	
		Mosquito bite.....4	
		Stress.....5	
		Excessive heat,wind or cold.....6	
		Dirty surrounding.....7	
		Drinking dirty water.....8	
		Malaria parasite.....9	
		Blood transfusion.....10	
		Other(pls,specify).....11	

22	What are the preventive measures against malaria that you know?(multiple response allowed)	Mosquito net.....1 Eating balanced diet.....2 Taking antimalarial drug.....3 Spraying insecticide.....4 Indoor Residual Spray.....5 Use of window and door screen.....6 Clearing bushes and surroundings.....7 Others(pls,specify).....8	
23	Which of these do you do to prevent your under-five child (ren) from being bitten by mosquito?(multiple response allowed)	Mosquito net.....1 Shutting door after sunset.....2 Eating balance diet.....3 Wearing long sleeve dress and trousers/ covering body with cloth .....4 Taking anti-malarial drug.....5 Mosquito repellent cream.....6 Spraying insecticide(aerosol).....7 Indoor residual spray.....8 Burning of repellent plants such as orange peel/leaves.....9 Use of window and door screen.....10 Clearing bushes and surrounding.....11 Others(pls, specify).....12	
24	How effective is the measure you use to prevent mosquito bite in your under-five children?	Very effective.....1 Effective.....2 Fairly effective .....3 Not effective 4	
25	What informed your choice of measure used to prevent mosquito bite?(multiple response allowed)	Affordability .....1 Media .....2 It's effective.....3 Health worker .....4 Friends/neighbour.....5 Religious belief .....6 Readily available.....7 Easy to use at home.....8 Others(pls,specify) 9	
26	In your opinion, which of these are mosquito breeding sites?(multiple response allowed)	Stagnant water.....1 Running water.....2 Uncovered-water containers.....3 Gutters and ditches.....4 Waste containers.....5 Dredges from construction site.....6 Broad leaves of plants and weeds.7 Others(pls,specify).....8	

SECTION C : Mosquito Net Knowledge, Ownership and Usage.

S/N	Questions	Responses and Codes	Response
27	What does mosquito net do?(multiple response allowed)	Prevents contact with mosquito.....1 Beautify the room where it is hung.....2 Prevent children from falling off the bed.....3 Treated mosquito nets kill mosquito.....4	

28	How did you get to know about what a mosquito net does?	Health worker……......1 Marketplace.....2 Media.....3 Friend/neighbour.....4 Others.....5	
29	What are the different types available?(multiple response allowed)	Untreated net.....1 Long-lasting insecticide treated net.....2 Retreatable net.....3 No idea.....4 Others(pls, specify).....5	
30	Do you have net in your house?(if no, skip to Q40)	Yes.....1 No.....2	
31	Which type do you have in your house?	Untreated net.....1 Retreatable net.....2 Long lasting insecticide treated net.....3 Others(pls,specify).....4	
32	How did you acquire it?	I was given in health facility.....1 I bought it.....2 LG officials distributed it.....3 Others (pls,specify).....4	
33	How many do you have in your house?		
34	Did your under five child (ren) sleep under the net last night?	Yes.....1 No.....2	
35	If no to Q34,What are the reasons your under-five child(ren) did not sleep under the net last night?(multiple response allowed)	It generates too much heat.....1 Child cannot sleep alone.....2 It is only for adults.....3 It causes itching/child reacts to it.....4 There is no space to hang it in the room.....5 Other (pls,specify).....6	
36	How many people sleep under the net in your household?		
37	How many people sleep under one net?		
38	Who are these people who sleep under the net?	1 adult and 1 child.....1 2 children.....2 2 adults.....3 2 adults and 1 child.....4 Other(pls,specify).....5	
39	Why don't you have mosquito net?	I can't afford it.....1 I don't think it's effective.....2 It's not available in the market.....3 I had but it's torn.....4 Others.....5	
40	How many times did your under five child have febrile illness suspected to be malaria in the last 1 year?		

APPENDIX D

Q. NO…

IWE IBEERE LORI ASA ATI ISE NIPA DIDENA KI EFON MAA JE AWON OMODE TI WON TII JU ODUN MARUN LO LAARIN AWON IYA AWON OMO WON YII NI IJOBA IBILE SOMOLU TI ILU EKO'.

ABALA AKOKO: AKOSILE AJEMONI:

S/N	Ibeere	Idahun ati atoka	Idahun
1	Omo odun melo niyin?	Ojo ori.....	
2	Esin wo ni e nse?	Igbagbo.....1 Musulumi.....2 Esin ibile.....3 Omiran(ejowo etoka) 4	
3	Nje oti gbeyawo tabi loko?	Omoge.....1 Iyawole.....2 Eni ikosile.....3 Atipin ya.....4 Opo.....5	
4	Eyin melo ni yin ninu ebi yin?		
5	Awon melo ni won ko ti ju omo odun marun lo laarin yin?		
6	Iru ise wo le n se?	Nko nise.....1 Akeko.....2 Iyawole.....3 Agbe.....4 Oniworobo.....5 Onisowo.....6 Onise owo.....7 Apeja.....8 Onisejoba kekere.....9 Onisejoba agba.....10 Ojogbon.....11 Omiran(ejowo eso).....12	
7	Eelo ni owo osu re?	Less than ₦20,000.....1 ₦21,000-₦40,000 .....2 ₦41,000-₦60,000.....3 ₦61,000 and above.....4 O soro la ti so.....5	
8	Iru ile wo ni e ngbe?	Yara kan pere.....1 Yara meji.....2 Yara kan ati eroja re.....3 Ile oni yara pupo(flat).....4 Odindiile Ile ile(bungalow).....5 Odindi ile(duplex).....6 Omiran(ejowo eso).....7	
9	Ile ti e n gbe,se eyin ni eko abi ayalegbe ni yin?	Emi ni mo ko.....1 Ayalegbe ni mi.....2	
10	(Akiyesi lati odo olubere) Iru ogiri ile	Konkere.....1	

		Amo.....2 Igi.....3 Omiran(ejowo,eso).....4	
11	Iru ilele to wa ninu ile	Konkere.....1 Amo.....2 Igi.....3 Ile didan.....4 Omiran(ejowo,eso).....5	
12	Iru orule to wa ninu ile	Asbestoes.....1 Oni ike.....2 Igi.....3 Amo.....4 Orule elewe.....5 Kosi.....6 Omiran(ejowo,eso).....7	

13	Iwe melo leka?	Mii ka rara.....1 Ile keu.....2 Ile eko ibeere.....3 Ile eko girama.....4 Ile eko giga.....5 Omiran(ejowo,eso).....6						
14	Se eni awon dukiya won yii(ti won si n sise)?	**Dukiya**	**Beeni(1)**	**Beeko(2)**	**Dukiya**	**Beeni(1)**	**Beeko(2)**	
		Fridge			Washing machine			
		Radio			GSM phone			
		Television			Generator			
		Video			Gas/electric cooker			
		Satellite dish			Motorcycle			
		Fan			Car			
		Kerosene stove			Electric grinding machine			
		Goats/ sheep			Poultry			
15	Ibo le ti npon omi lilo ninule?	Odo.....1 Omi inu apata.....2 Konga.....3 Konga dero.....4 Apon omi ta.....5 Ero igbalode.....6 Omiran(Ejowo eso).....7						
16	Bawo le se n da ile nu?	Ori akitan.....1 Ikole ti awon akole ma nko.....2 Jijo ile niwaju ile.....3 Jiju sina gota.....4 Jiju sinu odo to n san.....5						

		Omiran(Ejowo eso).....6	
17	Bawo le se n da igbe nu?	Aga oyinbo.....1	
		Ikole.....2	
		Yiyagbe sinu ora fun ji junu sinu gota.....3	
		Salanga.....4	
		Inu igbo.....5	
		Omiran(Ejowo eso).....6	

ABALA KEJI: IMO OLUDAHUN NIPA AISAN IBA ATI BI ASE N DENA KI EFON MA JEYAN

18	Aisan omode wo lo wopo nibi?		
19	Ninu ero yin, awon nkan wo le ma se akiyesi ninu omo yin ti ko iti ju omodun marun lo ti yo se atoka si pe oniba?(ele mu ju idahun kan lo)	Otutu.....1	
		Ara kurukuru 2	
		Bibi 3	
		Ori fifo.....4	
		Inu rirun 5	
		Aile jeun.....6	
		Ara gbigbona 7	
		Igbe gburu 8	
		Oju funfun 9	
		Omo ole sere.....10	
		Omiran(Ejowo eso).....11	
20	Ki le lero pe o nfa aisan iba?	Diduro labe orun.....1	
		Owo aye.....2	
		Jije ounje ti ko dara.....3	
		Efon.....4	
		Wahala.....5	
		Oru abi otutu to poju.....6	
		Agbegbe to doti.....7	
		Mimu omi to doti.....8	
		Kokoro iba.....9	
		Omiran (Ejowo,eso).....10	
21	Bawo ni iba se n ti ara eniyan kan bo si omiran?(ti won ko ba daruko efon, e lo si Abala keta)	Diduro si abe orun.....1	
		Ise aye.....2	
		Jije ounje ti ko da.....3	
		Efon.....4	
		Wahala.....5	
		Oru abi otutu ti o poju.....6	
		Agbegbe to doti.....7	
		Mimu omi to doti.....8	
		Kokoro iba.....9	
		Fifa eje si eyan lara.....10	

		Omiran (Ejowo,eso).....11	
22	Awon ona wo ni alegba dena aisan iba?	Apo efon.....1	
		Jije ounje to sa.re.....2	
		Lilo ogun iba.....3	
		Lilo ogun pefon pefon ti an fon...4	
		Kikun ara ile pelu ogun to n pa efon.....5	
		Didi ona aba wole ati oju fere setefon le gba wole.....6	
		Sisan igbo ayika.....7	
		Omiran (Ejowo,etoka).....8	
		Ogun pefon pefon ti elefi.....12	
		Omiran(ejowo,eso).....13	
23	Ewo ninu awon nkan won yi lo ma nse lati dena ki efon ma je omo re ti koju omo odun marun lo?	Apo efon.....1	
		Pipalekun de ti ile ba su.....2	
		Jije ounje ti o se ara lore.....3	
		Wiwo aso ti o bo ara.....4	
		Lilo ogun iba.....5	
		Pipa ara pelu ipara to ma nle efon6	
		Lilo ogun pefon pefon ti an fon...7	
		Kikun ogiri ile pelu ogun to n pa efon 8	
		Sisun ewe tabi epo osan.....9	
		Didi ona aba wole ati oju fere setefon le gba wole.....10	
		Sisan igbo ati imototo sgbegbe.....11	
		Omiran(ejowo,eso).....12	
24	Bawo ni ona ti on lo lati fi dena ki efon ma je omo re se n sisie si?	On sise daradara.....1	
		On sise.....2	
		On sise die die 3	
		Ko sise 4	
25	Kini idi ti o fi n lo ona ti o nlo lati dena ki efon ma je omo re?	Ohun ti apa mi ka 1	
		Ero mohun maworan ati beebee lo.....2	
		On sise daradara.....3	
		Eleto ilera 4	
		Ore/alajogbe.....5	
		Igabgbo ti esin 6	
		Ohun ti owa.....7	
		O rorun lati lo nile.....8	
		Omiran(ejowo,eso) 9	

26	Ninu ero re,ewo ninu awon nkan won yii ni efon ti n dagba?	Adagun omi.....1 Omi to n san.....2 Omi ti owa ninu ike ti a kode.....3 Gota.....4 Ike idalenu.....5 Omi to rogun si ibi ti ati n kole tabi se titi.....6 Ewe ati igbo.....7 Omiran (ejowo,eso).....8	

ABALA KETA: IMO LORI APO EFON, NINI ATI LILORE.

S/N	Ibeere	Idahun ati atoka	Idahun
27	Kini apo efon ma nse?(e le mu ju idahun kan)	On dena efon lati ba leyan.....1	
		O n mu ki yara ti a ta si dara.....2	
		Di dena ki omo jabo loribu sun.....3	
		Apo efon to niogun apefon lara ma n pa efon.....4	
		Omiran (ejowo,eso).....5	
28	Bawo ni e se mo ohun ti apo efon ma n se?	Eleto ilera.....1	
		Inu oja.....2	
		Ero mohun maworan ati beebee lo....3	
		Ore/ Alajogbe.....4	
		Omiran(ejowo,eso).....5	
29	Eya orisi apo efon wo lo mo? (e le mu ju idahun kan)	Apo efon ti ko ni ogun efon lara.....1	
		Apo efon toni ogun efon lara alalope.....2	
		Apo efon ti afi ogun apefon so lara lore koore.....3	
		Omiran(ejowo,eso).....4	
30	Se eni apo efon nileyin(bibeeko,e lo si ibeere 39)	Beeni.....1	
		Beeko.....2	
31	Iru apo efon wo leni ninu ile yin?	Apo efon ti ko ni ogun efon lara 1	
		Apo efon ti afi ogun apefon so lara lore koore 2	
		Apo efon toni ogun efon lara alalope.....3	
		Omiran(ejowo,eso).....4	
32	Bawo le se ni apo efon yii?	Won fun mi ni ile wosan.....1	
		Mo ra.....2	
		Awon osise joba ibile ha.....3	
		Omiran(ejowo,eso).....4	
33	Apo efon melo ni eni ninu ile yin?		
34	Nje omo re ti ko ti to odun marun sun inu apo efon lale ana?	Beeni.....1 Beeko.....2	
35	Bibeeko si ibeere 34, kini awon idi ti omo re ti ko tito odun marun o se sun inu apo efon lale	O n mu oru pupo.....1	
		Omo ole dasun.....2	

	ana?(e le mu ju idahun kan lo)	Agbalagba nikan lo wa fun.....3 O n fa ara hihu.....4 Ko si ibi ti ma ta si.....5 Mi ori ibi ti ma fi apo naa ko si.....6 Omiran(ejowo,eso).....7	
36	Awon melo lo n sun inu apo efon ninu ileyin?	Awon melo.....1 Gbogbo eyan to wa ninule.....2	
37	Awon eniyan melo lo n sun inu apo efon kan?		
38	Awon wo lawon won yii to n sun apo efon naa?	Agbalagba kan ati omode kan.....1 Omode meji.....2 Agbalagba meji.....3 Agbalagba meji ati omode kan.....4 Omiran(ejowo,eso).....5	
39	Kini idi ti o ko se ni apo efon?(e le mu ju idahun kan)	Apa mi oka.....1 Mi o ro pe onsise.....2 Ko si loja.....3 Moni sugbon oti ya.....4 Omiran(ejowo,eso).....5	
40	Emelo ni ara omo yin ti koju omo odun marun lo gbona tesi ro pe iba ni ni bi odun kan seyin?		

INSTITUTIONAL REVIEW BOARD

NIGERIAN INSTITUTE OF MEDICAL RESEARCH

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E-mail: nimr_irb@yahoo.com *Website:* www.nimr-nig.org
Secretariat: Room 207, Biochemistry Division, Research Block, NIMR

18th June, 2013

PROJECT TITLE: **MOSQUITO AVOIDANCE PRACTICES AND CORRELATES AMONG MOTHERS OF UNDER FIVE CHILDREN AT SOMOLU LOCAL GOVERNMENT, LAGOS STATE.**

PROJECT №: **IRB/13/214**

APPROVAL LETTER

The above named proposal has been adequately reviewed; the protocol and safety guidelines satisfy the conditions of NIMR-IRB, policies regarding experiments that use human subjects.

Therefore the study under its reviewed state is hereby approved by Institutional Review Board, NIMR.

PROF. F. E. OKONOFUA
Name of IRB Chairman

18/6/13
Signature of IRB Chairman & Date

MRS. O. A. NWOGBE
Name of IRB Secretary

18/6/13
Signature of IRB Secretary & Date

This approval is given with the investigator's Declaration as stated below;
By signing below I agree/certify that:

1. I have reviewed this protocol submission in its entirety and that I am fully cognizant of, and in agreement with, all submitted statements.
2. I will conduct this research study in strict accordance with all submitted statements except where a change may be necessary to eliminate an apparent immediate hazard to a given research subject.
   - I will notify the IRB promptly of any change in the research procedures necessitated in the interest of the safety of a given research subject.
   - I will request and obtain IRB approval of any proposed modification to the research protocol or informed consent document(s) prior to implementing such modifications.

3. I will ensure that all co-investigators and other personnel assisting in the conduct of this research study have been provided a copy of the entire current version of the research protocol and are fully informed of the current (a) study procedures (including procedure modifications); (b) informed consent requirements and process; (c) potential risks associated with the study participation and the steps to be taken to prevent or minimize these potential risks; (d) adverse event reporting requirements; (e) data and record-keeping; and (f) the current IRB approval status of the research study.

4. I will respond promptly to all requests for information or materials solicited by the IRB or IRB Office.

5. I will submit the research study in a timely manner for IRB renewal approval.

6. I will not enroll any individual into this research study until such time that I obtain his/her written informed consent, or, if applicable, the written informed consent of his /her authorized representative (i.e., unless the IRB has granted a waiver of the requirement to obtain written informed consent).

7. I will employ and oversee an informed consent process that ensures that potential research subjects understand fully the purpose of the research study, the nature of the research procedures they are being asked to undergo, the potential risks of these research procedures, and their rights as a research study volunteer.

8. I will ensure that research subjects are kept fully informed of any new information that may affect their willingness to continue to participate in the research study.

9. I will maintain adequate, current, and accurate records of research data, outcomes, and adverse events to permit an ongoing assessment of the risks/benefit ratio of research study participation.

10. I am cognizant of, and will comply with, current federal regulations and IRB requirements governing human subject research including adverse event reporting requirements.

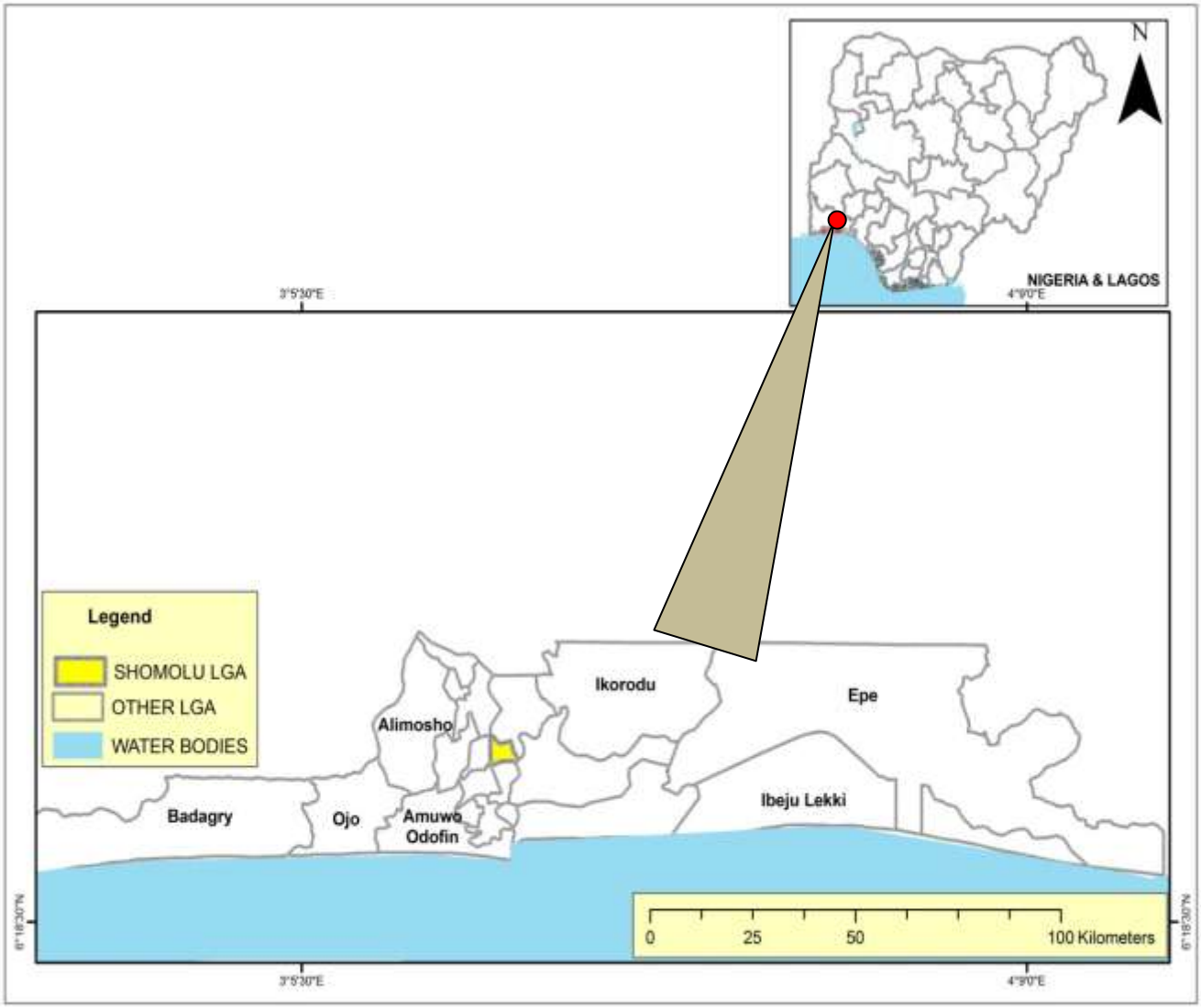
11. I will make a reasonable effort to ensure that subjects who have suffered an adverse event associated with research participation receive adequate care to correct or alleviate the consequences of the adverse event to the extent possible.

12. I will ensure that the conduct of this research study adheres to Good Clinical Practice guidelines

MISS OJO OREOLUWA
Principal Investigator's Name

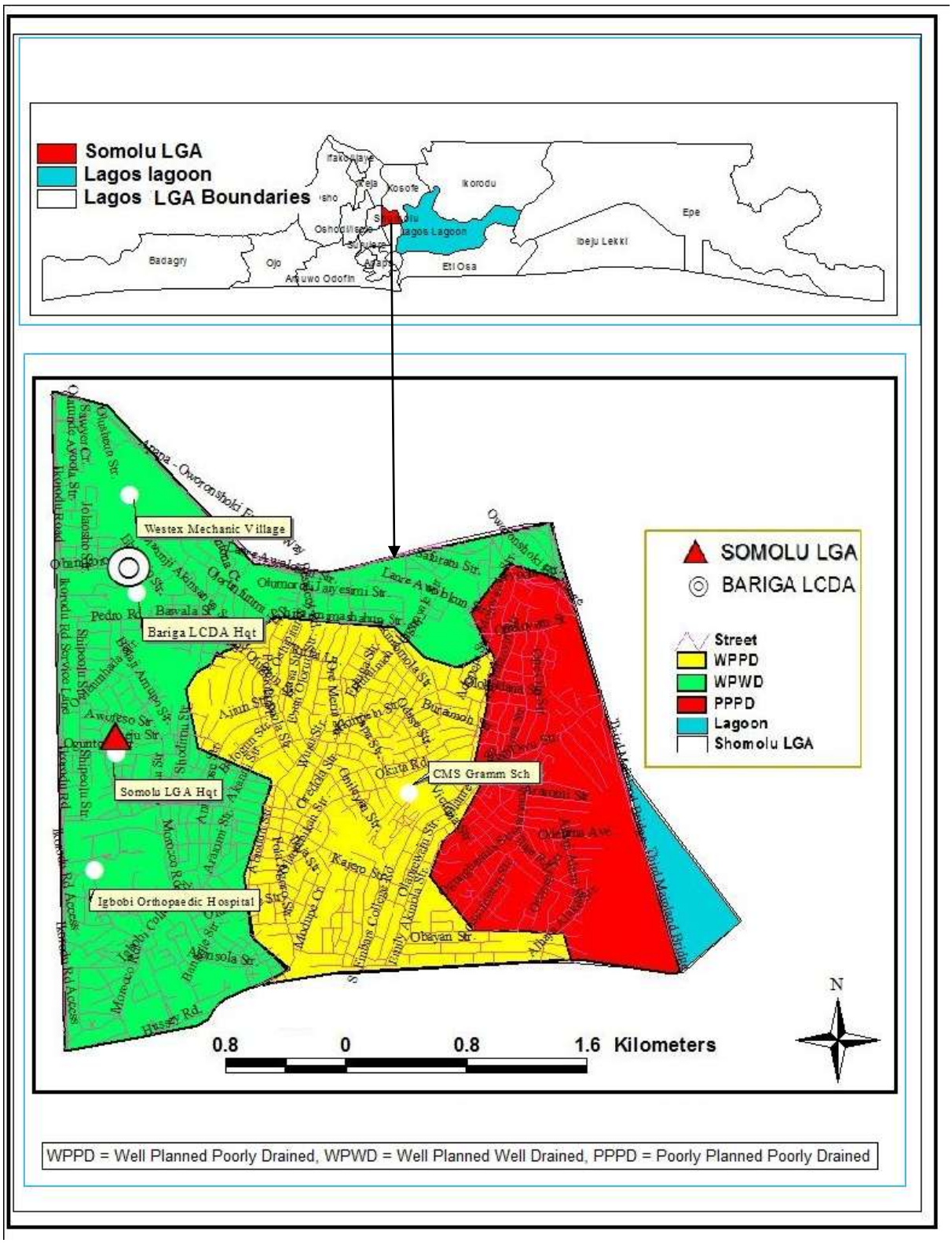
Ojo 15/07/2013
Principal Investigator's Signature and Date

APPENDIX F



Map of Nigeria showing Lagos State and its Local Government Areas

APPENDIX G



Map of Lagos State Showing Stratification of Somolu Local Government Area based on its Level of Planning and Drainage