Chapter One

Introduction

1.1 Background to the Study

Malaria is a life-threatening disease caused by parasites that are transmitted to people through the bites of infected female anopheles mosquitoes[1]. It is preventable and curable. Malaria is known to be an endemic disease in Africa over the years and in 2020, there were an estimated 241 million cases of malaria worldwide[1]. The estimated number of malaria deaths stood at 627 000 in the year 2020. The WHO African Region carries a disproportionately high share of the global malaria burden. In 2020, the region was home to 95% of malaria cases and 96% of malaria deaths. Children under 5 accounted for about 80% of all malaria deaths in the Region[1].

In a global preventive drive towards malaria, different methods abound and several strategies have been utilized. Worse still, malaria continues to be the leading cause of child mortality and morbidity in the region. The Roll Back Malaria (RBM) has identified pregnant women and mothers of under five children as one of the highest risk groups for malaria, and one of the strategies set to fight malaria in this group is to increase utilization of mosquito nets[2].

The seemingly most vulnerable to malaria infection are women and young children especially those under five years old. Fact wise, pregnant women have three times increased chance of suffering severely from malaria compared to non-pregnant women[3]. Pregnant women usually have more severe malaria symptoms and outcomes, with higher rates of miscarriage, anemia, intrauterine demise, premature delivery, low-birth-weight neonates, and neonatal death[15]. Infected pregnant

women have about 50% mortality rate in malaria endemic areas with the highest rate of infection occurring during the second trimester[3]. This high burden of disease backs the need for malaria prevention and treatment efforts as part of antenatal care in endemic areas[3]. Some adults who live in malaria endemic areas have developed some acquired immunity to malaria infection due to immunoglobulin production from prior childhood malaria infections[3]. However, for pregnant women, the malaria immunity diminishes during pregnancy, hence making them more vulnerable to malaria infection[3].

Malaria is a public health issue in more than 100 countries, with more than half of the world's population at risk [4]. Sub-Saharan Africa and parts of Asia and Latin America are the hardest hit regions for significant malaria epidemics[4]. Malaria affects about 3.3 billion people or half of the world's population, and in 2010, Africa had about 216 million malaria cases and about 655,000 deaths[5]. Pregnant women and their unborn babies are particularly vulnerable to the adverse consequences of malaria. In Africa, mortality due to malaria was highly prevalent and each year in malaria prone regions of Africa, an estimated 10,000 pregnant women died as a result of malaria[12]. Malaria as a health issue accounts for more cases and deaths in Nigeria than in any other country worldwide[5]. There are about 300,000 deaths annually from malaria compared with 215,000 deaths per year caused by HIV/AIDS[5]. Malaria is the leading cause of mortality in children under five and contributes to the estimated 11% of maternal mortality. In addition, a very high malaria prevalence rate (62.4%) among women attending traditional birth homes was found in Southwest Nigeria[7].

The Menace of malaria has been faced with wide array of preventive measures with different level of effectiveness. Among the measures put in place to prevent

the occurrence of malaria is use of insecticide treated bed net, use of insecticide spray, environmental fumigation among other methods. Mass use of ITNs protects the population against malaria, particularly children under the age of 5 years[6]. Providing free ITNs to people who do not own one should lead to a universal ownership of ITNs that could collectively protect the population[7]. Evidence has shown that when a large number of people use ITNs while sleeping, the maternal and child morbidity and mortality due to malaria can be reduced [7]. . Another study conducted in Africa and Thailand where pregnant women were randomized to receive treated nets or no nets showed that ITNs reduced the frequency of placental malaria and peripheral parasitemia at the time of delivery. Results also showed an increase in birth weight, and decrease in fetal loss[8]. ITNs serve as a form protection that has been shown to reduce malaria illness, severe disease, and deaths in regions where the disease is prevalent[9]. Prominent strategy is the use of insecticide treated nets (ITNs) which has been tested and found to be one of the most effective means of reducing malaria morbidity and mortality in children. However, utilization of ITNs is still unacceptably low with only 3% of African mothers and children are currently sleeping under it[9]. In Ogun state 23.6% of 495 respondents owned and were using LLINs. One of the main reasons for non-use of LLINs was lack of knowledge and unaffordability of LLIN cost. 84.2% of the 495 respondents were willing to pay at a hypothetical price of N800.00 (US$5.00) for a LLIN, 15.6% were unwilling and 0.2% was indifferent to buying it at the price.

Different from the distribution of insecticide treated nets, government and non governmental agencies has taken several initiatives in the prevention of malaria and these includes, the subsidizing of the cost of indoor residual insecticide sprays to rid off anopheles mosquitoes, special malaria prophylactic drugs to the rest of

the population and training in the community basic polyvalent skilled health workers capable of health educating community members of malaria prevention and also treatment of uncomplicated malaria cases[10].

1.2 Statement of the Problem

The estimated figures of women ranging from 75,000 to 200,000 were associated with malaria infection in pregnancy. Malaria accounts for approximately 1 million deaths annually and about 300,000 deaths in Nigeria alone[11]. In 2018, prevalence of exposure to malaria infection in pregnancy was highest in the West African sub region; about 39% of these were in the Democratic Republic of the Congo and Nigeria[13]. In Nigeria, the 11 million pregnant women who were exposed to malaria infections in 2019 delivered about 872 000 children with low birth weight (16% of all children with low birth weight across countries of the world. The use of malaria prevention methods among pregnant women offers hope in the amelioration of the above problem as most of the methods were found effective for the prevention of malaria during pregnancy some were also very cost effective. These benefits could only be achieved if mothers effectively utilized the methods[14]. Although efforts had been made by the government at all levels to make available programs and projects targeted at malaria prevention one of which is the free distribution of nets to pregnant women among other initiatives yet malaria remained prevalent among pregnant mothers especially in Ijebu Ode, Ogun state Nigeria. Considering the above identified burden of malaria and efforts of government, this study picked interest in assessing the knowledge and practice of malaria preventive measures among pregnant women attending PHC centres in Ijebu Ode Ogun state.

1.3 Justification of the Study

Malaria infection has been endemic in the West African region and Nigeria for a long time and must effort has been invested to nip the dangerous growing trend of malaria prevention in the bud, Ogun state also shared in this dangerous disease burden as pregnant mothers and under five children are most susceptible to this danger. Despite efforts invested by government and other non-governmental organizations to ensure that malaria infection is prevented among pregnant women malaria infection keeps growing on the upward trend hence the need to conduct a study that will reveal the knowledge and practice of malaria prevention measures specfically among pregnant women in Ijebu ode, Ogun state.

1.4 Aim and Objectives of the Study

The main aim of this study was to assess the knowledge and practice of malaria preventive measures among pregnant women attending PHC centers in Ijebu Ode Ogun state.

Specific Objectives are to:

i. assess the knowledge of malaria preventive measures among pregnant women attending PHC centres in Ijebu Ode Ogun state. .
ii. investigate the accessibility to malaria preventive measures among pregnant women attending PHC centres in Ijebu Ode Ogun state.
iii. examine the practice of malaria preventive measures among pregnant women attending PHC centres in Ijebu Ode Ogun state
iv. identify factors influencing the practice of malaria preventive measures among pregnant women attending PHC centres in Ijebu Ode Ogun state.

1.5 Research Questions

1. What is the level of knowledge of malaria preventive measures among pregnant women attending PHC centres in Ijebu Ode Ogun state?
2. Will malaria preventive measures be accessible to pregnant women attending PHC centres in Ijebu Ode Ogun state?
3. What is the pattern of practice of malaria preventive measures among pregnant women attending PHC centres in Ijebu Ode Ogun state?
4. Will there be a significant association between selected demographic factors with practice of malaria preventive measures among pregnant women attending PHC centres in Ijebu Ode Ogun state?

1.6 Significance of the Study

Findings from this study if made public by publishing could benefit policy makers at the federal ministry of health as it would enable them to plan and implement programs that ensure improved supply and utilization of malaria prevention commodities among expectant mothers. Findings from this study can also have a relative implications for health care service providers in PHC centres in Ijebu Ode, as they can be encouraged to regularly sensitize and health educate pregnant women about the importance of effective utilization of malaria preventive measures in pregnancy. Findings from this study can also serve as a valuable point of reference for future researchers carrying out similar studies and also contributed positively to the existing body of knowledge on the subject of knowledge and practice of malaria prevention among pregnant women.

1.7 Scope of Study

The study was conducted among pregnant women attending primary healthcare centers in Ijebu-ode Local Government. The purpose of the study was to assess the knowledge and practice of malaria preventive measure among pregnant women attending primary health care centers in Ijebu-ode, Ogun State.

1.8 Limitation of the Study

This study is subjected to some limitations

This study is interested in pregnant women attending primary healthcare center in Ijebu ode, therefore nursing mothers and sick pregnant women were excluded.

1.9 Operational Definition of Terms

In order to improve the conceptual clarity and consistency of the study, it is of the utmost importance to provide some of the primary vocabulary used in the study with operational definitions. This is necessary in order to eliminate any possible conceptual confusion. The following are the perquisites.

Antenatal Care: Is the care offered to a pregnant mother from the time of Conception until delivery

Insecticide Treated Net: Net made out of wool treated in a chemical that is hung to prevent mosquito bite.

Knowledge: The information, understanding and skills that one gained through Education or experience

Malaria: An infection caused by Plasmodium parasites which invade the human red blood cells.

Maternal Morbidity: Is the number of pregnant women or mothers who become sick or diseased.

Maternal Mortality: is the number of women or mothers who die from any cause related to or aggravated by pregnancy or its management during pregnancy and childbirth or within 42 days of termination of pregnancy.

Demographic Factors: selected demographic factors that will be considered along the independent variables of this study will be marital status and employment.

Endnotes

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Chapter Two

Literature Review

This study in this chapter shall review relevant literature of concepts pertinent to the study under the following sub-headings:

2.1 Conceptual Review

Definition and Overview of Malaria

Malaria is a parasite disease that can be fatal and is spread by infected female Anopheles mosquitoes. The disease was previously believed to originate from foul marshes, hence the name "malaria" (poor air). In the 18th century, researchers identified the parasite Plasmodium as the true source of malaria[17]. They later learned that the parasite is spread from person to person by the bite of an infected female anopheles mosquito, which needs a blood meal to feed her eggs.[18]. This disease affects all age groups. According to the latest World malaria report, there were 241 million cases of malaria in 2020 compared to 227 million cases in 2019. The estimated number of malaria deaths stood at 627 000 in 2020 – an increase of 69 000 deaths over the previous year. While about two thirds of these deaths (47 000) were due to disruptions during the COVID-19 pandemic, the remaining one third of deaths (22 000) reflect a recent change in WHO's methodology for calculating malaria mortality. The new cause-of-death methodology was applied to 32 countries in sub-Saharan Africa that shoulder about 93% of all malaria deaths globally. Applying the methodology revealed that malaria has taken a considerably higher toll on African children every year since 2000 than previously thought[19].

The WHO African Region continues to carry a disproportionately high share of the global malaria burden. In 2020 the Region was home to 95% of all malaria cases

and 96% of deaths. Children under 5 years of age accounted for about 80% of all malaria deaths in the Region[19].

Four African countries accounted for just over half of all malaria deaths worldwide: Nigeria (31.9%), the Democratic Republic of the Congo (13.2%), United Republic of Tanzania (4.1%) and Mozambique (3.8%) [19].

The "Roll Back Malaria" initiative campaign, which intends to significantly reduce the worldwide burden with an initial focus on the high transmission areas of Africa, was launched in 1998 when the World Health Organization declared malaria a top priority disease[17].

Young children in malaria endemic areas are hospitalized most frequently for the severe forms of the disease, which account for a significant portion of the morbidity and mortality associated with malaria. An important public health issue is the widespread prevalence of malaria in high-temperate regions and the adjacent areas. The growing treatment resistance of malaria parasites and the infrequent application of insecticides in mosquito breeding grounds are more likely to be the causes of rising malaria rates[20].

In the past, regular exposure to the illness has resulted in high rates of adult and pediatric mortality during epidemics. In addition, many previous epidemics have been permitted to spread more or less unchecked because national malaria control organizations lack the resources to recognize and address outbreaks. In order to effectively monitor and respond to epidemics, there is a simultaneous requirement for improved local capacity building and scientific understanding of malaria[20].

Most of these are related to the environment and temperature, which have an impact on the growth and survival of the vector as well as, more critically, the length of time Plasmodium remains in the invertebrate host. Relative humidity, which is influenced by temperature and rainfall, has a big impact on how long adult vectors live. For malaria to be transmitted effectively there has to be a relative humidity of at least 60%. Depending on the type of initial disruption and the system's resilience, the malaria transmission system will either find a new equilibrium or revert to its initial state[17].

Epidemiology of Malaria in Nigeria

Malaria is transmitted all over Nigeria; 76% of the population live in high transmission areas while 24% of the population live in low transmission areas. The transmission season can last all year round in the south and is about 3 months or less in the northern part of the country. The primary vector across most of the country is Anopheles (An.) gambiae s.s[22].

According to the 2020 World Malaria Report, Nigeria had the highest number of global malaria cases (27 % of global malaria cases) in 2019 and accounted for the highest number of deaths (23 % of global malaria deaths)[23].

Case numbers increased 3.5% between 2016 and 2019, from 293 to 303 per 1000 of the population at risk. Deaths fell 16%, however, from 0.57 to 0.47 per 1000 of the population at risk during that same period[23].

Microscopy data from the 2018 Nigeria Demographic and Health Survey (NDHS) show that the prevalence of malaria parasitaemia in children under five years of age is 23 percent (a decrease from 27% in 2015 and 42% in 2010), although there are significant regional, rural-urban, and socioeconomic differences[24].

Prevalence ranges from 16% in the South and South East Zones to 34% in the North West Zone. In rural populations, prevalence is 2.4 times that in urban populations (31% vs. 13%).

Compared to the highest socioeconomic group, prevalence among children in the lowest socioeconomic group is seven times higher (38% vs. 6%)[22].

The 2018 NDHS also indicated that 43% of the population slept under an insecticide-treated net (ITN) the previous night[22]. The 2014–2020 National Malaria Strategic Plan (NMSP) expired in December 2020. However, the 2019 Malaria Program Review indicated that there will be no significant changes in the strategic direction of the malaria elimination program in the new strategic plan[22].

The Government of Nigeria has secured credits from three multilateral banks (the World Bank, African Development Bank, and Islamic Development Bank) totaling $364 million to fund health sector interventions in 13 states of the Federation for five years (2020–2024) for malaria[22].

Severe Malaria Case Management and Control

Under the strategic plan, the Government of Nigeria supports the treatment of severe malaria using injectable artesunate[22]. The country's guidelines for Diagnosis and Treatment of Malaria (2015) recommend using injectable artesunate for the treatment of severe malaria, or intravenous quinine if injectable artesunate is not available. Both products are on the national essential medicines list and are readily available in country[22].

The recommended pre-referral intervention for severe malaria is intramuscular artesunate or artesunate rectal capsules (ARC), intramuscular artemether or intramuscular quinine[22].

Malaria in Pregnancy

Nigeria has adopted the 2016 WHO antenatal care (ANC) model which recommends a minimum of eight contacts during pregnancy. The proportion of pregnant women who received at least two doses of sulfadoxine-pyrimethamine (SP) more than doubled between 2013 and 2015 – from 17% to 41%[22]. There was a significant decrease in 2016 (31%), and then a return to 2015 levels in 2018 (i.e. 40% uptake of IPTp), A similar pattern was seen for the proportion of pregnant women who received at least three doses of SP, although coverage has not returned to 2015 levels (7% in 2013, 21% in 2015, 15% in 2016 and 17% in 2018)[23].

Factors hindering SP uptake among pregnant women include low antenatal care attendance rates, restrictions that prevent non-pharmacy workers from dispensing SP, missed opportunities during visits, and non-availability[22]. The National Guidelines specify that pregnant women with severe malaria should be treated with injectable artesunate (or intravenous quinine, if injectable artesunate is not available) from the 2nd trimester of pregnancy[22].

Seasonal Malaria Chemoprevention

The National Malaria Elimination Program (NMEP) strategy recommends seasonal malaria chemoprevention (SMC) in nine states in the Sahel region: Sokoto, Kebbi, Zamfara, Bauchi, Katsina, Kano, Jigawa, Yobe, and Borno. The recommendation is for four doses of SP + amodiaquine [SPAQ] at monthly intervals over the 4-month malaria transmission season). There are 227 local government areas (LGAs) and a population of approximately 11 million children under the age of five years in these states[22]. A total of 418,812,470 treatments of SPAQ will be required for SMC from 2020 - 2022 in the 9 eligible states to cover about 35 million children aged 3-59 months annually over the three-year interval[22]. In 2018, only about 30%

of the children eligible for SMC, received the intervention. The country intends to procure an additional 2.5 million SPAQ treatments to continue SMC efforts in Sokoto and Zamfara States[22].

Healthcare Tiers

The public health care system makes up 67% of all healthcare facilities and is divided into three levels: federal, state and local government areas (LGA) or National Primary Health Care Development Agency[22].

The federal health budget covers tertiary care and disease control programs (including malaria control). There are 83 tertiary healthcare facilities.

The state health budget covers secondary care and there are 3,992 secondary facilities.

The LGA budgets address primary healthcare while there are 30,098 primary healthcare facilities.

The government of Nigeria receives funds for malaria control from the Global Fund, USAID's President's Malaria Initiative and others. It has also secured loans from the World Bank, the African Development Bank, the Islamic Development Bank. The country has similarly been funded by DFID (now called Foreign, Commonwealth & Development Office (FCDO) as well as a number of nongovernmental players. Private sector companies in the extraction industry have also implemented malaria control programmes[22].

SMC programmes are being implemented in the Sokoto, Jigawa, Katsina and Zamfara States by the Malaria Consortium[22].

Populations with Low Access to Treatment

North Eastern Nigeria: Due to insurgencies and attacks on health workers there are operational challenges for delivering malaria intervention services[25].

Rural communities: Some hard-to-reach rural communities (~5%) require special measures (boats or camels) to access. Routine service is difficult[25].

Nomadic Population: Population has no fixed location, making them hard to reach. They believe that fever is a Fulani illness that needs no cure; prefer private medicine vendors and avoid health facilities[25].

Table 2.1: Severe Malaria Policy and Practice in Nigeria

National Treatment Guidelines	
Recommendation	**Treatment**
Strong	IV Artesunate
Alternative	IM Artemether
Alternative	IV Quinine
Recommendation	**Pre-referral**
Strong	IM Artesunate
Alternative	Rectal artesunate (children)
Alternative	IM Artemether
Alternative	IV Quinine
Pregnancy	
Recommendation	**Treatment**
Strong	Injectable Artesunate

Source: World Health Organization 2015.

Life Cycle of Plasmodium

Until recently, there were four plasmodium species that were considered responsible for malaria disease in humans:

- *P. vivax,*
- *P. falciparum,*
- *P. ovale and*
- *P. malariae.*

In 2008, *P. knowlesi*, a species that used to infect exclusively apes of the genous Macaque, was recognised by WHO as the fifth plasmodium species that infect humans[27]. The life cycle of these five Plasmodium species that cause malaria in humans is similar. The natural ecology of malaria involves malaria parasites infecting successively two types of hosts: humans and female Anopheles mosquitoes. In humans, the parasites grow and multiply first in the liver cells and then in the red cells of the blood. In the blood, successive broods of parasites grow inside the red cells and destroy them, releasing daughter parasites ("merozoites") that continue the cycle by invading other red cells. The blood stage parasites are those that cause the symptoms of malaria[20].

When certain forms of blood stage parasites ("gametocytes") are picked up by a female Anopheles mosquito during a blood meal, they start another, different cycle of growth and multiplication in the mosquito. After 10-18 days, the parasites are found (as "sporozoites") in the mosquito's salivary glands. When the Anopheles mosquito takes a blood meal on another human, the sporozoites are injected with the mosquito's saliva and start another human infection when they parasitize the liver cells. Thus the mosquito carries the disease from one human to another

(acting as a “vector”). Differently from the human host, the mosquito vector does not suffer from the presence of the parasites[20].

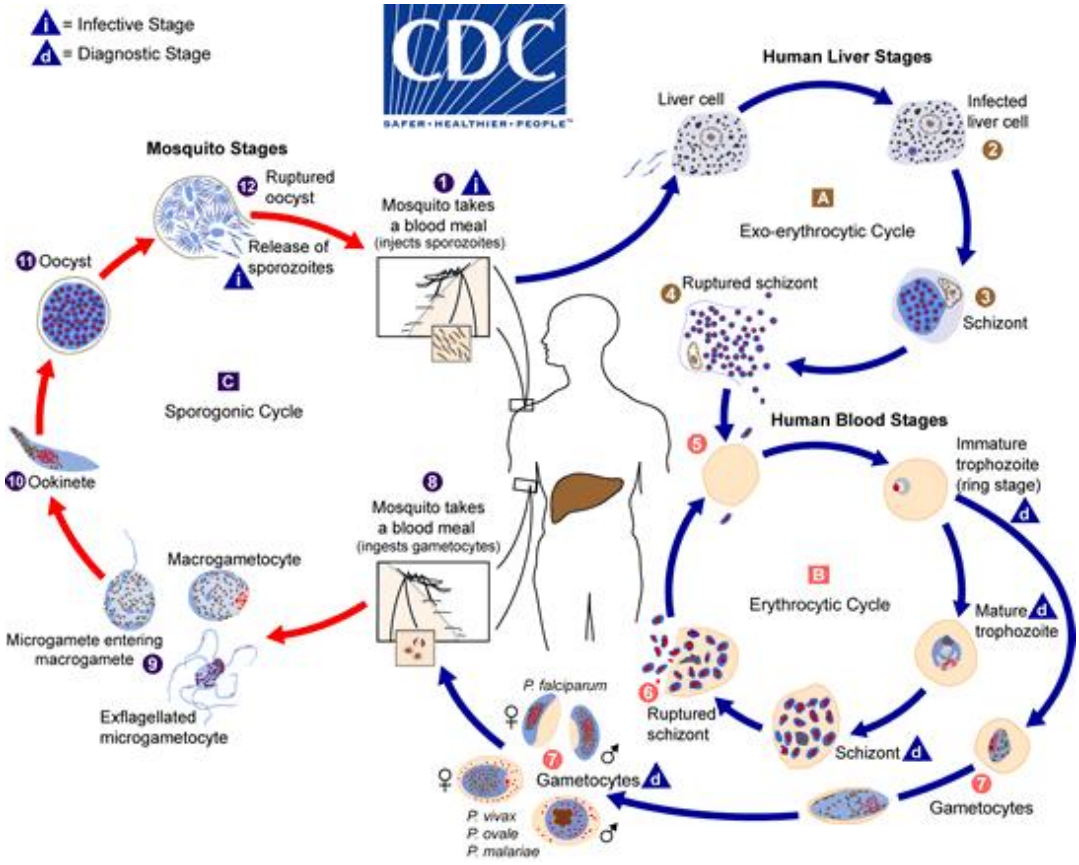

Figure 2.1 Life Cycle of Plasmodium[21]

The malaria parasite life cycle involves two hosts. During a blood meal, a malaria-infected female Anopheles mosquito inoculates sporozoites into the human host[28]. Sporozoites infect liver cells and mature into schizonts, which rupture and release merozoites . (P. vivax and P. ovale dormant stage [hypnozoites] can persist in the liver and cause relapses by invading the bloodstream weeks, or even years later)[29]. After this initial replication in the liver (exo-erythrocytic schizogony), the parasites undergo asexual multiplication in the erythrocytes (erythrocytic schizogony)[30]. Merozoites infect red blood cells. The ring stage trophozoites

mature into schizonts, which rupture releasing merozoites. Some parasites differentiate into sexual erythrocytic stages (gametocytes)[31]. Blood stage parasites are responsible for the clinical manifestations of the disease. The gametocytes, male (microgametocytes) and female (macrogametocytes), are ingested by an Anopheles mosquito during a blood meal . The parasites' multiplication in the mosquito is known as the sporogony cycle . While in the mosquito's stomach, the microgametes penetrate the macrogametes generating zygotes . The zygotes in turn become motile and elongated (ookinetes) which invade the midgut wall of the mosquito where they develop into oocysts . The oocysts grow, rupture, and release sporozoites , which make their way to the mosquito's salivary glands. Inoculation of the sporozoites into a new human host perpetuates the malaria life cycle[31].

Clinical Manifestations of Malaria

Malaria can present with anything from no symptoms to serious health complications. The first symptoms – fever, headache and chills – usually appear 10–15 days after the infective mosquito bite and may be mild and difficult to recognize as malaria[19]. Joint pains, muscle aches, backaches, general malaise, nausea, vomiting, diarrhea, splenomegaly, mental disorientation, appetite loss, irritability, rigors, dizziness, and sweating are some of the symptoms. These characteristics might exist separately or in combination. The result of an infection is influenced by the kind and strain of Plasmodium, the host's age, previous malaria infections, and other host-related factors.[32].

Transmission Route of Malaria

The main mode of transmission of the disease is through the bites from the infected Anopheles female mosquitoes that have previously had a blood meal from an individual with parasitaemia[33]. Less common routes of transmission are via

infected blood transfusion, transplantation, infected needles, and from a mother to her foetus during pregnancy[34].

Pathogenesis of Malaria

Every organ of the body is reached by the blood, which makes malaria a potentially multi-system disease. All types of malaria manifest with common symptoms like fever, but some patients may progress into severe malaria. Although severe malaria is more frequently seen in cases of P. falciparum infection, c. elegans infection, and d. albopictus infection, severe malaria is caused by the infection of the red blood cells by the asexual forms of the malaria parasite[17]. While P. falciparum infection is the primary cause of severe malaria and the associated death, problems can also arise from non-falciparum infections. Following infections with P. vivax and P. knowlesi infections, numerous cases of severe infection and even fatalities have been documented in recent years[35].

The development of severe malaria is influenced by a number of pathophysiological elements, including the parasite biomass, "malaria toxin(s)" and inflammatory response, cytoadherence, resetting, and sequestration, altered deformability and fragility of parasitized erythrocytes, endothelial activation, dysfunction, and injury, and altered thrombocytosis. Compared to non-falciparum infections, all of these features are more pervasive and profound in P. falciparum infections. Because of this, consequences from P. falciparum infections—aside from severe anemia—include cerebral malaria, hypoglycemia, metabolic acidosis, renal failure, and respiratory distress.[17].

Diagnosis of Malaria

Early and accurate diagnosis of malaria is essential for both rapid and effective disease management and surveillance. High-quality malaria diagnosis is important in all settings as misdiagnosis can result in significant morbidity and mortality. WHO recommends prompt malaria diagnosis either by microscopy or malaria rapid diagnostic test (RDT) in all patients with suspected malaria before treatment is administered. Diagnostic testing improves the overall management of patients with febrile illnesses, and may also help to reduce the emergence and spread of drug resistance by reserving antimalarials for those who actually have the disease[19].

Blood smears, both thick and thin, are used to diagnose malaria. With a detection sensitivity of 10–30 times greater than the thin smear, the thick smear is more dependable. For the purpose of detecting P. falciparum infection, a number of different techniques have been developed, including the quantitative buffy-coat centrifugal hematology system, Immunofluorescence, ELISA, and Polymerase Chain Reaction (PCR)[36]. Clinical characteristics may also be used to diagnose malaria17. Thick blood smears are advised for parasite detection, measurement of parasite density, and monitoring response to treatment. For species identification, it is recommended to use thin blood smears. It may be necessary to repeat tests if parasitemia drops below a detectable threshold due to a number of circumstances, including the stage of the patient's malaria infection and any prior therapy. If the blood slide is negative, additional research into the cause of febrile illness should be done, including repeating the blood slide in 24 hours[37].

Of all the diagnostic methods highlighted above, the Rapid Diagnostic Testing (RDT) is the most widely used diagnostic tool in the country. Malaria rapid diagnostic tests have the potential to significantly improve management of malaria

infections, especially in remote areas with limited access to good quality microscopy services[38].

Control of Malaria

Malaria control has remained a priority action within the national health system . There are favourable policies to ensure that malaria is controlled .Users fees were abolished in all public and few private health facilities making treatment free for malaria cases and government taxes on Long Lasting Insecticides Treated Nets (LLINs), medicines and laboratory supplies were waived in 2005[20].

Furthermore, the government is committed to the 2006 World Health Assembly (WHA) resolution to withdraw Artemisinin monotherapy. In order to ensure that malaria control is on the national agenda, a Parliamentary Health Committee was formed. The country has embraced global and regional commitments in malaria prevention and control. The African Union Heads of State jointly stated their commitment in 2000, during the Abuja Declaration, calling for "Universal Access" to HIV/AIDS, Tuberculosis and Malaria services by 2010[20].

All policies and strategic plans have always been aligned to the World Health Organisation (WHO) guidelines, Roll Back Malaria (RBM) and Millennium Development Goal (MDG) targets. Following the United Nations Secretary General's call for 100% coverage of malaria control interventions and the elimination of malaria as a threat to public health, the government of Sierra Leone has moved from targeting of malaria control interventions to universal coverage[20].

Malaria prevention and control work to lessen the disease's negative effects while preserving the environment, safeguarding human health, and limiting economic loss. The necessity to implement integrated control techniques for malaria

management has arisen due to the rise in the number of malaria cases in many tropical countries and the result of their struggling economies[19]. Either limiting mosquito bites or eliminating the parasite may be the emphasis of a malaria prevention strategy. The usage of ITNs, which serve as barriers to stop mosquito bites, is now the most effective method for controlling mosquitoes. Despite the fact that the WHO has started extensive malaria prevention initiatives, the parasite that causes the disease has become resistant to various medications, including those that include chloroquine[19].

Travelers to malaria-endemic areas should take preventative measures, including proguanil for sickle cell disease patients and mefloquine or doxycycline for non-visitors with tropical splenomegaly syndrome or hyperimmune malaria splenomegaly[39]. Even if enough prophylaxis has been taken, individuals should seek immediate medical attention if they get a fever three months after visiting an endemic location. Travelers should pack a full dosage of Artemether/Lumefantrine (stand-by therapy) in case they get a fever and are unable to seek medical assistance right away[40].

A key component of vector control is the elimination of mosquito breeding grounds by environmental change. By making the environment unsuitable for mosquito development, this technique tries to manage the environment. Since the mosquito's larval stages are aquatic, effective environmental management through the use of larvicides can aid in reducing vector numbers[19]. Climate change and necessary human activities like cultivating tea, planting bananas and maize, destroying forests, building fish ponds, and installing irrigation gutters all help to create breeding grounds that are conducive to vector occurrence[41]. The breeding places for mosquitoes may be considerably reduced with proper management,

helping to prevent the spread of malaria. After periodic drainage of intermittently irrigated subplots, there has been high death of mosquito larvae in the majority of populations, proving the effectiveness of this strategy in mosquito control. The fast growth in human population places great strain on the environment, resulting in a variety of mosquito breeding grounds that are either difficult or expensive to eradicate[42]. Clove and Neem tree extracts have been investigated as potential insect repellents and have shown good effectiveness against particular mosquito species[43]. It has been explored as a potential method of vector control to use predators, parasites, or entomopathogens as control agents, also known as biological control techniques. The fish Gambusia affinis, which consumes mosquitoes, helped to lower malaria rates throughout Europe. Particularly in dams, fish ponds, rivers, and other mosquito breeding grounds, these can have a positive impact on malaria control[17].

There are no community awareness programs, ITN distribution programs, indoor residual spraying (IRS) chemical applications, or malaria vector control strategies in place in Kayakoh town. The use of Artemisinin combination therapy for curative purposes has been superseded by Arthemeter/Lumefantrine (coartem), which is now available in all government hospitals[20].

Arthemeter/Lumefantrine or Artesunate (AS) are currently used often as first-line medications for treating uncomplicated malaria infections, whereas quinine is used frequently to treat severe malaria[44]. Advocacy, social mobilization, legislation, incorporating integrated vector management (IVM) principles into policy development, bolstering regulatory and legislative controls for public health, and community empowerment are all elements of integrated vector management that can be used to manage malaria[45].

Building capacity for planning, monitoring, and decision-making at the lowest possible operational level, as well as integrated approaches like the integration of chemical and non-chemical vector control methods with other disease control measures, are additional components of integrated vector management. Additionally, capacity building, creation of adequate human resources, training, and career structures at the national and local levels, adoption of strategies and interventions to the local context guided by operational research, entomological and epidemiological surveillance, and evaluation. Today, insecticide-treated nets are utilized extensively to reduce human-vector contact, control malaria, and make up the bulk of disease prevention strategies[45].

According to a report published in 2015 by the Sierra Leone Malaria Control Strategy Plan (SLMCSP), "combination of improved access to medical services and protection against the bites of the adult mosquitoes by application of ITNs by all would reduce the malaria morbidity and mortality cases by at least 40% by 2020 compared to 2015." However, universal ITN use has not yet been reached, and parasite resistance to various anti-malarial drugs is growing. The government can reduce the malaria problem through the promotion of ITNs and an integrated control of all parasite illnesses[20].

Malaria in Pregnant Women in Nigeria

The prevalence of malaria parasitaemia in pregnant women of peri-urban and rural communities of Ibadan in south-west Nigeria was much lower than in other national sub-regions: 42% in the north-east, 58% in the south-south, and 92-99% in the southeast[46]. The sample size was relatively larger than most of these other studies; and most of the participants were of low parity (women of low parity have the highest risk of malaria in pregnancy, as was also corroborated in this study)[46].

The prevalence is therefore likely to be reliable for the studied population. Other prevalence figures from the same geographic region ranged from a low 8.4%, to higher 21.3% and 41.8%, respectively. These higher figures were derived from relatively smaller studies, as found in the other sub national regions. About a third of participants with peripheral parasitaemia had asymptomatic malaria[46]. Other authors have recorded higher prevalence of asymptomatic parasitaemia: 48% and 89%.

Utilization of Malaria Prevention Methods

Anecdotal evidence shows that ITNs are routinely distributed free in the study areas. However, only half of the study population claims to sleep under these nets. Reasons discussed previously in the Introduction may explain this[15,16]. Fifty-three percent of the general population in sub-Saharan Africa is estimated to sleep under nets, which is accredited to the improved access to these nets[28]. However, evidence from meta-analysis shows that even though getting free nets improve ownership compared to paying a subsidized cost or in full; it had no effect on its utilization[29]. Educational intervention was found to have a positive effect on its use; therefore, more emphasis should be placed on health education about this control strategy[29]. About 55% of pregnant women in sub-Saharan Africa have at least one dose of IPTp-SP during pregnancy, while 31% have three doses[28]. Yet, less than a third of this study's participants had had at least one dose. SP is neither supplied free at the study areas nor dispensed under direct observation, so this maybe an obvious explanation for its poor utilization as compared to ITNs which are supplied free. IPTp use has been shown to reduce the risk of malaria in pregnancy and strategies to increase its uptake are therefore desired[13]. The World Health Organization noted in its current guidelines that its previous recommendation for at

least two doses resulted in countries (including Nigeria) formulating their national programs to target the administration of two doses in pregnancy[6]. This has been modified to unlimited monthly doses, with a target of at least three doses[7]. The findings of this study were far behind these guidelines, as most providers have been slow to implement the update. The late gestational age at booking that was prevalent in this study, is not uncommon in the study area. In the Demographic and Health Survey, only 17.6% booked in the first trimester; median pregnancy age of booking was at 5 months[30]. In a similar local study, 2.5% booked in the first trimester, while the average booking time was 23.5 weeks.

Prevention and Management of Malaria among Under Five Children

WHO recommends the following package of interventions for the prevention and treatment of malaria in children: use of long-lasting insecticidal nets (LLINs); in areas with highly seasonal transmission of the Sahel sub-region of Africa, seasonal malaria chemoprevention (SMC) for children aged between 3 and 59 months; in areas of moderate-to-high transmission in sub Saharan Africa, intermittent preventive therapy for infants (IPTi), except in areas where WHO recommends administration of SMC; prompt diagnosis and effective treatment of malaria infections. Because the clinical condition of children with malaria can deteriorate rapidly, there should be a low threshold for the use of parenteral treatment. Recent data support the use of intravenous artesunate in preference to artemether or quinine for the treatment of severe malaria in children. Because the clinical condition of children with malaria can deteriorate rapidly, there should be a low threshold for the use of parenteral treatment. Recent data support the use of

intravenous artesunate in preference to artemether or quinine for the treatment of severe malaria in children.

Level of Education and Malaria Prevention

A study on Education and Malaria Prevention by Kitua and Bloomberg showed that Most of the participants possessed good knowledge about malaria transmission (82.1%), prevention (85.2%) and where to get treatment (96.4%). Fewer were familiar with fever (58.2%) and other common symptoms of malaria (32.7%), and even fewer actually put their knowledge into action. The action score measured the use of bed net, treatment of nets, indoor use of insecticide residual spraying (IRS), and proportion of households with tight windows, among the participants. As many as 35.7% scored zero on preventive actions, while 37.2% achieved a high action score. Education level and belonging to the age group 30 to 49 were significantly associated with higher knowledge. Education level was associated with higher score for preventive action (OR 2.3, CI 95% 1.2-1.4).

Presence of Health Facility and Malaria Prevention

Aregbesola and Khan health care facilities have an impact on malaria control interventions for children under-five years of age and pregnant women in Nigeria. Findings from the study showed that there is low uptake of malaria control interventions such as IPTp, ACTs and RDTs among pregnant women and children under 5 years of age. This implies that health care facilities are ill-equipped to address the high burden of malaria in Nigeria. Governments should pay attention to the challenges of availability of and accessibility to well-equipped health care facilities for these high risk groups in order to improve their health status and reduce the high mortality rate that is consistently recorded among these groups.

Addressing the burden of malaria among children under five years and pregnant women through the availability of and accessibility to well-equipped health facilities will tremendously improve health indicators such as under five mortality, infant mortality and maternal mortality. Policy makers and political actors across Nigeria should show strong commitment to the plight of children and pregnant women and improve access to health delivery services through the provision of well-equipped physical infrastructure within the specified.

Trends in Prevalence of Malaria in Pregnancy

The primary cause of illness and mortality, particularly in the most vulnerable populations, is Plasmodium falciparum infection[47]. The largest adult risk category for malaria is pregnant women. The National Malaria Control Program (NMCP) in Nigeria reported 4.3 million suspected cases of malaria in 2009, a 42% rise from 2000–19. The most common form of severe malaria in African regions with high P. falciparum transmission is anemia, and during the high transmission season, children's hemoglobin concentration decreases seasonally, likely as a result of increased malaria transmission[48,49].

The development of an active immunity to malaria is often gradual[50]. Although maternal immunity is compatible with the extremely low incidence in newborn infants, it cannot be ruled out that social practices might also limit the exposure of very young infants to mosquitoes[51]. Maternal antibodies provide protection against the disease for the first six months of life for children born to immune moms. They develop an acquired immunity and become comparatively protected against sickness and blood-stage parasites as they age as a result of repeated exposure to

malaria parasites throughout time, hence lower prevalence of malaria among the older age groups[51, 52].

The indicator data on the level of naturally acquired immunity to malaria, as well as indirect data on the long-term intensity and stability of malaria transmission, are provided by the age distribution of parasite prevalence and parasitemia density[53].

Malaria in pregnancy is a significant health problem in subSaharan Africa where 90% of the global malaria burden occurs. Malaria disease is more hazardous especially an infection with P. falciparum during pregnancy. P. falciparum malaria can run a turbulent and dramatic course in pregnant women.

Pregnancy appears to interfere with the immune processes in malaria, a disease which itself alters immune reactivity[53]. The physiological changes of pregnancy and the pathological changes due to malaria have synergistic effect on each other, thus making life difficult for both the mother and the child[54].

Malaria often manifests itself in an unusual way in pregnant women. This might be brought on by changes in the mother's hematology, immunology, and hormone levels[51]. Pregnant women are more likely to get clinical malaria than non-pregnant women in highly endemic regions like Nigeria, where semi-immune individuals typically have significantly acquired resistance to local strains of Plasmodia[55]. Pregnant women with falciparum malaria are significantly more anaemic than non-infected pregnant women or infected non-pregnant women[56].

At pregnancy, immunity has been altered; hence, with malaria 70- 80% of pregnant women in malarious areas are susceptible to anaemia[57]. Falciparum infection is higher during pregnancy, more so in primigravidae and is usually associated with anaemia or reduced haemoglobin levels[56].

Anaemia is the trademark of malaria, especially with P. falciparum infection. The mean haematocrit level is lower in primigravidae when compared with secundigravidae and multigravidae in malaria endemic areas[58]. Cell-mediated immune responses to malaria antigens are more markedly suppressed in first than in subsequent pregnancies[58]. The multigravidae are presumably less affected because immunological memory from first pregnancy is retained[58]. Younger maternal age is also an independent risk factor for malaria in pregnancy[59]. Due to the ongoing development of older women's malaria immunity, young primigravidae and multigravidae are, respectively, more susceptible to malaria and its negative effects than older primigravidae and multigravidae[58].

Malaria infection becomes more common and severe as a result of human immunodeficiency virus (HIV) infection, and gravid-dependent immunity is relatively lost[60]. With a high risk of maternal death, cerebral malaria was a frequent consequence of severe P. falciparum infection[61].

Regardless of parity status, Akinboro reported an 88% prevalence of P. falciparum with the highest prevalence (59.4%) in the first trimester[62]. Pregnancy-related P. falciparum infection increases the risk of maternal anemia, miscarriage, stillbirth, preterm, IUGR 8 and low birth weight[56]. About 3% of abortions, 3.7% of stillbirths, and 2.2% of neonatal mortality in P. falciparum-infected women were reported by Uko in 1955.

Congenital malaria may be to blame for the presence of malaria parasites in neonates' blood. Prior to recent studies indicating high prevalence rates, congenital malaria, defined as the presence of malaria parasites in the erythrocytes of babies aged less than 7 days, was thought to be uncommon in endemic areas[63].

More recent investigations, however, reveal that incidence has grown and values between 0.30 and 33.00% have been found from both endemic and non-endemic areas[64]. Although it has been recognized for many years, it was previously assumed to be uncommon, especially among indigenous groups.

The wet season has a higher prevalence of P. falciparum infection than the dry season[65]. The presence of more habitats for larvae and higher humidity levels during the rainy season favorably influence mosquito reproduction and survival[66].

Infants' Responses to Maternal Malaria Falciparum malaria during pregnancy is well known to play a significant role in determining infants' low birth weights, minimal birth weight (LBW), which is defined as a birth weight of less than 2.5 kg, typically affects primigravidae more prominently than second- and third-gravidae in regions with minimal malaria transmission (areas with LBW: 2.5 kg)[61, 67].

Most research examining the connection between malaria during pregnancy and birth weight have not taken into consideration potential confounding variables such socioeconomic level, maternal nutrition, and smoking[68]. The prevention of malaria, however, increases birth weight, as demonstrated by numerous randomized controlled studies of preventive antimalarial interventions throughout pregnancy which have verified this causal effect[68, 69].

Anemia is the main side effect of malaria on the mother during pregnancy. Anemia during pregnancy is a widespread issue, and in regions where malaria is common, it typically peaks in the second trimester of pregnancy after a period of acute malaria infection in the first trimester[61]. Low birth weight, iron, and foliate insufficiency are all significantly exacerbated by severe anemia during pregnancy, particularly in first pregnancies[56].

While severe maternal anemia has been linked to an increased risk of newborn death in the prenatal and postneonatal periods, malaria during pregnancy has not been directly linked to a rise in infant mortality. Although it has been hypothesized that malaria and anemia during pregnancy would indirectly increase newborn mortality by lowering birth weight, low birth weight is a significant factor in determining infant mortality[73]. Although anemia and malaria are likely to work together to lower birth weight in malaria-prone locations, it can be difficult to tell how they work independently. In a Papua New Guinea research in a region with a high prevalence of malaria, severe maternal anemia was linked to low birth weight in primigravidae, while parasite positivity was not clearly linked to low birth weight[61]. However, a more recent study from Nigeria that attempted to quantify the individual effects of low birth weight caused by anemia and malaria came to the conclusion that in malaria-prone locations, malaria was a more significant risk factor for low birth weight than anaemia[69]. In the tropics, it has been challenging to distinguish between full-term and preterm low birth weight until recently. As a result, it was unable to determine the proportional contributions of preterm birth and malaria-associated intrauterine growth retardation.

It has been proposed that the relative significance of these causes of low birth weight may depend on the extent of malaria transmission and the time of malaria infection during pregnancy since the development of precise methods for estimating gestational age[74].

Malaria symptoms frequently cause premature birth, which is typical in cases of severe malaria. As a result, it is widespread in epidemics and low transmission areas with poor acquired premonition. However, in prospective investigations carried out in a setting with low malaria transmission, malaria infection—which

was frequently asymptomatic—was linked to low birth weight, which was primarily caused by intrauterine growth restriction rather than preterm delivery[75].

Some research have shown that distinct effects on the newborn infant depended on the timing of infection in sub-Saharan Africa, where malarial transmission is typically significantly higher and maternal malaria is rarely accompanied with symptoms[61].

While cord blood parasitemia, likely reflecting a recent active infection, was associated with premature birth, parasitaemia throughout the prenatal period was linked to intrauterine growth retardation. Chronic placental infection was linked to both processes in a region with significantly greater transmission rates, and premature births with low birth weight were more frequent than previously believed[68].

Immune Response to Malaria during Pregnancy

Over the course of subsequent pregnancies, women develop an increased resistance to malaria infection. The development of antibodies to the surface of placentally parasitized erythrocytes has been linked to this pattern of parity-specific resistance. Women typically do not have antibodies early in their pregnancies, which show that the placental binding parasitized erythrocytes are expressing unique surface variations. However, by the second trimester (about 20 weeks), many primigravid women have antibodies that respond to chondroitin sulphate A binding lines that have been modified in a lab, indicating that they may have come into contact with placental adherent parasitized erythrocytes[76]. In line with this theory, the placenta begins to receive blood around 10 weeks into pregnancy, and biochemical data shows that by the end of the first trimester, low sulfate chondroitin sulfate

proteoglycans are present in the placenta and intervillous blood spaces and can support parasitized erythrocytes binding in vitro[77]. The binding phenotype shows that most placental parasites circulate and sequester throughout the later embryonic stages rather than completing a full cycle of replication in the placenta. As a result, from the first 10 to 12 weeks of pregnancy, women are at risk for placental infections.

Women start to produce antibodies against placental binding isolates during this initial exposure[61]. Pregnant women experience the highest prevalence of puerperal blood parasitemia at the start of the second trimester (between 13 and 20 weeks of gestation). Infected placentas frequently contain monocytes and macrophages. They frequently have the malarial pigment hemozoin. Free malaria parasites or fibrin deposits remain in the placental infections after parasites and monocytes have been cleared. These deposits can be divided into four categories: no infection, acute, chronic, and past infection. Based on the presence or absence of PEs and malarial pigment in the placental blood spaces, this grade is assigned. These rankings are thought to represent the normal development of infection and immunity. Acute infections are brought on by the presence of parasitized erythrocytes and little pigment in macrophages but not in fibrin. Erythrocytes that have been parasitized and pigment deposits in monocytes and fibrin are characteristics of chronic infections. Past infections, however, left no parasitized erythrocytes but did leave color deposits.

Poor pregnancy outcomes are linked to the presence of malaria pigment in intervillous monocytes. Therefore, both malaria complications and infection resolution include monocytes[78]. According to studies, chondroitin sulphate A

binding isolates can be neutralized by adhesion-blocking antibodies in both primigravid and multigravid women.

However, the timing of the initial detection of these antibodies during pregnancy is the main distinction between primigravid and multigravid women. As a result, in multigravid women, the antibody response may be quickly increased upon re-exposure to placental isolates. This has been suggested as a potential contributing element to multigravid women's superior pregnancy outcomes[79]. Pregnancy is often when specific antibodies against the surface of chondroitin sulphate A binding parasites form. Children and men have low levels or none of these antibodies. Therefore, immune evasion is made possible by low affinity non-immune IgG/IgM. Once specific antibodies form against the chondroitin sulphate A - ligand in multigravid women, they might be displaced[80].

Antenatal Care Services in Nigeria and Malaria in Pregnancy

In Africa's endemic areas, malaria threatens thirty million pregnancies annually[81]. The illness is responsible for roughly 25% of newborn and 11% of maternal deaths in Nigeria[19]. Although these numbers indicate sorrow and financial loss, the majority of pregnant women in Nigeria do not have access to antenatal care[82]. Antenatal care is the term used to describe the professional services provided to expectant mothers to promote and maintain the expectant mothers and the unborn child's excellent health until the baby is safely delivered and is mature and healthy. Pregnancy lasts around 266 days from the time the egg is fertilized until labor. The first day of the previous cycle is used in the calculation of the anticipated delivery date83 because it is difficult to determine the precise day of fertilization and

because the majority of women do not get pregnant until their next menstrual cycle is missed. The majority of the pregnancy is spent under observation to:

i. Identify any previously unidentified illnesses, such as heart disease, hypertension, diabetes mellitus, and renal issues.

ii. Recognize and, if possible, stave off pregnancy problems such anemia, cephalopelvic disproportion, and slow fetal growth.

iii. Control the discomfort and conditions associated with pregnancy, such as heartburn and vomiting.

iii. Get the lady ready for labor, lactation, and proper child care.

97% of women in developed nations receive prenatal care. This is in stark contrast to the situation in many underdeveloped nations, where less than 30% of women receive antepartum care[84]. Initial and subsequent visits to the health facility can be categorized into two periods of antenatal care. A booking visit is another name for the first visit. Booking ought to take place at least 18 weeks into the pregnancy in order to execute the proper interventions where risk indicators are present. The mother's medical history is obtained, she is physically examined, and additional research is conducted during the booking appointment.

The number of follow-up visits after a scheduled appointment depends on the pregnancy's past. Prenatal visits are advised for the expectant woman unless there are specific risk factors:

i. Every four weeks up to 28 weeks.

ii. Every fortnight till 36 weeks.

iii. From the start of labor to the end of each week

Every time you go, your weight, blood pressure, and urine are checked. Pregnancy causes most women to gain 10 kg or so. Mothers should be questioned about fetal

movement starting in the 24th week of pregnancy. At 30 and 36 weeks of pregnancy, the hemoglobin is once again measured. The engagement of the fetal head should be examined at 36 weeks and every subsequent time[85]. If properly implemented, antenatal care services should offer the straightforward technology available to prevent and treat malaria in pregnancy.

These technologies include intermittent preventive treatment in pregnancy (IPTp), the drug regimen advised for shielding women and their unborn children from the effects of malaria and long-lasting insecticide-treated nets (LLINs), which create protective barriers between women and mosquitoes while they sleep[86]. The chances that a mother will live and give birth to a healthy baby are increased by antenatal care services. This is accomplished by giving pregnant women particular attention and observation before to delivery. If neglected, pregnancy will always put the mother at risk, especially in complex situations[87]. Obstetric and delivery-related problems lead to maternal death. However, some of these can be identified during prenatal care before they pose a life-threatening concern. In contrast to women in other African nations, Nigerian women unfortunately use antenatal care services less frequently overall88. The inability to pay for antenatal care, the length of time it would take to acquire antenatal treatment and ignorance of the value of antenatal care are the three main variables affecting the use of antenatal care services, according to Dairo[89].

The National Malaria Control Program of the Federal Ministry of Health, the Roll Back Malaria (RBM) partners, and other significant stakeholders have developed policies and guidelines that aim to improve the general health status of both mother and child in Nigeria's antenatal care services. Education activities aimed at

developing orientation package, producing complete curriculum and training package; conducting workshops and trainings.

i. Measuring the size of the belly by tape measure.
ii. Palpation – Examining the belly with hands or fingertips (the ultrasound system is used in some hospitals).
iii. Checking the blood pressure, blood group and genotype.
iv. Haemoglobin test to determine percentage of blood in the body.
v. Urine test to detect the level of blood sugar and protein.
vi. Administration of iron tablets and folic acids.
vii. Screening for Sexual Transmitted Infections (STIs), Tuberculosis (TB) and Human Immunodeficiency Virus/Acquired Immune Deficiency Syndrome (HIV/AIDS).
viii. Tetanus toxoid vaccination.
ix. Malaria prophylaxis (IPTp).
x. Counselling on the signs of danger in pregnancy, safer sex and contraceptive.
xi. Health education on nutrition, body fitness and breast feeding[90].

All the antenatal clinics use antenatal care cards. This helps in controlling the amount of visits. Also, information on the progress of pregnancy is marked on these cards. The card also contains the possible next antenatal date visit depending on the age of pregnancy. HIV positive mothers are given special birth planning during antenatal[91].

Confirmatory Diagnosis of Malaria

Identification of the malaria parasite or its antigens/products in the patient's blood is necessary for the confirmation of the diagnosis of malaria[92]. Although it appears straightforward, a number of factors can affect how well the diagnosis works. The

four different types of malaria, the various stages of erythrocytic schizogony, the endemicity of various species, population movements, the interactions between transmission rates, immunity, parasitaemia, and symptoms, recurrent malaria issues, drug resistance, persistent viable or non-viable parasitaemia, sequestration of parasites in deeper tissues, and the use of chemoprophylaxis or even presumptive vaccination are some of these[93]. The diagnosis of malaria is confirmed by blood tests and can be divided into microscopic and non-microscopic tests.

Microscopic Tests

The preferred method for diagnosing malaria in the majority of settings, from the clinical laboratory to field surveys, has been the direct microscopic observation of the parasite on the thick and/or thin blood smears for almost a century. For diagnosing malaria, light microscopy of thick and thin stained blood smears is still the preferred technique. Blood must be drawn, stained with Giemsa or another stain, and then examined for the presence of intracellular malarial parasites in the Red Blood Cells. When screening for Plasmodium parasites, thick smears are 20–40 times more sensitive than thin smears, with a detection limit of 10–50 trophozoites/l94. Thin smears make it possible to determine the species of malaria (including the diagnosis of mixed infections), measure parasitemia, and check for the presence of the disease[94]. The accuracy of the diagnosis depends on the caliber of the blood smear and the expertise of the lab staff. Both thick and thin smears, which have a sensitivity of 90%95, should be checked in at least 200 oil immersion visual fields at a magnification of 100 before a negative result is reported. The percentages of parasitized erythrocytes or the parasite count per micro liter of blood are two ways to express the parasitaemia level. While parasitaemia can be significantly higher (>50%) in falciparum malaria, it seldom goes above 2% in

non-falciparum malaria[94]. According to Lopez-Antunano (1990), hyper parasitaemia (>5% parasitaemia or >250 000 parasites/l) is typically linked to severe sickness in non-immune persons. Falciparum malaria may cause parasitized erythrocytes to become trapped in tissue capillaries, giving rise to a falsely low parasitemia. In some situations, the parasite's developmental stages visible on a blood smear may be more useful than parasite count alone in determining the severity of the condition. More advanced disease and a worse prognosis are indicated by the presence of more mature parasite forms (>20% of parasites as late trophozoites and schizonts) and of more than 5% of neutrophils expressing malarial pigment[95]. Malaria is extremely uncommon to be diagnosed after one negative blood test (particularly the severe variety), but if it is still suspected, tests should be repeated every 6–12 hours for 48 hours[95]. Blood obtained from finger pricking, ear lobe stabbing, and venipuncture can be used to prepare the smear. Cord blood and placental impression smears are both applicable in obstetric practice. Post-mortem cerebral grey matter samples taken through the foramen magnum, superior orbital fissure, ethmoid sinus through the nose or through the fontanel in young children may be used in fatal instances. Even in cases of severe infections, parasites are occasionally not detectable in peripheral blood smears from malaria patients. Partial antimalarial therapy or the confinement of parasitized cells in deep vascular beds may also provide an explanation for this. In certain situations, the aspirates of the bone marrow may contain parasites or malarial pigment. It may also be a sign of malaria to find malarial pigment in circulating neutrophils and monocytes[21].

Rapid Diagnostic Tests (RDTs)

Although the peripheral blood smear examination that provides the most comprehensive information on a single test format has been the "gold standard" for the diagnosis of malaria, the immunochromatographic tests for the detection of malaria antigens, developed in the past decade, have opened a new and exciting avenue in malaria diagnosis. Immunochromatographic tests are based on the capture of the parasite antigens from the peripheral blood using either monoclonal or polyclonal antibodies against the parasite antigen targets. Currently, immunochromatographic tests can target the histidine-rich protein 2 of P. falciparum (PfHRP2), a pan-malarial Plasmodium aldolase, and the parasite specific lactate dehydrogenase (pLDH)[95]. These RDTs do not need electricity, a lab, or other specialized tools. P. falciparum's asexual stages and gametocytes produce PfHRP2, a water-soluble protein that is expressed on the surface of red blood cells and has been demonstrated to persist in the blood for at least 28 days beyond the start of antimalarial treatment. Plasmodium aldolase is an enzyme of the parasite glycolytic pathway expressed by the blood stages of P. falciparum as well as the nonfalciparum malaria parasites. Monoclonal antibodies against Plasmodium aldolase are pan-specific in their reaction and have been used in a combined 'P.f/P.v' immunochromatographic test that targets the pan malarial antigen (PMA) along with PfHRP2[95]. Parasite lactate dehydrogenase (pLDH) is a soluble glycolytic enzyme produced by the asexual and sexual stages of the live parasites and it is present in and released from the parasite infected erythrocytes. It has been found in all 4 human malaria species, and different isomers of pLDH for each of the 4 species exist. With pLDH as the target, a quantitative immunocapture assay, a qualitative immunochromatographic dipstick assay using monoclonal

antibodies, an immunodot assay, and a dipstick assay using polyclonal antibodies have been developed. The RDTs have been developed in different test formats like the dipstick, strip, card, pad, well, or cassette; and the latter has provided a more satisfactory device for safety and manipulation[96]. The test procedure varies between the test kits. In general, the blood specimen (2 to 50µL) is a finger-prick blood specimen, anticoagulated blood, or plasma, and it is mixed with a buffer solution that contains a haemolysing compound and a specific antibody that is labelled with a visually detectable marker such as colloidal gold. In some kits, labelled antibody is pre-deposited during manufacture and only a lysing/washing buffer is added. If the target antigen is present in the blood, a labelled antigen/antibody complex is formed and it migrates up the test strip to be captured by the pre-deposited capture antibodies specific against the antigens and against the labelled antibody (as a procedural control). A washing buffer is then added to remove the haemoglobin and permit visualization of any coloured lines formed by the immobilized antigen-antibody complexes. The pLDH test is formatted to detect a parasitaemia of >100 to 200 parasites/µL and some of the PfHRP2 tests are said to detect asexual parasitaemia of >40 parasites/µL[96]. The PfHRP2 test strips have two lines, one for the control and the other for the PfHRP2 antigen. The PfHRP2/PMA test strips and the pLDH test strips have three lines, one for control, and the other two for P. falciparum (PfHRP2 or pLDH specific for P. falciparum) and non-falciparum antigens (PMA or pan specific pLDH), respectively. Change of colour on the control line is necessary to validate the test and its non-appearance, with or without colour changes on the test lines, invalidates the test. With colour change only on the control line and without colour change on the other lines, the test is interpreted as negative. With the PfHRP2 test, colour change on both the

lines is interpreted as a positive test for P. falciparum malaria. With the PfHRP2/PMA [the immunochromatographic test (ICT Malaria P. f. /P.v.test)] and the pLDH tests, colour change on the control line and the pan specific line indicates non-fa1ciparum infection and colour change on all the 3 lines indicates the presence of P. falciparum infection, either as mono-infection or as a mixed infection with non-falciparum species. Also, if the PfHRP2 line is visible when the PMA line is not, the test is interpreted as positive for P. falciparum infection. Mixed infections of P. falciparum with the non-falciparum species cannot be differentiated from pure P. falciparum infections. However, with regard to the pLDH test, it is claimed that in the presence of P. vivax infection, the genus specific line is much darker and more intense than the species specific line due to the presence of all the stages of the parasite in the blood[97].

Challenges to Diagnosis of Malaria

Access to medical care is limited in many malaria-endemic areas and where medical services exist, they commonly lack facilities for laboratory diagnosis, and as a result, malaria treatment is mostly given on the basis of clinical or self diagnosis. Determination of a patient's clinical history and symptoms is an acceptable basis for the management of malaria disease[19]. Although the signs and symptoms of malaria, such as fever, chills, headache and anorexia, are generally nonspecific, some signs and symptoms, especially in combination, have diagnostic value in specific epidemiological and operational situations[98]. However, it is not possible to apply any one set of clinical criteria to the diagnosis of all types of malaria in all patient populations. Experience has shown that the appropriateness of particular clinical diagnostic criteria vary from area to area according to the intensity of transmission, the prevalent malaria species, the incidence of other

causes of fever, the qualifications of the health care staff and the health service infrastructure[19]. Measurement of axillary temperature, however, did not achieve sufficient sensitivity or specificity to be useful. The observation of fever alone and of fever combined with chills and/or headache both achieved quite high sensitivities, but both criteria led to high rates of overtreatment, and any narrower combination of symptoms resulted in sensitivities unacceptable in relation to the detection of a life-threatening illness[99]. In areas where malaria is endemic, clinical diagnosis usually results in all patients with fever and no other apparent causes of malaria being treated for malaria[19]. This approach can identify most patients that really need malaria treatment but is also likely to misclassify many who are not. The specificity of clinical diagnosis is only 20-60% compared with microscopy[99]. While clinical diagnosis offers the advantages of ease, speed and low cost, overdiagnosis can be substantial and contributes to the misuse of antimalarial drugs[19]. Clinical diagnosis is very inaccurate, even in areas where malaria is a common cause of fever, since signs and symptoms of uncomplicated malaria are non-specific and overlap with those of other febrile infectious diseases and the subjective sensation of fever is unreliable[19]. Given the low specificity of all clinical case definitions, there is a compelling need to make parasite detection more widely available. Evidence of the presence of parasites can be made by the examination of a stained blood smear by light microscopy. Basic microscopy has the advantages of low direct costs if the infrastructure to maintain the service is already available can be sensitive if the quality of microscopy is high can be used to differentiate between species; determine parasite densities and can be used to diagnose many other conditions[99]. However, experience in malaria endemic areas has shown that it can be difficult to maintain good microscopy at the periphery of the health services

where most patients are treated because of the poor quality of microscopists, particularly at the peripheral level difficulties in maintaining microscopical facilities in good order; logistic problems and high costs of maintaining adequate supplies and equipment; lack of adequate training and retraining of laboratory staff; delays in providing results to clinical staff; and lack of quality assurance and control of laboratory services[101]. Although asymptomatic parasite carriers may be common, it is of limited use for kids and to some extent for adults in regions with high transmission rates[19]. To identify treatment failures, confirm severe disease, and diagnose complex malaria during a low transmission season, the WHO Expert Committee advised confirmatory diagnosis in these regions[19]. Rapid Diagnostic Test (RDT) may be used instead of light microscopy when a parasite-based diagnosis is required if standard laboratory services are unavailable or overburdened. According to a review of the most recent data on the use of RDTs conducted through WHO informal consultations, these tests provide a wide range of potential benefits[19]. It produces results quickly, which is very helpful in clinical care as well as quick epidemiological assessments; requires less training and specialized staff; has lower capital costs than light microscopy (though they can be more expensive when there are a lot of cases); boosts patient confidence in the diagnosis and the health service; also identifies patients who do not have malaria for whom another cause of fever should be sought; and allows rational use of expensive high-resolution imaging equipment. This might not hold true if parasite prevalence is particularly high, in which case the extra expenses associated with improved diagnosis might not be worth it in terms of drug cost savings. On the other hand, RDT test findings may incorrectly suggest a positive diagnosis in individuals with parasitaemia incidental to another condition where prevalence

(and host immunity) is high[19]. Since RDTs look for antigens rather than parasites, the results can indicate parasitaemia that is recent rather than present. Light microscopy may not, however, be a better indicator of parasite load than antigen detection[19]. Field sensitivity could be unexpected. For P. falciparum, published sensitivities range from good field microscopy (>90% at 100–500 parasites/l) to extremely poor (40–50%) for some commonly used products. Nonfalciparum species typically have lower sensitivities[19]. Poor sensitivity has no obvious cause. They could be attributed to subpar manufacturing, deterioration from exposure to extremes of temperature or humidity, improper end-user handling, potential geographic variation in the test antigen, and subpar comparative microscopy[19].

2.2 Theoretical Framework

Health belief model (HBM) is one of the longest established theoretical models designed to explain health behavior by better understanding beliefs about health. It was proposed by Rosenstock in the 1950s; it was originally developed to explain why people failed to utilize health services and has under gone many revisions. The central theme of health belief model is that individual will not adopt health behaviors designed to prevent specific disease unless they believe they are susceptible to the disease or disorder in question and that the recommended actions will be effective.

The HBM asserts that an individual must believe;

- That the disease (Malaria) is common
- They are susceptible to the (Malaria) disease
- The disease is serious
- The proposed preventive (Malaria Control) action will be beneficial

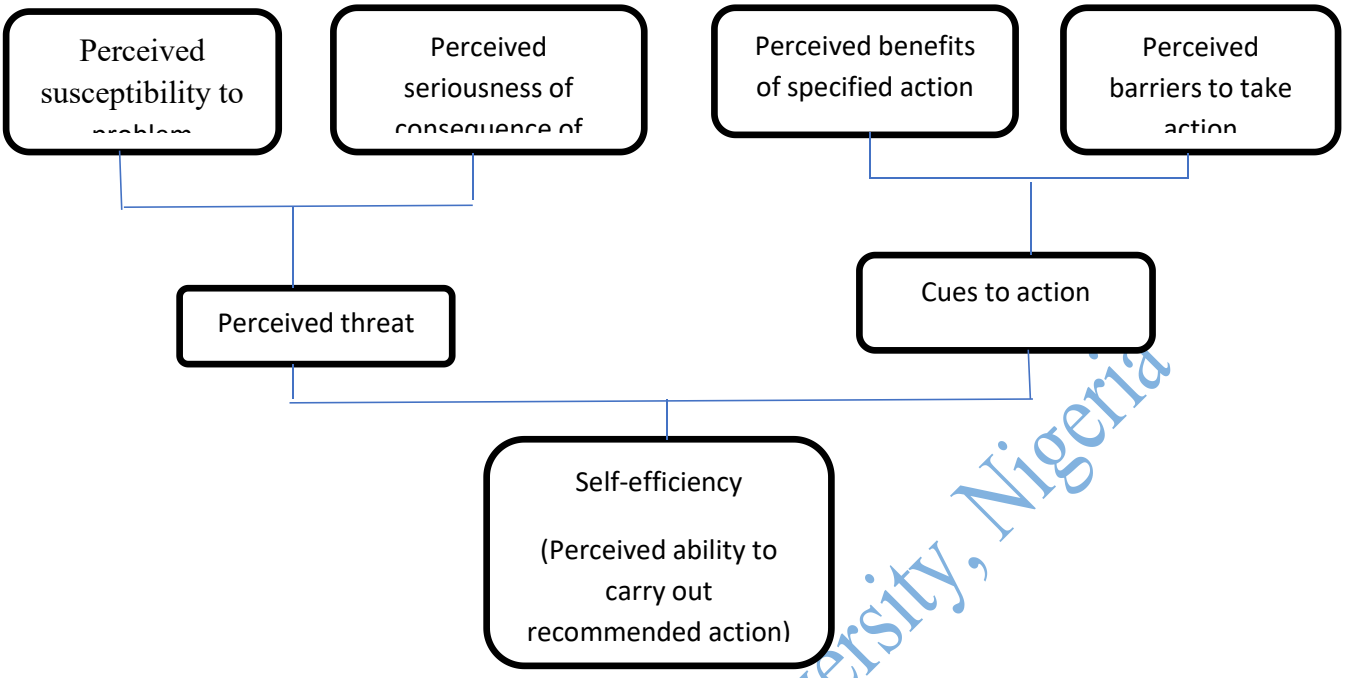

Fig 2.2: Health Belief Model: Major Component and Linkages.

Source: Baker, 2012.

Perceived Susceptibility to Problem

Perceived susceptibility refers to subjective assessment of risk of developing a health problem. This is also referred to as a person's feeling on the seriousness of contracting an illness or disease or leaving the illness or disease untreated[21]. There is wide variation between a person's feeling of severity and what a person considers the medical consequences e.g. death or disability and social consequences e.g. family life, social relationships when evaluating the severity. The health belief model predicts that individuals who perceive that they are susceptible to a particular health problem will engage in behaviors to reduce their risk of developing the health problem. Individuals with low perceived susceptibility may deny that they are at risk for contracting a particular illness. Others may acknowledge the possibility that they could develop the illness but

believe it is unlikely. Individuals who believe they are at low risk of developing an illness are more likely to engage in behaviors to decrease their risk of developing the condition[22].

Perceived Seriousness of Consequence of Problem

Perceived seriousness or severity refers to the subjective assessment of the severity of a health problem and its potential consequences. This is also referred to as a person's subjective perception of the risk of acquiring an illness or disease. There is wide variation in a person's feeling of personal vulnerability to an illness or disease[23]. The health belief model proposes that individuals who perceive a given health problem as serious are more likely to engage in behaviors to prevent the health problem from occurring or to reduce its severity. Perceived seriousness encompasses beliefs about the disease itself (e.g. whether it is life-threatening or may cause disability or pain) as well as broader impacts of the disease on functioning in work and social roles. For instance, an individual may perceive that malaria is not medically serious but if he or she perceive that there would be serious financial consequences as a result of being absent from work for several days when she has to take care of her sick child from malaria, then he or she may perceive malaria to be a particular serious condition[24].

Perceived Threat

The combination of perceived severity and perceived susceptibility is referred to as perceived threat. Perceived severity and perceived susceptibility to a given health condition depend on knowledge about the condition. The health belief model predicts that higher perceived threat leads to higher likelihood of engagement in health-promoting behaviors[25].

Perceived Benefits of Specified Action

Perceived benefits refer to an individual's assessment of the value or efficacy of engaging in a health-promoting behavior to decrease risk of disease. This also refers to a person's perception of the effectiveness of various actions available to reduce the threat of if illness or disease (or to cure illness or disease)[26]. The course of action a person takes in preventing (or curing) illness or disease relies on consideration and evaluation of both perceived susceptibility and perceived benefit, such that the person would accept the recommended health action if it was perceived as beneficial. Health-related behaviors are also influenced by the perceived benefits of taking action[27]. If an individual believes that a particular action will reduce susceptibility to a health problem or decrease its seriousness, then he or she is likely to engage in that behavior regardless of objective facts regarding the effectiveness of the action. For example, individuals who believe that wearing sunscreen will prevent the occurrence of skin cancer[28].

Perceived Barriers to Take Action

Perceived barriers refer to an individual's assessment of the obstacles to behavior change. This also refers to a person's feeling on the obstacles to performing a recommended health action. There is wide variation in a person's feeling of barriers, or impediments, which lead to a cost/benefit analysis[29]. The person weighs the effectiveness of the actions against the perceptions that it may be expensive, dangerous (side effects), unpleasant (e.g. painful), time consuming or inconvenient. Health-related behaviors are also a function of perceived barriers to taking action[30]. Even if an individual perceives a health condition as threatening

and believes that a particular action will effectively reduce the threat, barriers may prevent engagement in the health-promoting behavior.

In other words, the perceived benefits must outweigh the perceived barriers in order for behavior change to occur. Perceived barriers to taking action include the perceived inconvenience, expense, danger (e.g. side effects of a medical procedure) and discomfort (e.g. pain, emotional upset) involved in engaging in the behavior[31]. For instance, lack of access to affordable health care and the perception that a flu vaccine shot will cause significant pain may act as barriers to receiving the flu vaccine. Modifying variables, individual characteristics, including demographic, psychosocial and structural variables can affect perceptions (i.e. perceived seriousness, susceptibility, benefits and barriers) of health-related behaviors. Demographic variables include age, sex, race, ethnicity and education among others[32]. Psychosocial variables include personality, social class, peer and reference group pressure, among others. Structural variables include knowledge about a given disease and prior contact with the disease, among other factors. The health belief model suggests that modifying variables affect health-related behaviors indirectly by affecting perceived seriousness, susceptibility, benefits and barriers[33].

Cues to Action

This is the stimulus needed to trigger the decision-making process to accept a recommended health action. The health belief model posits that a cue or trigger is necessary for prompting engagement in health-promoting behaviors. Cues to action can be internal or external[34]. Physiological cues (e.g. pain, symptoms) are an example of internal cues to action. External cues include events or information

from close others, the media, or health care provider promoting engagement in health-related behaviors. Examples of cues to action include a reminder home visit from a community health practitioner, the illness of a friend or family member and product health warning labels[35]. The intensity of cues needed to prompt action varies between individuals by perceived susceptibility, seriousness, benefits and barriers. For example, individuals who believe they are at high risk for a serious illness or family member in this case under five child and who have an established relationship with a primary health care worker may be easily persuaded to get screened for malaria infection after seeing a public campaign, whereas individuals who believe they are at low risk for the same illness and also do not have reliable access to health care may require more intense external cues in order to get screened[36].

Self-efficiency

Self-efficacy was added to the four components of the health belief model (i.e. perceived susceptibility, severity, benefits and barriers) in 1988. Self-efficacy refers to an individual's perception of his or her competence to successfully perform a behavior[37]. This refers to the level of a person's confidence in his or her ability to successfully perform a behavior. Self-efficacy is a construct in many behavioral theories as it directly relates to whether a person performs the desired behavior. Self-efficacy was added to the health belief model in an attempt to better explain individual differences in health behaviors. The model was originally developed in order to explain engagement in one-time health-related behaviors such as being screened for cancer or receiving an immunization[38]. Eventually, the health belief model was applied to more substantial, long-term behavior change such as diet modification, exercise and smoking. Developers of the model

recognized that confidence in one's ability to effect change in outcomes (i.e. self-efficacy) was a key[39].

2.3 Review of Empirical Studies

Knowledge of Malaria Preventive Measures among Pregnant Women

Less than one-tenth of respondents (7%) among pregnant women and even lower (2.9%) among non-pregnant mothers of children under the age of five did not know anything about malaria, according to a 2019 study on the knowledge of malaria prevention among pregnant women in Ibadan, South West Nigeria[40]. And the statistical significance of this was p 0.05101. Nearly half of mothers of children under the age of five, both pregnant and not, did not know where mosquitoes reproduce (47.1% vs. 49.7%, respectively), but this finding was not statistically significant ($p > 0.05$)[41]. The majority of participants had little knowledge of malaria symptoms and could only name a maximum of two symptoms of malaria (74% of pregnant women and 69% of non-pregnant mothers of children under the age of five); the proportional difference was on the cusp of statistical significance with a p value of 0.051. A third of respondents in both maternal groups said insecticide-treated nets (ITN) were a typical way of malaria control[42]. Another third also mentioned pesticide spray as a typical malaria prevention strategy. 39.6% of pregnant women and 54.2% of non-pregnant mothers of children reported having the right knowledge of malaria prevention, including ITN, environmental sanitation, and chemotherapy such artemisinin-based combination therapy (ACT)[43]. In the study, there was no discernible difference in awareness about malaria between pregnant women and non-pregnant moms of children under the age of five. Additionally, there was no statistical difference in knowledge

scores between the respondents' age groups. Significantly, respondents from the lower middle class (4.10 1.28) and lower upper class (4.10 1.26) had more knowledge about malaria than respondents from the lower class (3.73 1.66); F = 4.43, p 0.001. In addition, never-married women scored higher on knowledge (4.31 1.52, F = 30.2, p 0.001) than married women (1.08 1.26, F = 30.2, p 0.001)[44]. Mothers' educational status was also related to their knowledge of malaria; those with secondary (4.07 1.28) and tertiary (4.20 1.18) degrees as their highest level of education had significantly higher knowledge of the disease than those with no formal education (3.38 1.84) and primary (3.38 1.79), F = 16.80, p 0.001. The clinical traits of the women, including gravidity, HIV status, blood type, and genotype, demonstrated a strong connection with knowledge of malaria. Women who had more children knew more about malaria[45]. In comparison to respondents who did not know their HIV status (3.63 1.71), those HIV sero-status was either positive (4.35 0.88) or negative (4.14 1.21) had higher mean knowledge scores about malaria. A substantial correlation between a few socio-demographic and clinical factors and patients' knowledge of malaria is also revealed by the post hoc analysis. The socioeconomic position of the study's female participants and their malaria knowledge score were significantly correlated. The lower class and lower middle class, as well as the lower class and lower upper class, showed considerable variances[46]. Women with elementary education differed significantly from women with secondary and tertiary education, and women with secondary education differed significantly from women with no formal education and women with primary education[101]. Socio-demographic variables such as married status, education, gravidity status, and the clinical factor HIV status persisted as

significant predictors of malaria knowledge in the multivariate linear regression analysis to evaluate the predictors of malaria knowledge[47].

According to a different study, a total of 373 (92.6%) clients correctly identified mosquito bites as the source of malaria, while 65 (16.1%) clients incorrectly stated that drinking contaminated water was the cause[102]. 13.6%, 7.2%, and 2.7% of the clients, respectively, claimed that eating palm oil, working hard in the sun, and believing in witchcraft were the causes of malaria[48].

The most common symptoms reported were a headache and a hot body (fever), accounting for 79.2% and 65.5%, respectively. Only 25 (5.2%) out of 382 clients (or 94.8%) disagreed that malaria was hazardous during pregnancy. 95.5% of clients were aware that malaria could be avoided. The majority of consumers (74.9%) knew that using an ITN was the best way to prevent malaria[49]. A total of 267 respondents (66.3%) agreed with the idea of maintaining a clean environment, while 214 (53.1%) acknowledged the usage of medication to ward off malaria. IPT against malaria was known to 344 women (84.4%), whereas only 63 (15.6%) were not[50]. 173 respondents (43.7%) had excellent knowledge of malaria and its prevention during pregnancy, compared to 52 (12.9%), 60 (14.9%), 60 (14.9%) average, 56 (13.9%) fair, and 59 (14.6%) bad respondents.

The relationship between parity and awareness of malaria was not statistically significant (X2 = 6.072, P = 0.639). But there was a statistically significant link between education level and awareness of malaria (X2= 16.053, P = 0.035). Significant socio-demographic factors (X2 = 3.347, P = 0.51) were associated with knowledge of malaria and usage of malaria preventative medications during pregnancy. The usage of ITN the night before the interview was not statistically associated with knowledge of malaria (X2 = 3.487, P = 0.480)[51].

Another study revealed that less than half of respondents (42.3%) had good knowledge of malaria prevention. About 85%, 82%, and 75% knew that malaria could be prevented through keeping the environment clean, clearing of bushes around houses and use of ITN respectively[52]. However, approximately 77% and 82% of respondents felt taking native concoction and using malaria prophylaxis respectively could prevent the occurrence of malaria infection. Nearly 84% of participants had heard of ITN, while almost 70% had good knowledge of the use of ITN in malaria prevention. Regarding the use of ITN in malaria prevention, about 80% knew that ITN is useful in malaria prevention and over three-quarters understood that it could kill mosquito[53].

Another study revealed that of the 443 respondents, 437 (98.6%) had heard about malaria before while 6 (1.4%) said they had not. Awareness of malaria was similar in the rural (98.04%) and urban (98.97%) areas ($F = 0.42$)[54]. Following multiple entries, the health facility was the most popular source of information (74% of respondents), followed in decreasing order by the radio (55%), television (46%), tracts/posters (8%) and other sources such as relatives and mobile telephone network (MTN - 4%)[55]. Following the varied views of malaria by the respondents, their perceptions were grouped into three categories: right perception of malaria, wrong perception and "don't know"/no responses. Correct views of malaria ranged from simply, malaria is "a very bad disease", "a dangerous disease", "a killer disease", to "a disease associated with the bites of female Anopheles mosquitoes". Wrong perceptions included: malaria is: "an air-bone disease", "a virus in the blood", "a disease of palm wine", "dirty environment" among others[56]. A total of 389 respondents (87.8%) were aware of at least one accurate malarial symptom or indication. 36 respondents (8.1%) provided incorrect answers, while 18 (4.1%)

either indicated they were unaware of any signs or provided no response. In total, 407 respondents (91.9%) had the correct perception of malaria, compared to 13 respondents (2.9%) with the incorrect perception and 23 respondents (5.2%) with no knowledge of what malaria is 389 responders in all (87.8%) knew at least one accurate malarial symptom or indication. 36 respondents (8.1%) provided incorrect answers, while 18 (4.1%) either indicated they had no knowledge of the signs or had not responded at all[57]. The most common symptoms of malaria were a hot body and a high body temperature, followed by headaches, nausea and/or vomiting, bodily aches, and weakness. Yellow urine, swollen eyes, catarrh, and cough were examples of incorrect signs and symptoms[58]. The effects of malaria in children under five and pregnant women were well-known to the respondents. Out of the 443 respondents, 329 (74.3%) and 294 (66.4%) were aware of at least one consequence of malaria in children under five and pregnant women, respectively, while 114 (25.7%) and 149 (33.6%) either reported incorrect effects or no responses for the aforementioned groups of respondents[59]. Anemia, mortality, and convulsion were the most often mentioned symptoms of malaria in children under five, while abortion, anemia, foetal and maternal deaths were the most frequently mentioned effects in pregnant women. Other side effects mentioned were nerve issues, ongoing fever, malnutrition, and collapse[60].

When asked if they agreed or disputed that malaria is a serious disease, respondents responded with 240 (54.2%) strongly agreeing, 172 (38.9%) agreeing, 17 (3.8%) neutrally agreeing, 9 (2%) disagreeing, and 5 (1.1%) strongly disagreeing. The 412 respondents (93%) who at least concurred that malaria is a serious disease provided arguments to support their viewpoint, including the fact

that malaria interferes with daily activities, is expensive and difficult to treat, results in anemia, abortions, and many fatalities[61].

A total of 382 respondents (86.2%) identified mosquito bites as the proper means of transmission, while 45 respondents (10.2%) misidentified the mode as drinking unclean water, eating dirty food, loitering by the fire all the time, having poor personal hygiene, or being bitten by other insects. 16 (3.6%) of the responses were women[62]. The modes of transmission were reflected in the malaria prevention strategies provided by respondents. Out of the 443 respondents, 413 (93.2%) provided the proper malaria prevention measures, 13 (2.9%) provided the incorrect measures, and 17 (3.8%) provided no response. The right preventive measures mentioned included wearing clean clothes, avoiding drying clothes on grass, taking nivaquine every three months, using insecticidal sprays and mosquito bed nets, keeping the environment clean, draining stagnant water, and clearing bushes from around homes[61]. The wrong preventive measures mentioned included avoiding cold, dirty drinks and foods.

In order to evaluate the participants' level of malaria knowledge, the categories of correct and incorrect/no responses for each of the six knowledge-related topics mentioned above (meaning of malaria, signs and symptoms of malaria, effects of malaria in children under five and pregnant women, mode of transmission, and measures of prevention) were combined[62]. A participant was assessed to have a good level of knowledge if they had correctly answered at least four of the components, whereas those who had correctly answered three and two or less questions were regarded as having average and poor levels of knowledge, respectively. The majority of respondents, 390 (88%) had strong understanding of malaria, while 30 (6.8%) and 23 (5.2%) had average and poor knowledge,

respectively[63]. At least 79% of respondents in all the different categories had a good knowledge of malaria. The proportion decreased with age from 93% in the ≥ 51 years to 79% in the 15–20 years old participants, but the difference was not significant (F = 0.09). The level of good knowledge in secondary/high school/university level respondents (91%) was significantly higher ($\chi 2 = 6.60$; P = 0.01) than in none/primary level respondents (83%)[64]. Respondents with secondary/high school/university level of education were 2.1 times (OR = 2.12, 95% CI: 1.18 – 3.78) more likely to have a good level of knowledge on malaria than their none/primary level counterparts[65]. The level of knowledge on malaria in urban (90%) and rural (85%) respondents were comparable. Buea Road (93%) had the highest proportion of respondents and Muea (83%) had the least level of good knowledge on malaria, but the difference was not statistically significant[66].

Another study showed that a majority of the women (85.2%) knew that mosquito bites could cause malaria[67]. While low proportion accepted that heavy oil consumption (2.3%), work-related fatigue (3.3%), insufficient sleeping (0.9%), exposure to sunlight (6.2%), consumption of certain fruits (2.2%), milk (0.9%), and dirty water (15.1%) can be the main cause of malaria.

More so, a majority of the women identified fever (81.5%), vomiting (54.5%) as the main symptoms of malaria. About 10% reported jaundice and 28.4% headache as the common symptoms[68]. Those who reported other physical symptoms, such as fainting, convulsion, and urinary problems were comparatively lower. The level of knowledge of malaria for rural dwellers was at 53%, while the urban dwellers had a higher level of knowledge at 68.2%. In sum, there was 56.1% level of the accurate knowledge of malaria preventive measures, causes and symptoms among women of reproductive age[69]. The association between the level of knowledge on

malaria and socio-demographic and maternal factors was tested using Chi-squared bivariate analysis to determine the variables that will be included in the logistic regression model. Results revealed that place of residence, religion, educational attainment; ANC and being in possession of radio or television had signification association with the level of knowledge[70]. On the contrary, age, wealth index, sex of household head and source of antimalarial drug during pregnancy, did not show any significant association with the level of knowledge among women aged 15–49 years. This study also revealed that revealed that women in rural locations had 40% reduction in the odds of having accurate knowledge of malaria when compared to the urban women (aOR = 0.60; 95%CI: 0.52–0.68)[71]. For religion, it was reported that Christianity had 14% reduction in the odds of having accurate knowledge when compared to Islam (aOR = 0.86; 95%CI: 0.78–0.95). Educational attainment was a factor of the knowledge of malaria. The odds of having accurate knowledge of malaria increased as the educational level increased; hence, secondary and higher education had 29% and 93% increase in the odds of having accurate knowledge of malaria when compared to the women without formal education[72]. Furthermore, respondents who had radio and television were 2.59 times and 1.22 times more likely to have accurate knowledge of malaria when compared to those who have none. It was also evident that antenatal care services teach women about malaria as women who reportedly utilized ANC services were 3.90 times more likely to have accurate knowledge of malaria when compared to those who did not utilize skilled ANC services (aOR = 3.90; 95%CI = 3.34–4.56)[73]. In another study the women's understanding of malaria showed that 355 (79%) perceived malaria as a serious illness; 13 (3%) said it was a parasitic infection. Another 5 (2%) associated it with mosquito bites, while 68 (15%) had no

knowledge of malaria[74]. The signs and symptoms of malaria mentioned by the pregnant women included: headache, 109 (24.2%), fever, 77 (17%), weakness, 77 (17%), body pains, 44 (10%), and chills 42 (9.3%). Other signs and symptoms mentioned were lack of appetite, 18 (4%), and bitter tongue, 16 (3.5%), while 14 (3.1%) mentioned vomiting and yellow eyes, respectively[75]. On the frequency of attacks, 162 (36%) mentioned they suffered malaria once during pregnancy, while 81 (18%) had it twice, 27 (6%) had it three, and 22 (5%) had it four times. 158 (36%) did not suffer from malaria[76].

When asked about their knowledge on sulfadoxinepyrimethamine utilization results of knowledge of SP among the pregnant women of different age groups showed that 43% of pregnant women in the age bracket of 16-20 years and 65% of the age bracket 21-25 years had knowledge of SP, respectively[77]. The result also showed that 86% and 75% from the age groups 26-30 years and 31-35 years, respectively, exhibited knowledge of SP, while 71% and 25% in the age brackets of 36-40 years and of 41-45 years, respectively, had knowledge of SP. There was no association between age and knowledge of SP ($P>0.05$)[78].

When asked, "Have you heard of malaria?," respondents in a different study on the knowledge, attitude, and practices of malaria among rural communities in Aliero, Northern Nigeria, answered 187 times (93.5%) in the affirmative and 13 times (6.5%) in the negative. 80 (42.8%) of the "yes" respondents knew about malaria because they had the disease[79]. Only 22 (11.8%) respondents accurately identified mosquitoes as the mode of transmission in cases of malaria, compared to 139 (74.3%) who reported bites from any vector. Only 18 people (9.6%) correctly identified the Plasmodium parasite as the primary cause of malaria[80]. The majority of them, 103 (55.1%), claimed that malaria was caused by a mosquito bite. Fever

and shivering were the most often stated symptoms, according to 122 respondents. The majority of respondents—180 (90.0%)—identified bed nets of any kind as the most widely used recognized preventative measure against malaria, while only 128 (64.0%) respondents were aware of insecticide-treated bed nets (ITNs)[81]. Use of mosquito coils was the second most popular preventive technique, according to 79 respondents (37.8%). A total of 97 people (48.5%) and 58 people (29.0%) claimed to be aware of the methods for preventing mosquito breeding, including cleaning the area around the house and draining stagnant water. Most respondents—129 (64.5%)—identified stagnant water as a mosquito breeding ground[82]. The percentage of people who understood that a mosquito bite more frequently at night was nearly all of 162 (81.0%), which indicates that knowledge was generally high. The majority of responders (140; 70.0%) said that mosquitoes 108 like to sleep indoors in dark places during the day.

According to a different study, the vast majority of participants (94.9%, N = 1415) believed that a mosquito bite caused malaria. 94% of participants (N = 1526) reported using treated bed nets to prevent malaria. Insecticide spray or coils (32.2 percent, N = 523) and window screens (5.0 percent, N = 82) were also utilized as additional measures[83]. The majority of participants (84.4%) ranked using treated nets as a means of protection against mosquito annoyance (bites) as either their first or second choice, while only 47.3% ranked using bed nets to stop malaria transmission as either their first or second choice[84].

Out of the 224 people who said they did not use bed nets, 49% of the respondents (N = 110) said it was because they felt hot while sleeping under a net, while others claimed they did not have a bed net (38.4%, N = 86), forgot to hang the net (6.7%, N = 15), or felt suffocated while sleeping under a net (5.8%, N = 13).

Static water bodies (51.5%, N = 770) were the most often stated mosquito breeding environment, followed by gutters (25.8%, N = 386), dirt (25.6%, N = 383), marshy places (10.4%, N = 155) and shrubs (6.2%, N = 92). 5.6% (N = 84) of respondents claim to be unaware of mosquito breeding locations[85]. The most frequently stated management strategies for larval breeding habitats included draining (49.6%, N = 648), cleaning (26%, N = 339), and treating sites (2.6%, N = 34). However, only 23.2% (N = 302) of the respondents were able to name a management strategy for larval breeding locations.

People were asked to list symptoms they believed to be caused by malaria when questioned about the illness' symptoms. Over 80% of respondents chose fever as their first or second option, while over 40% chose headache. Backache (18.5%), weariness (17.5%), vomiting (10.83%), and anorexia (4%), among others, were also cited[86].

A total of 668 (83.8%) of the women classified malaria as the most prevalent disease in their environment in a study done on the factors influencing the usage of malaria prevention methods[87]. Most of them, 709 (89%) associated malaria transmission with mosquito bites, but a significant number also listed at least one incorrect cause of malaria, including eating fatty foods (188, 23.6%), excessive sunlight (106, 13.3%), hard work (78, 9.8%), witchcraft (6%), and the effects of prior evil deeds (2%), among others[88]. The majority of the women went on to list other typical malaria symptoms, including fever (687; 86.2%), fatigue and sleepiness (527; 66.1%), a sour or bitter taste in the mouth (463; 58.1%), and loss of appetite (438; 55%). A total of 481 people (60.4%) knew the cause and method of transmission of malaria, whereas 316 people (39.6%) did not. Similar to this, 335 individuals (46.4%) correctly identified malaria symptoms, while 387

individuals (53.6%) incorrectly identified malaria symptoms[89]. As a result, the cause and symptoms of malaria were combined to create a composite knowledge index. It was discovered that 410 women (51.4%) knew the right causes and signs of malaria, compared to 387 women (48.6%) who did not. Their degree of education and their understanding of malaria were significantly correlated (2 = 3.6993, P = 0.0544)[90]. Family members (19.32%), hospitals (23.46%), and schools (25.72%) were the main sources of malaria information. Few 52 (6.5%) mentioned 'keeping the environment clean', 50 (6.3%) did not know any malaria preventive method, while 9 (1.1%) each mentioned drinking clean water and the use of drugs as malaria preventive measures[91].

Another study revealed that two hundred sixty one (65.6 %) women responded that malaria is transmitted due to poor personal hygiene and environmental sanitation whereas seventy-five (18.8 %) of them said malaria is acquired because of bad season[92]. Only 62 (15.6 %) of them responded that malaria is transmitted through mosquito bite. The majority of the respondents 362 (91 %) was aware of the consequences of untreated malaria and 326 (81.9 %) of them mentioned ITNs as one of malaria prevention methods. Almost two third, 267 (67 %) of the pregnant women reported that malaria mosquitoes feed during night time and 376 (94.5 %) of them correctly identified high risk groups to malaria i.e., under five children or pregnant women to prioritize them for the disease prevention. Only eighty-five of the mothers (21.4 %) used ITNs every night rather majority of them 312 (78.6 %) used it seasonally particularly during cold season[93].

The pregnant women's overall level of knowledge about malaria and its prevention methods like ITNs was categorized as good or poor. Consequently, almost three fourth, 295 (74.3 %) of them had good knowledge while the remaining 25.7 % of

the mothers possessed poor knowledge[94]. Even though women of the age group 26–35 had a bit higher percentage of good knowledge (76.7 %) than the other two age groups i.e., 15–25 (71.7 %) and 36–45 (71 %), the association was not statistically significant (P = 0.85) (Table 1). Similarly, in terms of receiving information about malaria and ITNs, 74.9 % of the mothers who received information had good knowledge which is more than the percentage of good knowledge by those mothers who did not receive information (57.1 %) but the difference was not statistically significant (P = 0.14)[95].

In a study on Barriers to Malaria Control among Marginalized Tribal Communities findings revealed there were multiple barriers to malaria control, ranging from experiences at the village level extending to the functioning of NVBDCP initiatives within the district[96]. These barriers fall into six broad categories 1) tribal knowledge about malaria, 2) reliance on traditional healers and informal providers for management of fevers, 3) surveillance, diagnosis, and treatment of malaria, 4) adherence to anti-malarial medications, 5) and malaria prevention with ITNs and IRS.

This study found that knowledge regarding malaria infection varies greatly among tribal villagers. There is no Gondi word for malaria. Instead tribal people utilize the English word ‘malaria’ or the Marathi term ‘hivtaap’. The various physical symptoms that villagers and traditional healers associate with malaria infection[97]. When asked about the vector, the overwhelming majority of respondents reply “mosquitoes”; however, there is diversity in explanation as to whether it is simply presence of mosquitoes or their bite specifically that transmits infection. Other villagers attribute malaria to “filth” or “germs that enter the body at night”. When asked about groups that should be considered high-risk for malaria infection, tribal

participants replied, “everyone”, “children” and “women” (some replied pregnant women specifically). Villagers also consider the monsoon (July through September) and winter seasons as highest risk for contracting malaria, stating that cases are less common in the summer. Our data suggest that gender does not seem to affect the overall content of knowledge about malaria infection. The sources of tribal knowledge regarding malaria are heterogeneous[98]. Participants report learning about malaria through CHW visits to the villages. Others learn from the medical practitioners at the PHCs, informal health care practitioners, and from the outreach program of SEARCH. As one female tribal FGD respondent said, “Until we go to a doctor, we don't know anything. Doctor tests blood and tells us if we have malaria or not.” The final source of education about malaria can be described as ‘experience’. A number of villagers reported that they knew about malaria having suffered it previously, or through discussions with friends, family or neighbors who have been infected[99].

Lived experience was a powerful source of knowledge about mosquitoes and malaria. For example, tribal participants demonstrated a clear understanding about the propensity for mosquitoes to breed in stagnant water. Language barriers, geographic isolation and high rates of illiteracy contribute to current deficiencies in tribal knowledge about malaria. Currently, NVBDCP educational posters are in Marathi, with heavy reliance on text to communicate information to a largely illiterate population. Among our sample, 53% of participants reported no formal education with only one-third (18/55) completing education above the 5th standard[100]. Existing posters are inadequately distributed in rural areas. We only encountered one village with posters visible during our research period. There

is currently no collaboration between NVBDCP and other governmental divisions to present this material in primary schools or other public venues.

In addition, current NVBDCP malaria educational programs are carried out by CHWs in the villages, where they often encounter a language barrier, as many CHWs do not speak Gondi, the local tribal language, and many villagers do not comprehend the dominant state language of Marathi[101]. Another study shows that Malaria was perceived to be transmitted by a mosquito by the majority although not all study participants were aware of the type of mosquito that transmits the Plasmodium parasite; only a few number reported knowing a female mosquito, termed "Anopheles". Participants cited seasonal weather variations with rainy seasons associated with high mosquito proliferation. Other participants reported human behaviors such as household practices including the keeping of water tanks uncovered and failing to clear stagnant water bodies as determinants of malaria transmission. In addition to knowledge on how malaria is transmitted in the community, participants had wide knowledge on malarial symptoms with fever, nausea, headache and shivering reported as the most observed symptoms. Convulsions were associated with presumed severe malaria[102].

Another study showed that majority of participants (89.6%) was aware of malaria being transmitted through mosquito bites. However, other transmission routes of the disease given were cold / changing weather (11.7%), drinking un-boiled water (10.1%) and eating maize (6.9%). Over half of the participants (56.1%) had heard or seen messages about malaria in the previous 12 months. The main source of malaria information was radio (70.6%) while others were health facilities (9.5%), community leaders (5.2%) and television (4.3%)[103].

Another study revealed that 172 (86%) respondents cleared bushes around to prevent breeding of mosquito, while 28 (14%) did not[116]. One hundred and seventy (85%) of respondents, used nets on their doors and windows to prevent malaria, while 30(15%) did not. The majority (92%) of the respondents said that eliminating stagnant water around the house prevent breeding of mosquito while 8% does not agree. Ninety two percent of respondents agreed that sleeping under ITN prevent malaria attacks, but 8% does not. Finally 129 (64.5%) respondents said that they knew that IPTP should be taken twice after 16 weeks of pregnancy to prevent malaria attack while 71 (35.5%) said they did not know[104]. Based on the above, it was concluded that pregnant women attending antenatal clinic at the General Hospital have good knowledge of malaria prevention.

Another study showed that when responding to the open-ended question about perceived illnesses in pregnancy, malaria (locally referred as Dzedzedze) was the most frequently mentioned health problem in pregnancy, followed by abdominal, back and body pains[109]. Headache, fever, chills, and joint pains were mentioned as the main symptoms of malaria in pregnancy. The majority of pregnant women (74%), perceived the mosquito bite as the main mode of malaria transmission. Other ways of transmission were mentioned, such as unhygienic backyards and heat. This study also revealed that More than half (65%) of the participants reported that pregnant women and children were the groups most at risk for the infection.

"Pregnant women are those who catch malaria more easily. Even among those who are not pregnant, there are those who catch malaria more easily. But it happens more often to us, pregnant women, because we can catch any type of disease easily, because of our state [being pregnant]". 24 year old pregnant

women, IDI2. In the view of the participants, the increased risk of malaria in pregnant women resulted from sharing their protection with the unborn child, and therefore, being more fragile and susceptible to malaria.

In contrast to their knowledge about pregnant women's vulnerability to malaria, 58% of participants did not consider themselves at risk or ignored the risk of malaria because they felt protected by ITNs and IPTp[100].

"No, [I don't feel at risk of getting malaria] because every day I sleep under a net, and I take the tablets in the hospital, the ones they said are to treat malaria". - 24 years old pregnant women, IDI1

Fifty-four women believed that malaria in pregnancy had adverse consequences. When asked through an open-ended question about the specific deleterious effects of malaria, the majority only referred to the consequences for the pregnant woman (maternal death, and hallucinations), very few mentioned consequences for the fetus or the baby (miscarriage, stillbirth, congenital malaria, prematurity) having only one respondent indicated low birth weight.

A 2015 study in communities in the Central African Republic revealed that Most attributed the disease to cold weather during the rainy season (67.5%) and to mosquito bites (65.6%); others associated malaria with intestinal worms (32.0%), fatigue (3.7%) and sorcerers or evil spirits (3.4%)[101]. Most respondents in Bangui (79.7%) and in Ouaka (79.0%) attributed malaria to cold weather, while 73.3% of respondents believed that mosquito bites cause malaria transmission in Ouham, 72.0% in Ouaka, 63.3% in Lobaye and 56.2% in Bangui. Abdominal pains, convulsions, yellowish urine and fever were the most frequently mentioned symptoms, reported by 65.1%, 44.9%, 40.3% and 39.1% of respondents, respectively.

Hygiene and sanitation were the most frequently mentioned methods for preventing malaria (81.1%), while only 6.5% of participants believed that insecticide-treated nets provided protection from mosquito bites, although 72.1% of households reported that they had been given a net[98].

Another study revealed that almost all the mothers/caregivers have heard about ITN in the municipality. The majority, 52.9% heard about ITN from the RCH clinic; other information sources include: the ANC clinic (33.6%), community gathering (durbar) (8.6%), Radio (3.8%) and Television (1.1%). Only 1.3% of mothers/caregivers said they have never heard of ITN. The mothers/caregivers had knowledge about malaria and were able to identify the local name for malaria in their community. The local names for malaria documented from the study are "Asra" or "Ndorgbe" among the Ewe speaking communities; "Atikesi", "Buwi", "Evi" and "Ortoyeebe" among the Guans and "Suule" which is common among the Moslims (Zongo community)[87]. About 80% of mothers/caregivers said malaria presents itself as hot body or fever, diarrhea (8.0%), vomiting yellowish substance (4.0%), bitterness in the mouth (3.2%), whilst (6.2%) did not express their knowledge about Malaria. Majority of the mothers/caregivers (82.2%) said malaria is transmitted through mosquito bites, 10.4% associated the cause of malaria to playing in the sun, 5.3% believed malaria is caused by dirty environment and 2.0% attributed it to drinking dirty water. About 90% of the mothers/caregivers were of the view that children under five years were the most vulnerable, whilst the remaining percentage were of the view that pregnant women were also at a great risk for malaria[90].

Another study revealed that six hundred twenty seven (72.6%) of the study participants mentioned stagnant water as breeding sites for mosquitoes and only

two hundred seventy nine (32.3%) of study participants knew that Anopheles mosquitoes are responsible for the transmission of malaria[120]. Only 14 (1.6% of the interviewees) knew that malaria is brought on by microscopic organisms (plasmodium species), while 450 (48%) indicated that mosquitoes reportedly bit people at night[20]. The study revealed that misconceptions about causes and transmissions of malaria are very common. The three most common misconceptions of study participants about causes of malaria were exposure to cold weather 219 (25.3%), hunger 135 (15.6%), drinking dirty water 127 (14.7%). Also the mentioned eating corn cane 27 (3.1%), sleeping with malaria patients 20 (2.3%) and due to evil spirit 10 (1.2%) as causes of malaria. Their source of information was health organizations 430 (49.8%), religious institutions 270 (31.25%), radio 49 (5.7%), Friends 44 (5.1%), Schools 39 (4.5%) and Television 12 (1.4%) were major sources of information about malaria in the community. In health institutions, health extension workers were the dominant sources of information about malaria in the community[99].

Accessibility of Malaria Preventive Measure among Pregnant women attending PHC centers.

According to a research, 237 respondents (51.3%) had at least one mosquito net, whereas 196 (48.7%) did not[102]. 35 (8.7%) of those who owned mosquito nets had regular nets, whereas 172 (42.6%) had insecticide-treated bed nets (re-treatable and long-lasting ITN). Prior to becoming pregnant, ITN use was 28.5%; during pregnancy, it was 24.6%; and the night before the reservation, it was 18.6%. Another study revealed that out of the 443 respondents, 208 (47.0%) possessed at least one mosquito bed net (total = 275) with a median of 1.33 nets[104]. Of the 275 nets found in households, 89 (32%) were potent ITNs and others had never been

retreated/treated. The level of awareness of ITNs as a preventive measure against malaria was quite high among respondents. Of the 437 respondents, 432 (98.9%) had heard about ITNs before. Similarly as for malaria, the sources of information about ITNs were the same. The most accessible channel was the health facility (302, 69.1%), followed by the television (231, 52.9%) and the radio (190, 43.5%). Another study reveals that the majority of bed nets available in households surveyed were freely acquired (94.8%, N = 1453) from the national free distribution campaigns and the remainder were either bought on the market or were gifts from relatives[101]. Concerning ITN ownership, the proportion of households owning at least a net varied from 82.3 to 100%. The proportion of households possessing an ITN for two people varied greatly according to districts from 42.2 to 76%. The proportion of the population with access to an ITN within their household varied from 41.1 to 57.7%. The proportion of the population that used an ITN the previous night varied from 65.7 to 95.5%. Another study showed that almost all of the pregnant women (96.8 %) who owned ITNs had never re-treated their ITNs mainly because of the absence of K-O tab in the area[103].

A study on surveillance and treatment of malaria cases among tribal communities is inadequate. The study showed a number of barriers to malaria diagnosis due to inadequate active surveillance of fever cases by CHWs at the village level[112]. This process is complicated by the rural nature of the villages, lack of transportation facilities for CHWs, isolation of villages secondary to flooding of roads during the monsoon, and non-availability of RDKs in some areas.

A CHW stated, *"We don't have transportation facilities. During rains, rivers are flooded; hence we often miss regular village visits."*

In addition, the activity of Naxalite groups within the district often results in closure of roadways due to threats of violence. These groups also de-motivate NVBDCP staff from seeking employment in this region.

A NVBDCP officer stated, *with the vacancy positions in our district, with some insurgency factors, [malaria] surveillance is not weekly. In some areas it is fortnightly (every other week) … if we go with fortnightly visits, probably we will never be able to control [malaria].*

There is also delay to smear results, as large distances between villages, lack of transport, and vacancies in the district contribute to create a long delay between blood smear collection and results communicated back to the village level.

Pattern of Practice of Malaria Preventive Measures among Pregnant Women

According to a study, a total of 146 (56.4%) out of 259 non-primigravidae used anti-malarial medications to avoid malaria in pregnancy in their previous pregnancy[102]. 65 (25.1%) of the women in this group took IPT in combination with sulphadoxine pyrimethamine. A total of 109 clients (27%) took antimalarial medications. 64 (15.9%) women who took IPT with sulphadoxine-pyrimethamine, or 58.7% of all the women who used malaria preventative medications, did so. Only 31.6% of sulphadoxinepyrimethamine users received their medication through direct observed therapy. When the parity of the customers was compared to the use of malaria preventative medications during the index pregnancy, no statistically significant link was identified (X2 = 0.330, P = 0.848). A total of 237 respondents (51.3%) owned at least one mosquito net, compared to 196 (48.7%) who did not. 35 (8.7%) of those who owned mosquito nets had regular nets, whereas 172 (42.6%) had insecticide-treated bed nets (re-treatable and long-lasting ITN). Prior to becoming pregnant, ITN use was 28.5%; during pregnancy, it was

24.6%; and the night before the reservation, it was 18.6%. This suggests that 81.4% of the study's participants did not spend the night before the interview sleeping beneath an ITN. Owning ITN and using it the night before the interview were associated statistically significantly (X2 = 64.972, P = 0.000)[67].

Socio-demographic factors that significantly correlate with knowledge of malaria and the usage of anti-malarial medications during pregnancy (X2 = 3.347, P = 0.501).

The usage of ITN the night before the interview was not statistically associated with knowledge of malaria (X2 = 3.487, P = 0.480).

The clients' parity and their use of ITN both before and during pregnancy were statistically significantly correlated (P = 0.035 and P = 0.021, respectively). Parity and ITN use the night before the interview did not, however, have a statistically significant correlation. The fact that the ladies were healthy was the main justification for avoiding utilizing malaria preventive medications[68]. 135 participants, or 33.5%, provided justifications for not using the ITN. The majority of them, 102 out of 135 women (75.6%), noted that it was uncomfortable to sleep under insecticide-treated bed nets, particularly in the heat and due to the fear of suffocation. Additionally, 15 (11.1%) said that the size did not fit their beds, and 12 (8.9%) said that their husbands did not find it acceptable. Of these respondents, six (4.4%) thought it was ineffective at preventing malaria. A majority of women (97.4%) and more than 80% of women, respectively, stated that sleeping beneath a mosquito net and sleeping under a net treated with pesticide are the best practices for preventing malaria[103].

Furthermore, a very low proportion of the women opined that: using insecticide sprays creams and lotions (6.1%), taking preventative medications (6.4%),

insecticide coils (4.5%), and drinking plant juice/root (5.9%), coil smoke (4.9%) and covering the body (8.7%) were the best preventive measures. About one-fifth reported that keeping the surrounding clean is the best preventive measure. On the malaria prevention practices, out of 4,656 women, 20.4% reported not using any net at all and 77.9% reported using only insecticide treated nets for children during the night. Regarding the use antimalarial drugs for febrile illnesses during malaria, amodiaquine was the commonest one (21.6%) followed by fansidar, quinine and chloroquine. A majority of the women (84.7%) reported taking antimalarial drugs during pregnancy[101]. No significant different was observed in these practices between urban and rural areas except for taking fansidar.

Another study showed that actions taken by women to treat malaria during pregnancy included going to the hospital, 261 (58%), taking herbs, 49 (11%), self-medication, 77 (17%) with pyrimethamine, paracetamol, SP or chloroquine injection. Another 63 (14%) did nothing. In this study the respondents also indicated the preventive measures taken against malaria included taking herbs 135 (30%), chloroquine 126 (27%) or pyrimethamine 103 (23%). Other measures included the use of blood tonic, 54 (12%), paracetamol 23 (5%) or SP, 18 (4%). Mosquito control measures included use of insecticide spray, 215 (48%), mosquito coils, 95 (21%), bush clearing 27 (6%), and 18 (4%) put mosquito screening on doors and windows. Environmental cleanliness was mentioned by 27 (6%) of the women, while use of repellents was practiced by a mere 0.3%; 59 (13%) did nothing. In addition, 9 (2%) said they did not know about preventive measures. On awareness of LLINs and its use, 356 (79%) were aware of LLINs, while 94 (21%) said they were not aware. The result showed that only 13% of those who had heard of ITNs used them. On probing further whether the various actions taken to protect

themselves from mosquito bites were effective, 383 (85.1%) claimed that the actions were effective in protecting them against mosquito bites, while 67 (14.9%) said these were not[100].

According to a different poll, the majority of caregivers 137 (68.5%) said they would visit a hospital108 if their child had a fever. When considering whether to seek official care for a kid with fever, 104 (52.0%) respondents said that the child's condition was most essential, followed by perceived cost by 77 (38.5%) respondents. The majority of them, 106 (56.7%), agreed that chloroquine was the best antimalarial medication. The majority of respondents—about 160 (80.0%)—said they owned bed nets, the most popular malaria prevention strategy in use, while only 40 (20.0%) said they didn't. Only 51 (31.9%) of those who said they used bed nets said they used ITNs, while 109 (68.1%) said they used untreated nets. The second most frequently used preventive method, according to 35 (17.5%), was mosquito coils. Approximately 110 (68.8%) people claimed that their entire family slept under bed nets, compared to 32 (16.0%) who claimed to have taken no preventative measures. 89 respondents (47.6%) indicated that they had received antimalarial treatment at home[99].

The majority (60.5%; N = 963) of the 1590 household heads surveyed claimed to employ self-medication when they suspect a case of malaria. About 34.3% (N = 545) and 5.2% (N = 82) of respondents said they used traditional medicine and went to a hospital or clinic for advice, respectively. Self-medicating respondents reported purchasing their medications from pharmacies in the majority (72.7 percent; N = 1078).

Some of the individuals admitted to using plants or purchasing their medications from street vendors (36.2%; N = 537), hospitals (20.6%; N = 306), or both. A

household would spend, on average, CFAF 11,589 1133 (US $21.87 2.14) and CFAF 66,403 4012 (US $125.29 7.57) per year on vector control and malaria treatment, respectively. Both malaria treatment and mosquito control expenditures by households varied significantly between districts (F = 7.951; P 0.001) and (F = 1.549; P = 0.03)[11].

Three hundred and ninety respondents (49.3%) in another research owned at least one mosquito bed net. ITNs made up 325 (88.3%) of the mosquito net owners, whereas the remaining 65 (16.7%) used standard nets. Of those that owned ITN, only 59 (18.0%) actually used them the night before the interview. At the time of the study, 62 women (7.78%) were pregnant, of whom 31 (50.0%) had used IPTp during the index pregnancy. One hundred and ten, or 101 (12.67%), women who were pregnant at the time of the study delivered 60 (59.41%) of their kids.

Another study showed that slightly more than half of the pregnant women 203 (51.1 %) had positive attitude towards malaria and ITNs[102]. Women of the younger age group i.e., 15–25 possessed significantly high percentage of positive attitude (60 %) as compared to other age groups, 26–35 (50.7 %) and 36–45 (35.5 %) in both univariate and multivariate analysis (P = 0.01) (Table 2). Likewise, mothers who obtained information about malaria and ITNs had significantly high frequency of positive attitude (52.2 %) than those who didn't receive (21.4 %) (P = 0.02). The source of information was also significantly associated with attitude towards malaria and ITNs. Information obtained from TV/Radio and health extension workers being more important to change attitude than the information from friends/neighbours (P = 0.003).

Only sixty-three (15.8 %) of the participants owned at least one ITNs (Fig. 3). The main reasons reported for this was unavailability in local markets (74.4 %) (Fig. 4).

More than half of the pregnant women who owned ITNs 33 (52.4 %) had poor practice of ITNs utilization[76]. Similarly, almost half 29 (46 %) of the mothers who possessed ITNs had six or more family members though maximum number of ITNs they owned was only two, and nearly half of them (47.6 %) reported that they were not using it all. A little more than half (52 %) of the mothers who had ITNs had not slept under bed net the previous night of the interview date.

In another study on the factors influencing the usage of different types of malaria prevention methods during pregnancy in Kenya, approximately half of the pregnant women used ITNs (52.9%), while only 24.1% received IPTp. Forty-seven percent of the study sample was aged 15-24 years, and 12.9% older than 35 years. Seventy-five percent of the sample was Christian and 21.4% were Muslim. Other characteristics of participants indicate that close to 90.0% of participants were married. For 56.3% of women, primary education was the highest level reached. A low percentage of pregnant women (22.8%) reported higher education. Most women made healthcare decisions together with their partners, though for a quarter of women still had their health care decisions made solely by their partners.

Another study revealed that malaria was perceived as not inherited rather acquired in all accounts and thus preventable[104]. Preventive measures cited as already in use included LLIN and IRS, closing windows and doors early in the evening, clearing mosquito breeding sites and seeking early healthcare after first symptoms emerged. Although emerging themes on LLIN use included acceptability, factors influencing their use were also described by participants, such as knowledge, seasonality, adverse events, perceived insufficient number of LLIN distributed and bedbug infestation. All participants agreed on the effectiveness of LLIN when used correctly every night. There were no clear differences among people who

commonly used LLIN on a household level. Some participants had a preference for the type of nets distributed with the rectangular type of LLIN less preferred to the more common distributed circular type[86]. Rectangular LLIN are hung at all four corners of a bed while rounded ones are simply hung in the middle of the bed then lowered and tucked under the mattress at bedtime. When there is no bed, a mattress is laid on a mat by the floor and the net hung over the mattress whist being suspected by a long string. LLIN were perceived to prevent malaria and reduce mosquito-biting frequency, provide warmth during rainy seasons, and prevent snakebites. Another study showed that Majority of participants, (67.6%) were aware of ways to avoid getting malaria[66]. The most prominent methods were: sleeping under mosquito nets including untreated (81.7%) and insecticide treated ones (29.6%), using mosquito coils (36.9%) and spraying houses with insecticides (17.3%).

Another study revealed that practice of malaria prevention by respondents in secondary health facility in Calabar[87]. One hundred and thirty eight respondents (69%) practised malaria prevention while 62(31%) respondents were not practising malaria prevention strategies.

Findings from another study regarding pregnant women's preferences of the different interventions against all others, shows that 62.5% of the first choices were ITNs, followed by IPTp which amounted to 12.5% of the first choices[104]. Nine percent of the first choices were iron supplements and HIV PMTCT. The interventions which were least elected as the first choice were tetanus toxoid vaccine (TT vaccine), antihelmintics, and IRS. The top second choices were IPTp and iron supplements and the bottom three choices were antihelmintics, IRS and HIV PMTCT. In terms of malaria interventions, ITNs were by far mostly

mentioned as first choice (69%). IPTp was mostly mentioned as second choice (28%), but also and less frequently, elected as first and third choice (15% and 14% respectively). IRS was mostly mentioned between the third and the last three choices and hardly elected as the first choice (1.2%). In terms of other interventions, iron supplements were mostly elected between the second, third and fourth choices, and tetanus vaccine was more skewed towards the third, fourth and fifth choices. Both antihelmintics and HIV PMTCT were mostly elected among the last three choices[95].

Another study shows that almost all the mothers/caregivers did something to prevent their children from getting malaria. The use of ITNs was the most common means of malaria prevention in children under five years at the household level and this method was used by 66.4% of the mothers/caregivers. Other methods of malaria prevention mentioned were, cleaning of the environment (20.7%), use of herbal preparations (12.0%), mosquito coils (4.7%), and mosquito sprays (2.7%), and the remaining 3.6% did not identify any methods currently being employed at the household level for malaria prevention.

Demographic Factors and Practice of Malaria Preventive Measures among Pregnant Women

A study on the prevalence and risk factors associated with malaria infection among pregnant women in a semi-urban community of north-western Nigeria, results revealed that the average age of the participants was 26.1 ± 1.7 years (range:- 14 – 41)[107]. Over one- third (36.1%) had no education, whilst 25.0%, 21.6%, and 17.3% had primary, secondary and tertiary education, respectively. One hundred and forty-eight women used ITNs (58.0%), while 107 (42.0%) didn't use nets. Malaria prevalence was 41.6%[103]. Age was not significantly associated with malaria prevalence ($x^2 = 5.27$, $p = 0.153$); the 14 – 20 age group had the highest

prevalence (51.6%), as well as highest mean parasite density (800 parasitesμl−1 of blood). There was a significant association between malaria prevalence and education (x 2 = 20.9, p = 0.000). Malaria prevalence in women with no education was 63.0%, while in those with primary, secondary and tertiary education; it was 45.3%, 32.7%, and 27.3% respectively.

Use of ITNs was significantly associated with malaria prevalence and parasite density, as the number of participants who did not use ITNs regularly reported a high occurrence of malaria infection with a high parasite density, as compared to those who used ITNs on a daily basis (x 2 = 33.6, p = 0.000). While malaria prevalence and parasite density were 62.6% and 800 parasitesμl−1 of blood among non- ITN users, it was 26.4% and 600 parasitesμl−1 of blood, respectively, among ITN users[104].

In a different study, comparisons were made to determine whether there was any correlation between education level, good behaviors, and malaria knowledge. According to the research, participants with a secondary or university education had more knowledge of malaria than those with a primary education (OR = 7.03; P 0.001). Additionally, individuals with university or secondary education levels were better knowledgeable about best practices for treating and preventing malaria than those with elementary education (OR = 1.61; P = 0.03). Comparisons were also conducted to assess potential associations between good knowledge of malaria, good practices and socioeconomic status of the household. From the analysis, it appeared that households of good economic status were more aware of or applying good practices concerning malaria prevention and treatment compared to the poor ones (OR = 2.34; P < 0.001). However, no significant association was found between socioeconomic status and knowledge of malaria (OR = 1.27; P = 0.40)[100].

To assess the level of association between practices and knowledge and some measured indicators, a multivariate analysis with good knowledge or practices as outcome variable and different measured parameters (gender, education level, occupation, economic status, and presence of window screens) as explanatory variables was undertaken. When analyses were performed with best practices as outcome variable, the presence of screens on windows and university or secondary education level exhibited strong positive association with best practices ($P < 0.05$). When good knowledge was considered as outcome variable, the following explanatory variables were recorded significantly associated with good knowledge: gender (women), education level (secondary or university level) and economic status (wealthy) ($P < 0.05$)[104].

Significant variations were recorded when comparing knowledge and practices between districts ($P < 0.002$). From the analysis, it appeared that in most districts, more than 50% of people interviewed had good knowledge of malaria and prevention measures. Concerning practices, it appeared that in 24 out of 32 districts less than 50% of people interviewed apply good practices concerning malaria treatment and prevention.

Married women were 3 times more likely to use ITN than unmarried women, according to another study (odds ratio [OR] = 2.69, confidence interval [CI] = 1.56-4.62)[110]. In comparison to nulliparous women, women who had ever given birth were twice as likely to have used ITN the night before the survey (OR = 2.42, CI = 1.42-4.14). Between awareness of malaria transmission, ITN ownership, respondents' educational levels, and ITN use by women, there was no statistically significant correlation. The pregnant women in this study did not significantly differ in their knowledge of malaria etiology, marital status, educational attainment,

parity, or use of IPTp. Another study showed that twenty out of twenty nine pregnant mothers (68 %) who attended secondary education or above had positive attitude which is higher than those who are illiterate (49 %), but the association was not statistically significant (P = 0.17)[1].

Level education was significantly associated with ITNs utilization among the pregnant mothers with 86.7 % of mothers attending secondary education or above had good practice (P = 0.01) (Table 3). There was also considerable difference in ITNs utilization according to the respondents' occupation. In this regard civil servants had absolutely good practice (100 %) but the difference was not statistically significant in multivariate analysis (P = 0.28). In the same way pregnant women who had good knowledge about malaria and ITNs also had relatively good practice of ITNs utilization (52.9 %) as compared to those who had poor knowledge (25 %) though the association was not statistically significant (P = 0.09)[1].

Another study shows that unadjusted and adjusted odds ratios indicate strong associations between demographic factors and the uptake of prevention methods. Age was associated with both outcomes[113]. Women aged 25-34 were close to two times more likely to utilize ITNs (AOR=1.52; 95% CI=1.04-2.21). Similar odds were reported for IPTp (AOR=1.83; 95% CI=1.21-2.81). Women who resided in seasonal risk and low risk areas were 42.0% and 83.0% less likely to use ITNs than women in endemic areas (AOR=0.58; 95% CI=0.39-0.87 versus AOR=0.17; 95% CI 0.10-0.30).

In contrast to endemic areas, fewer pregnant women in seasonal and low risk areas received IPTp (AOR= 0.60; 95% CI 0.38-0.94 versus AOR=0.28; 95% CI 0.26-0.60). Muslim women were 2.3 times more likely to use ITNs in comparison to

Christian women (95% CI AOR=1.35-3.76). Married women were higher users of ITNs than never-married ones as reflected in the odds ratios (AOR=2.29; 95% CI=1.28-4.07). Similarly, relative to never-married women, the married ones were more likely to receive IPTp (AOR=2.19; 95% CI=0.99- 4.82). After adjusting for potentially confounding variables, associations were also detected between socioeconomic indicators, ITN use and combined uptake. Socioeconomic indicators such as the level of education and wealth index were associated with study outcomes[102]. Women with higher education also had almost two-fold higher odds of ITN usage than women with no education (AOR=2.07; 95% CI=1.28-4.07). No associations were established between education, wealth index and IPTp. Associations between women from wealthier households and ITN use were considerably higher than women from poorer households (AOR=1.83; 95% CI=1.17-2.83).

In study it was found that from the assessment score, the majority of participants (64.6%) had low knowledge on malaria prevention methods, with the rest having no (32.5%) or medium (2.9%) knowledge. None of the participants had high knowledge on malaria prevention methods. The factors found to be associated with knowledge on malaria prevention methods were age ($\chi2 = 32.1$; $p < 0.01$), employment status ($\chi2 = 18.1$; $p < 0.01$), education ($\chi2 = 20.3$; $p = 0.01$), income ($\chi2 = 14.5$; $p = 0.01$) and having heard malaria message in the previous 12 months ($\chi2 = 92.3$; $p < 0.01$). Findings from another study revealed that calculated r-value of 0.62 obtained at 0.05 level of significance with 198 degrees of freedom. When compared to the critical value of .138 was found to be greater. On the basis of this observation, the null hypothesis is rejected and this implies that, there is a

significant relationship between pregnant women's knowledge and practice of malaria prevention[104].

2.4 Conceptual Framework

The conceptual framework below shows the nexus that exist between the independent and the dependent variables of the study. The figure further shows that there is connection between knowledge and practice of malaria preventives measure in this study. Also, there are certain factors (age, place of residence, level of education, marital status, and type of family) that affect the practice of malaria preventives measure. These relationships will be established in this study in a bid to recommend pragmatic solutions to the issues of knowledge and practice of malaria preventive measures.

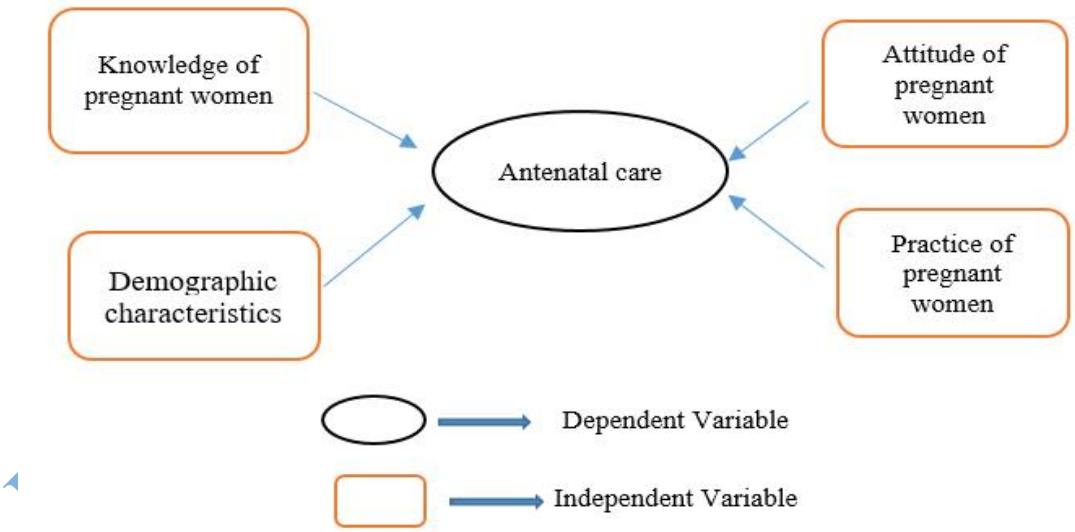

Fig. 2.3: Conceptual Framework

Source: Rosenstock, 1974.

2.5 Summary of Gaps in Literature Reviewed

Several studies have explored the knowledge and practice of malaria preventive measure among pregnant women still; there are very few studies that have been done in PHC centers in Ijebu Ode Ogun State,, which is why this study is investigating the accessibility to malaria preventive measures among pregnant women attending PHC centers in Ijebu Ode. Limited knowledge about malaria prevention, many pregnant women have a lack of comprehensive knowledge about malaria prevention measures, such as the use of insecticide-treated bed nets (ITNs), intermittent preventive treatment in pregnancy (IPTp), and indoor residual spraying (IRS). There is a need for more research to explore the specific gaps in knowledge and identify the most effective ways to improve awareness.

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Chapter Three

Methodology

3.1 Research Design

The research design adopted for the study was a cross sectional design

3.2 Population of the Study

All pregnant women seeking antenatal treatment in the public primary health care facilities in the Ijebu Ode Local Government Area comprised the research group.

Study Area

This study was carried out in Ijebu-ode Local Government; Ijebu ode local government was created on March 11, 1938 with the Headquarter at Ijebu-Ode, since its inception several years ago. Ijebu-Ode Local Government has witnessed one reform or the other. Ijebu-Ode became the seat of the Ijebu Divisional Council when created as Ijebu Division. The advent of Military Administrative approach in Local Government reforms brought drastic change in 1973[1]. However, the 1973.reform put the Local Government on a sound footing and since then, it has been witnessing verging degree of change[2]. In 1991, Odogbolu Local Government was carved out of Ijebu- Ode Local Government and later Ijebu North-East in1996. Despite the creation of these two Local Government, Ijebu-Ode still remain a formidable council because of its leading roles among the Local Government in the Country today[3].

3.3 Sample and Sampling Techniques

A two-stage cluster sampling technique was used to select 400 pregnant women attending primary health care centres in Ijebu Ode for this study. At stage one, a

simple random sampling was used to select 10 Primary Health Care Centers out of the (16) public PHC facilities in Ijebu ode LGA. At stage 2, 40 pregnant women were selected using cluster sampling in the 10 health facilities earlier selected to make a total of 400 pregnant women as study respondents for this study

The study adopted Fisher's single proportion formula to determine the same size. The formula is as follows:

$$N = \frac{Z^2PQ}{d^2}$$

Where:

N signifies the estimated sample size

Z is the value of the standard normal distribution of 1.96 at the 95% confidence level

P is the prevalence of exposure to malaria infection in pregnancy reported for Nigeria (39%)[4].

E is the 0.05 level of significance (level of precision of 5%)

$$n = \frac{1.96^2 \times 0.39 \times 0.61)}{0.05^2}$$

$$n = \frac{3.8416 \times 0.39 \times 0.61}{0.0025}$$

$$n = \frac{0.9139}{0.0025}$$

n = 365.5

n= 366

n= 400

3.4 Description of the Research Instrument

The instrument for data collection used for this study was an interviewer administered questionnaire divided into four sections:

Section A: Sought information on demographic characteristics of the respondents: Section B: Focused on knowledge of malaria preventive measures among study respondents.

Section C: Extracted information on accessibility to malaria preventive measures among pregnant women.

Section D: Present questions on practice of malaria preventive measure: the last section will focus on factors influencing the practice of malaria preventive measures.

3.5 Validity and Reliability of the Research Instrument

The questionnaire for the study was adapted from previous studies

3.6 Method of Data Collection

The researcher approached the Medical Officer of Health in charge of the Local Government prior to the days chosen for data collection with an addressed letter from the Head of Department, Department of Public Health Lead City University. Following approval from the Medical Officer of Health, the researcher visited the primary health care facilities for the study with three trained research assistants. The researcher also obtained clinic-level approval from the health workers in

charge of the facilities in order to meet with potential study participants and administer the questionnaires.

3.7 Method of Data Analysis

Data entry and analysis were conducted using SPSS version 20. Demographic information about the respondents was described using descriptive statistical tools like frequency count and percentage. The relationship between the dependent variable and independent factors was determined using the Chi-Square test.

3.8 Ethical Approval

The faculty of public health at Lead City University issued a signed letter of introduction and a request for data collection permission, which was given to the Medical Officer of Health in charge of the health centers in the Ijebu ode local government area. These steps were taken to ensure the confidentiality of respondents in this study. Additionally, the researcher made sure that names or any other form of identification number were not included for data collection purposes. The Ministry of Health Ethical Approval Committee, in the state of Ogun, granted ethical approval.

Endnotes

[1] K. Oladimeji, J. Tsoka-Gwegweni, E. Ojewole & S. Yunga. "*Knowledge of Malaria Prevention among Pregnant Women and Non-Pregnant Mothers of Children Aged Under 5 Years in Ibadan, South West Nigeria*". **Malaria journal**, 18(1), 1-12.

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Chapter Four

Results and Discussion of Findings

This chapter presents analysis of data which is divided into two sections which includes the presentation of data and the objectives.

4.1 Demographic Data Analysis

The table below shows the percentage distribution of respondents according to their socio-demographic characteristics in Ijebu ode, Ogun state which reveals that for the variable "Age", 77 respondents (19.30%) are less than 20, 131 respondent (32.83%) are between 20 and 24 years of age, 117 respondents (29.32%) are between 25 and 29 years of age, 58 respondents (14.54%) are between 30 and 34 years of age and 16 respondent (4.01%) are between 35 years and above. It also reveals that 67 respondents (16.80%) had primary education, 86 (21.55%) had up to secondary education and 246 respondent (61.65%) had their level of education up to higher education. Likewise, 36 respondents (9.02%) are not married, 363 (90.98%) are married. It thereby reveals that 345 respondents (86.47%) are from nuclear family types, 54 (13.53%) are from polygamous family types.219 respondents (54.89%) are Christians and 180 respondents (45.1%) are not Christians. The table shows that 168 respondents (42.11%) indicated none, 201 respondents indicated once (50.4%) while 30 respondents (7.5%) indicated more than once. Also, 152 respondents (38.10%) live in the rural are while 247 (61.90%) live in an urban area. This reveals that 85 respondents (21.30%) have no children, 146 respondents (36.59%) have 1 child, 101 (25.31%) have two children, 67 respondents (16.79%) have 3 children and above. It is seen that 85 respondents (21.30%) indicated their family size is 3, 147 (36.84%) indicated 4, 99 (24.81%)

indicated 5 and 68 (17.05%) indicated 6 children. Data shows that 67 respondents (16.8%) are professionals/managers, 82 (20.6%) are clerical staffs, 174 (43.6%) do skilled manual jobs and 76 (19%) are unemployed

Table 4.1: Socio-demographic Characteristics of Respondents

Variable	Frequency	Percent
Age		
Less than 20	77	19.30
20-24	131	32.83
25-29	117	29.32
30-34	58	14.54
35 and above	16	4.01
Level of Education		
Primary	67	16.80
Secondary	86	21.55
Tertiary	246	61.65
Marital Status		
Living with a partner	363	91.0
Not living with a partner	36	9.0
Family Type		
Nuclear	345	86.5
Polygamous	54	13.5
Religion		
Christianity	219	54.9
Muslim	180	45.1
Number of Times Treating Malaria in the Last Two Months		
None	168	42.1
Once	201	50.4
More than once	30	7.5

Place of residence		
Rural	152	38.1
Urban	247	61.9
Number of Children		
None	85	21.3
One	146	36.6
Two	101	25.3
Three and Above	67	16.8
Family Size		
Three	85	21.30
Four	147	36.84
Five	99	24.81
Six	68	17.05
Occupation		
Professional	67	16.8
Clerical Job	82	20.6
Skilled Manual Jobs	174	43.6
Unemployed	76	19.0

Source: Researcher's Field Survey (2023)

4.2 Presentation of Result

4.2.1 Knowledge of Malaria

Table 4.2 reveals that 358 respondents (89.72%) indicated that sleeping under insecticide treated bed net can prevent malaria, while 41 (10.28%) indicated otherwise. The results reveals that 326 respondents (81.70%) said that spraying the house with mosquito repellants can prevent malaria while 73 (18.30%) said otherwise. 367 respondents (91.98%) also indicated that ensuring all rooms and doors in the house are screened with mosquito net can prevent malaria while 32 (8.02%) indicated otherwise. From the table, 344 respondents (86.22%) indicated that maintenance of no bushes or crevices around the home one stays through constant environmental cleaning can prevent malaria while 55 (13.78%) indicated otherwise. Likewise, 298 (74.69%) responded that reporting early enough to the clinic can prevent opportunistic malaria infections while 101 (25.31%) responded otherwise. It is seen that 238 (59.67%) said that painting and repainting of the walls of rooms in the house with mosquito repelling paint can prevent malaria while 161 (40.33%) said otherwise.

In addition, 329 respondents (82.46%) indicated that ensuring that drainage is covered always can prevent malaria while 70 respondents (17.54%) indicated otherwise. Likewise, 315 respondents (78.9%) said that not allowing stagnant water where mosquitoes can breed in and around the surroundings of the house by pouring kerosene or DDT to the water can prevent malaria while 84 (21.05%) disagreed

Table 4.2: Knowledge of Malaria Preventive Measures among Pregnant Women in Ijebu Ode, Ogun State

Variables	Correct	Incorrect
Sleeping under Insecticide Treated Bed Net can prevent malaria	89.7% [358]	10.3% [41]
Spraying the house with (Mosquito) Insecticide/Repellants can prevent malaria	81.7% [326]	18.3% [73]
Ensuring all rooms and doors in the house is screened with mosquito net can prevent malaria	92.0% [367]	8.0% [32]
Maintenance of no bushes or crevices around the home one stay through constant environmental cleaning can prevent malaria	86.2% [344]	13. 8 [55]
Reporting early enough to the clinic can prevent opportunistic malaria infections	74.7% [298]	25.3% [101]
Painting and repainting of the walls of rooms in the house with mosquito repelling paint can prevent malaria	59.7% [238]	40.3% [161]
Ensuring that drainage is covered always can prevent malaria	82.5% [329]	17.5% [70]
Not allowing open stagnant water where mosquitoes can breed in and around the surroundings of the house by pouring kerosene or DDT to the water can prevent malaria	78.9% [315]	21.1% [84]

Source: Researcher's Field Survey (2023)

Figure 4.1 below shows a chart illustrating the level of knowledge among pregnant women in Ijebu ode, Ogun state, explaining how 80.5% of the respondents total: 321 have good knowledge while 19.5% do not have total: 78. This actually depicts a high knowledge level of malaria preventive measures among the respondents.

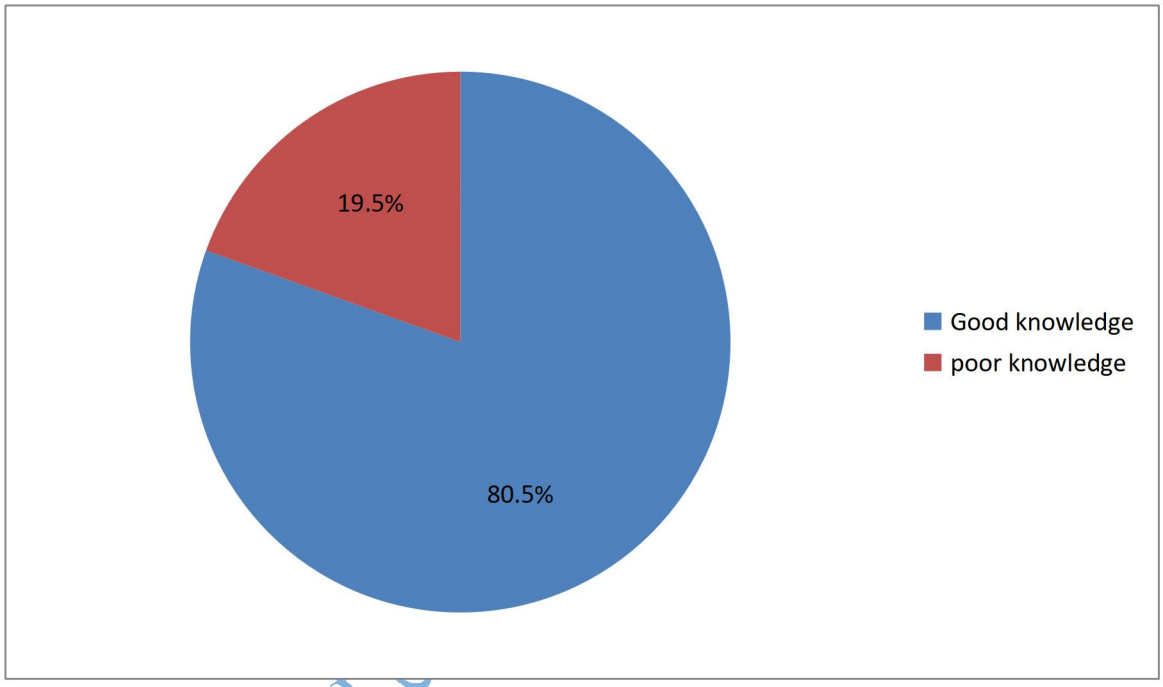

Figure 4.1: Level of Knowledge among Respondents

Source: Researcher's Field Survey (2023)

4.2.2 Accessibility of Malaria Preventive Measures

Table 4.3 shows the accessibility of respondents to malaria preventive measures in Ijebu ode, Ogun state. 285 respondents (71.43%) indicated they have access to getting a long lasting insecticide treated net, 114 (28.57%) indicated otherwise. The result shows that 242 respondents (60.65%) indicated they had access to getting a malaria prophylactic drug to prevent malaria, 157 (39.35%) indicated otherwise. Also, 223 (55.89%) indicated they had access to a neat and clean environment without bush or breeding places for mosquitoes while 176 (44.11%) said otherwise. 356 respondents (89.22%) said they had access to getting insecticide spray while 43 (10.78%) indicated they did not.

Likewise, 92 respondents (23.06%) indicated they painted their room/house with mosquito repelling paint while 307 (76.94%) indicated they didn't. Finally, 273 respondents (68.45%) indicated they had access to prompt treatment of opportunistic infection while 126 respondents (31.55%) indicated they did not.

Table 4.3: Accessibility to Malaria Preventive Measures

Variables	Accessible	Not Accessible
I have access to getting a long lasting insecticide treated net	285 (71.43%)	114 (28.57%)
I have access to getting a malaria prophylactic drug to prevent malaria	242 (60.65%)	157 (39.35%)
I have access to a neat and clean environment without bush or breeding places for mosquitoes	223 (55.89%)	176 (44.11%)
I have access to getting insecticide spray	356 (89.22%)	43 (10.78%)
Painted room/house with mosquito repelling paint	92 (23.06%)	307 (76.94%)
Prompt treatment of opportunistic infection	273 (68.45%)	126 (31.55%)

Source: Researcher's Field Survey (2023)

Figure 4.2 shows a chart illustrating the level of accessibility to malaria preventive measures among pregnant women in Ijebu ode, Ogun state, explaining how 61.7% of the respondents [total: 246] have good accessibility while 38.3% do not have [total: 153]. This shows an above average accessibility level of malaria preventive measures among the respondents.

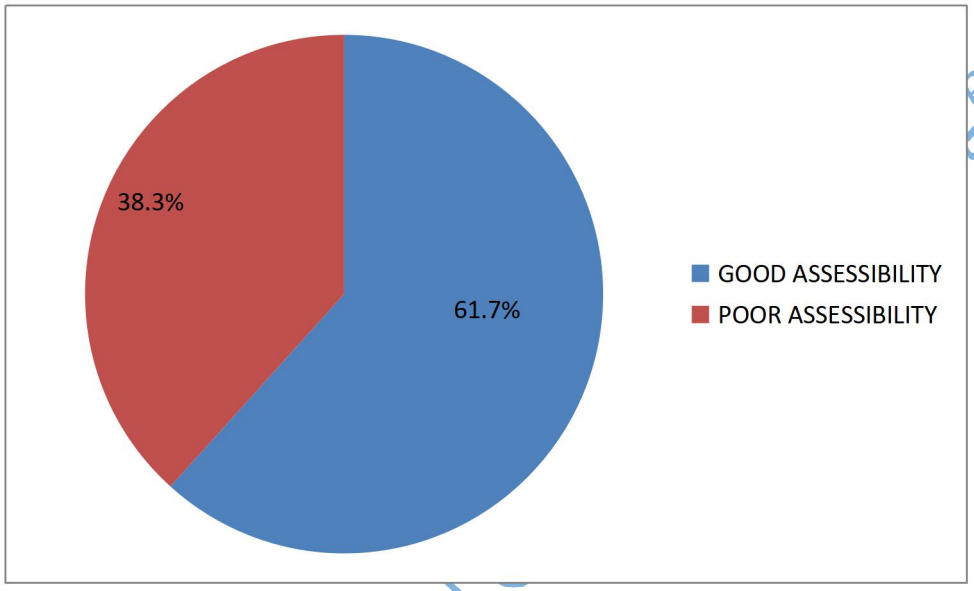

Figure 4.2: Level of Accessibility to Malaria Preventive Measures among the Respondents

Source: Researcher's Field Survey (2023)

4.2.3 Practice of Malaria Preventive Measures

Table 4.4 reveals the practice of malaria preventive measures among pregnant women in Ijebu ode, Ogun state. It shows that 111 respondents (27.82%) always slept under ITN and 288 respondents (72.18%) never slept under ITN. 110 respondents (27.6%) indicated they always stayed in a clean and non bushy environment and 289 (72.4%) indicated never. The table reveals that 199 (49.9%) said they always sprayed their room with insecticide, 200 respondents (50.1%) never did so.

Table 4.4: Practice of Malaria Preventive Measures

Variable	Always	Not always
I sleep under ITN	27.8% [111]	72.2% [288]
I stay in a clean and non-bushy environment	27.6% [110]	72.4% [289]
I spray my room with insecticide	49.9% [199]	50.1% [200]

Source: Researcher's Field Survey (2023)

Figure 4.3 depicts a chart illustrating the practice level among pregnant women in Ijebu ode, ogun state, unveiling how 62% of the respondents (total: 247) have poor practice while 38% have well (total: 152) practice. Unfortunately, this shows a relatively high level of poor practice on malaria prevention measures among the respondents.

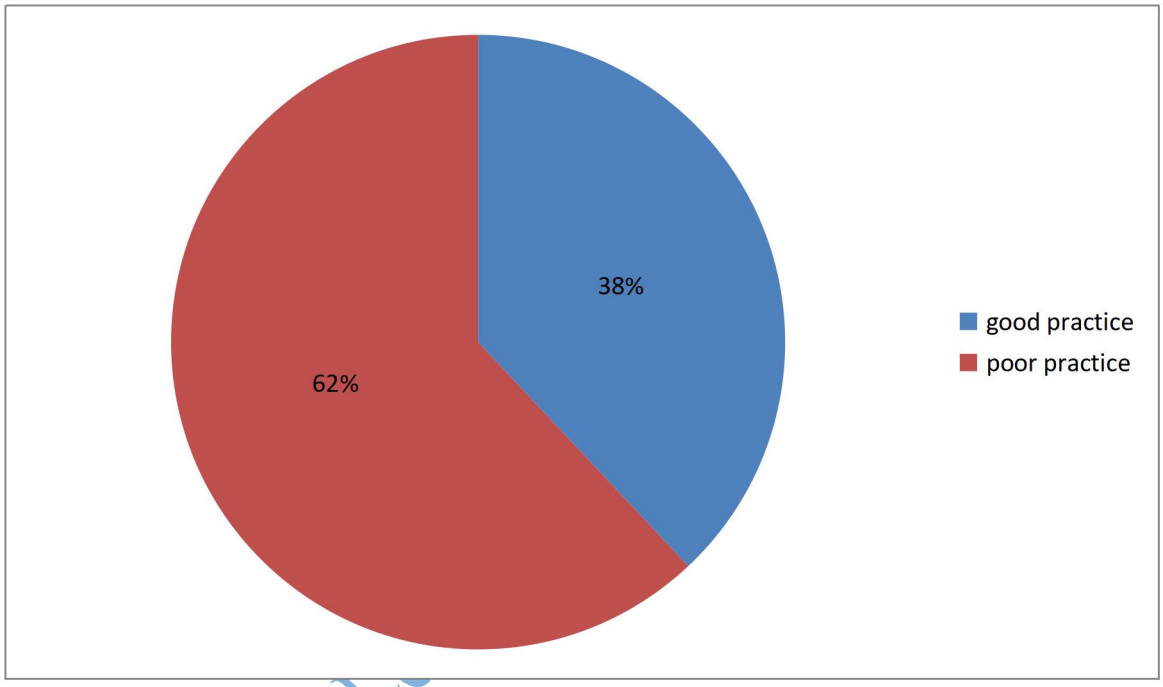

Figure 4.3: Level of Practice among Respondents

Source: Researcher's Field Survey (2023)

4.2.4 Association between Demographic Variables and Malaria Prevention Practice

Table 4.5 shows the association between selected socio-demographic characteristics and the practice of malaria preventive measures among pregnant women attending PHCs in Ijebu Ode, Ogun state. However, there are no significant association between the age of the respondents and their level of practice at a p-value 0.214. It also shows no significant association between the level of education of the respondents and their practice at a p-value 0.777. There is no significant association between the marital status of the respondents and their practice at a p-value 0.168. It also shows no significant association between the family type of the respondents and their practice at a p-value 0.687

Results from the table reveal no significant association between the religion of the respondents and their practice at a p-value 0.709. It also shows no significant association between the number of times the respondents have had malaria and their practice at a p-value 0.521. Likewise, no significant association is seen between the place of residence of the respondents and their practice at a p-value 0.640. It also shows no significant association between the family size of the respondents and their practice at a p-value 0.498. In addition, it shows no significant association between the number of children of the respondents and their practice at a p-value 0.443. Finally, it also shows no significant association between the occupation of the respondents and their practice at a p-value 0.274

Table 4.5: Association between Demographic Variables and Malaria Prevention Practice

Variable	Poor	Good	P-value	Chi square
Age			5.801	0.214
Less than 20	58(75.3%)	19(24.7%)		
20-24	95(72.5%)	36(27.5%)		
25-29	87(74.4%)	30(25.6%)		
30-34	46(79.3%)	12(20.7%)		
35 and above	8(50.0%)	8(50.0%)		
Level of Education			0.504	0.777
Primary	49(73.1%)	18(26.9%)		
Secondary	61(70.9%)	25(29.1%)		
Tertiary	184(74.8%)	62(25.2%)		
Marital Status			1.900	0.168
Living with a partner	264(72.7%)	99(27.3%)		
Not living with a partner	30(83.3%)	6(16.7%)		
Family Type			0.162	0.687
Nuclear	41(75.9%)	13(24.1%)		
Polygamous	253(73.3%)	92(26.7%)		
Religion			0.139	0.709
Christianity	163(74.4%)	56(25.6%)		
Muslim	131(72.8%)	49(27.2%)		
No. of Times Treating Malaria in the Last Two Months			0.469	0.521
None	121(82.0%)	47(28.0%)		
Once	150(74.6%)	51(24.5%)		

More than once	23(76.7%)	7(23.3%)		
Place of Residence			0.219	0.640
Rural	110(72.4%)	42(27.6%)		
Urban	184(74.5%)	63(25.5%)		
Number of Children			2.681	0.443
One	57(67.1%)	28(32.9%)		
Two	110(75.3%)	36(24.7%)		
Three	75(74.3%)	26(25.7%)		
More than three	52(77.6%)	15(22.4%)		
Family Size			2.379	0.498
One	59(69.4%)	26(30.6%)		
Two	106(72.1%)	41(27.9%)		
Three	78(78.8%)	21(21.2%)		
More than three	51(75.0%)	17(25.0%)		
Occupation			3.883	0.274
Professional	55(82.1%)	12(17.9%)		
Clerical job	56(68.3%)	26(31.7%)		
Skilled manual jobs	126(72.4%)	48(27.6%)		
Unemployed	57(75.0%)	19(25.0%)		

Source: Researcher's Field Survey (2023)

Figure 4.4 shows the accessibility and practice of respondents using LITN and insecticides. 71.43% of the respondents are accessible to LITN while only 27.8% practice its use. 89.22% of the respondents are accessible to insecticides while 49.9% practice its use. This shows a huge disparity between the accessibility to these preventive measures and the application or practice of these measures in their home.

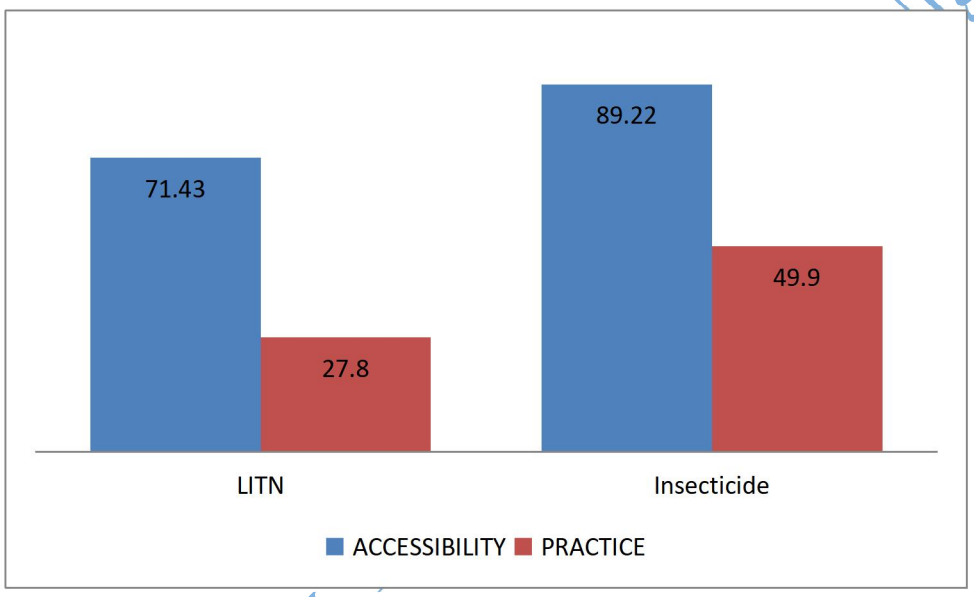

Figure 4.4: Accessibility and Practice of Respondents using LITN and Insecticides

Source: Researcher's Field Survey (2023)

4.2 Discussion of Findings

4.2.1 Background Data of Respondents

The Demographic data obtained from the field work of this study revealed that majority of the respondents, 32.83% are between 20 and 24 years of age, 61.65% had their level of education up to higher education, 90.98% are living with partner, 86.47% are from nuclear family types, 54.89% are Christians, 57.9% indicated once and more, 61.90% live in an urban area, 36.59% have 1 child, 36.84% indicated their family size was three and 43.6% said their occupation was skilled manual jobs. A study on the prevalence and risk factors associated with malaria infection among pregnant women in a semi-urban community of north-western Nigeria, results revealed that the average age of the participants was 26.1 ± 1.7 years (range:- 14 – 41)[5]. Over one- third (36.1%) had no education, whilst 25.0%, 21.6%, and 17.3% had primary, secondary and tertiary education, respectively. One hundred and forty-eight women used ITNs (58.0%), while 107 (42.0%) didn't use nets. Malaria prevalence was 41.6%. Age was not significantly associated with malaria prevalence (x 2 = 5.27, p = 0.153); the 14 – 20 age group had the highest prevalence (51.6%), as well as highest mean parasite density (800 parasitesμl^{-1} of blood).

4.2.2 Research Question One: What is the Knowledge of Malaria Preventive Measures among Pregnant Women?

Findings from this study revealed that 89.72% indicated that sleeping under insecticide treated bed net can prevent malaria, 81.70% said that spraying the house with mosquito repellants can prevent malaria, 91.98% indicated that ensuring all rooms and doors in the house are screened with mosquito net can prevent malaria, 86.22% indicated that maintenance of no bushes or crevices

around the home one stays through constant environmental cleaning can prevent malaria, 74.69% responded that reporting early enough to the clinic can prevent opportunistic malaria infections. 59.67% said that painting and repainting of the walls of rooms in the house with mosquito repelling paint can prevent malaria, 82.46% indicated that ensuring that drainage is covered always can prevent malaria, 78.95% of the respondents said that not allowing stagnant water where mosquitoes can breed in and around the surroundings of the house by pouring kerosene or DDT to the water can prevent malaria. We can summarily say that the respondents have a good knowledge of malaria preventive measures, this is in close agreement with Fuge, that shows that almost three-fourths, 295 (74.3%) of the respondents has good knowledge about malaria preventive measures[7].

It was revealed that less than half of respondents (42.3%) had good knowledge of malaria prevention. About 85%, 82%, and 75% knew that malaria could be prevented through keeping the environment clean, clearing of bushes around houses and use of ITN respectively. This is not so similar to our finding which sees that our respondents have 80.5% good knowledge on malaria[3].

Another similarity is seen in a 2019 study, on the knowledge of malaria prevention among pregnant women in Ibadan, South West Nigeria it was showed that there was a low proportion of respondents who were not aware of malaria, less than one-tenth among the pregnant women (7%) and even lower among non-pregnant mothers of children aged under 5 years (2.9%) and this was statistically significant, $p < 0.05$[1]. Almost half proportion of both the pregnant and the non-pregnant mothers of children aged under 5 years did not have knowledge on the breeding sites of mosquitoes (47.1% vs 49.7%, respectively), however this finding was not significant ($p > 0.05$). Majority of the participants had low knowledge of malaria

symptoms and was only able to identify a maximum of 2 or less symptoms of malaria (74% among pregnant mothers and 69% among non-pregnant mothers of children aged under 5 years), the difference in the proportion was on the edge of being statistically significant with $p = 0.051$. Across both maternal groups, about a third of the respondents reported insecticide treated nets (ITN) as common method of malaria prevention. Similarly, another one-third reported insecticide spray as common prevention methods for malaria. The proportion which reported the correct prevention knowledge for malaria to include ITN, environmental sanitation and chemotherapy such as artemisinin-based combination therapy (ACT), were 39.6% among the pregnant women and 54.2% among non-pregnant mothers of children aged under 5 years, $p < 0.001$[1].

Similarly, 128 (64.0%) respondents knew of insecticide-treated bed nets (ITNs), while 180 (90.0%) respondents said that using any type of bed net was the most common protective measure against malaria. Use of mosquito coils was the second most popular preventive technique, according to 79 respondents (37.8%). A total of 97 people (48.5%) and 58 people (29.0%) claimed to be aware of the methods for preventing mosquito breeding, including cleaning the area around the house and draining stagnant water. Most respondents to Fana's studies—129 (64.5%)—identified stagnant water as a mosquito breeding ground, and this finding is in line with the high awareness levels we saw in our study[5].

4.2.3 Research Question Two: Will Malaria Preventive Measures be Accessibility to Pregnant Women?

71.43% indicated they have access to getting a long lasting insecticide treated net, 60.65% indicated they had access to getting a malaria prophylactic drug to prevent malaria, 55.89% indicated they had access to a neat and clean environment without

bush or breeding places for mosquitoes, 89.22% said they had access to getting insecticide spray, 23.06% indicated they painted their room/house with mosquito repelling paint, 68.45% indicated they had access to prompt treatment of opportunistic infection. Majority of the respondents in this study have access to malaria preventive measures. Findings in this study are not in consonance with other study that show that 42.6% had insecticide-treated bed nets (re-treatable and long-lasting ITN) but was in consonance with another study that showed the proportion of households owning at least a net varied from 82.3 to 100%[2,6].

A study on surveillance and treatment of malaria cases among tribal communities is inadequate[8]. The study showed a number of barriers to malaria diagnosis due to inadequate active surveillance of fever cases by CHWs at the village level. This process is complicated by the rural nature of the villages, lack of transportation facilities for CHWs, isolation of villages secondary to flooding of roads during the monsoon, and non-availability of RDKs in some areas. In addition, the activity of Naxalite groups within the district often results in closure of roadways due to threats of violence. These groups also de-motivate NVBDCP staff from seeking employment in this region. There is also delay to smear results, as large distances between villages, lack of transport, and vacancies in the district contribute to create a long delay between blood smear collection and results communicated back to the village level.

It was revealed that two hundred and seven respondents (51.3%) owned at least a mosquito net while 196 (48.7%) did not have any[2]. Among those who had mosquito nets, 172 (42.6%) had insecticide-treated bed nets (re-treatable and long-lasting ITN) while the remaining 35 (8.7%) had ordinary nets. This is slightly close

to our 61.7% result gotten from the accessibility of mosquito nets among the total respondents.

4.2.4 Research Question Three: What is the Pattern of Practice of Malaria Preventive Measures?

27.82% always slept under ITN, 27.57% indicated they always stayed in a clean and non bushy environment, 49.87% said they always sprayed their room with insecticide, 33.58% said they always made sure their doors and windows were closed with screened net and 39.10% said they should make sure they use malaria prophylactic drugs. Findings from this study are in line with Nyavor that shows that almost all the use of ITNs was the most common means of malaria prevention at the household level and this method was used by 66.4% of the mothers/caregivers[10]. Other methods of malaria prevention mentioned were, cleaning of the environment (20.7%), use of herbal preparations (12.0%), mosquito coils (4.7%), and mosquito sprays (2.7%).

A study conducted along this topic showed that a majority of the women (97.4%) and over 80% of the women reported that sleeping under a mosquito net and sleeping under insecticide treated net respectively, are the best practices to prevent malaria[4]. Furthermore, a very low proportion of the women opined that: using insecticide sprays creams and lotions (6.1%), taking preventative medications (6.4%), insecticide coils (4.5%), and drinking plant juice/root (5.9%), coil smoke (4.9%) and covering the body (8.7%) were the best preventive measures. About one-fifth reported that keeping the surrounding clean is the best preventive measure. On the malaria prevention practices, out of 4,656 women, 20.4% reported not using any net at all and 77.9% reported using only insecticide treated nets for children during the night. Regarding the use anti-malarial drugs for febrile illnesses

during malaria, amodiaquine was the commonest one (21.6%) followed by fansidar, quinine and chloroquine. A majority of the women (84.7%) reported taking antimalarial drugs during pregnancy. No significant different was observed in these practices between urban and rural areas except for taking fansidar.

In comparison to Akaba showed that a total of 146 (56.4%) out of 259 non-primigravidae in this study used anti-malarial drugs in their last pregnancy toward preventing malaria in pregnancy[2]. Our findings are somewhat similar as only 39.1% made use of prophylactic drugs. However, there are no significant association between any of the socio-demographic characteristics and the practice of malaria preventive measures: among the respondents in our study.

It was revealed that practice of malaria prevention by respondents in secondary health facility in Calabar[9]. One hundred and thirty eight respondents (69%) practiced malaria prevention while 62(31%) respondents were not practicing malaria prevention strategies. This is very similar to the seen practice level among the respondents[10].

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Chapter five

Conclusion

This chapter presented the summary, conclusion, suggested areas for further research, contribution to knowledge and recommendations of the findings of the entire research project. It is presented under the following subheadings:

5.1 Summary of Findings

The Demographic data obtained from the field work of this study revealed that majority of the respondents, 32.83% are between 20 and 24 years of age, 61.65% had their level of education up to higher education, 90.98% are living with partner, 86.47% are from nuclear family types, 54.89% are Christians, 57.9% indicated once and more, 61.90% live in an urban area, 36.59% have 1 child, 36.84% indicated their family size was three and 43.6% said their occupation was skilled manual jobs.

Objective one sought to find out the knowledge of malaria preventive measures among pregnant women. Findings from this study revealed that 89.72% indicated that sleeping under insecticide treated bed net can prevent malaria, 81.70% said that spraying the house with mosquito repellants can prevent malaria, 91.98% indicated that ensuring all rooms and doors in the house are screened with mosquito net can prevent malaria, 86.22% indicated that maintenance of no bushes or crevices around the home one stays through constant environmental cleaning can prevent malaria, 74.69% responded that reporting early enough to the clinic can prevent opportunistic malaria infections. 59.67% said that painting and repainting of the walls of rooms in the house with mosquito repelling paint can prevent malaria, 82.46% indicated that ensuring that drainage is covered always can prevent malaria, 78.95% of the respondents said that not allowing stagnant

water where mosquitoes can breed in and around the surroundings of the house by pouring kerosene or DDT to the water can prevent malaria. We can summarily say that the respondents have a good knowledge of malaria preventive measures, this is in close agreement with Fuge, that shows that almost three-fourths, 295 (74.3%) of the respondents has good knowledge about malaria preventive measures.

It was revealed that less than half of respondents (42.3%) had good knowledge of malaria prevention. About 85%, 82%, and 75% knew that malaria could be prevented through keeping the environment clean, clearing of bushes around houses and use of ITN respectively. This is not so similar to our findings which see that our respondents have 80.5% good knowledge on malaria.

Similarly, 128 (64.0%) respondents knew of insecticide-treated bed nets (ITNs), while 180 (90.0%) respondents said that using any type of bed net was the most common protective measure against malaria. Use of mosquito coils was the second most popular preventive technique, according to 79 respondents (37.8%). A total of 97 people (48.5%) and 58 people (29.0%) claimed to be aware of the methods for preventing mosquito breeding, including cleaning the area around the house and draining stagnant water. Most respondents to Fana's studies—129 (64.5%)—identified stagnant water as a mosquito breeding ground. This result is consistent with the high levels of knowledge we discovered during our investigation.

Objective two sought to find out the accessibility to malaria preventive measures: 71.43% indicated they have access to getting a long lasting insecticide treated net, 60.65% indicated they had access to getting a malaria prophylactic drug to prevent malaria, 55.89% indicated they had access to a neat and clean environment without bush or breeding places for mosquitoes, 89.22% said they had access to getting

insecticide spray, 23.06% indicated they painted their room/house with mosquito repelling paint, 68.45% indicated they had access to prompt treatment of opportunistic infection. Majority of the respondents in this study have access to malaria preventive measures. Findings in this study are not in consonance with other study that show that 42.6% had insecticide-treated bed nets (re-treatable and long-lasting ITN) but was in consonance with another study that showed the proportion of households owning at least a net varied from 82.3 to 100%.

Majority (237) of respondents (51.3%) owned at least one mosquito net, while 196 (48.7%) did not. 35 (8.7%) of those who owned mosquito nets had regular nets, whereas 172 (42.6%) had insecticide-treated bed nets (re-treatable and long-lasting ITN). This is rather similar to our result of 61.7% for the availability of mosquito nets among all respondents. Objective three sought to find out the practice of malaria preventive measures: 27.82% always slept under ITN, 27.57% indicated they always stayed in a clean and non bushy environment, 49.87% said they always sprayed their room with insecticide, 33.58% said they always made sure their doors and windows were closed with screened net and 39.10% said they should make sure they use malaria prophylactic drugs. Findings from this study are in line with Nyavor that shows that almost all the use of ITNs was the most common means of malaria prevention at the household level and this method was used by 66.4% of the mothers/caregivers. Other methods of malaria prevention mentioned were, cleaning of the environment (20.7%), use of herbal preparations (12.0%), mosquito coils (4.7%), and mosquito sprays (2.7%).

In comparison to Akaba showed that a total of 146 (56.4%) out of 259 non-primigravidae in this study used anti-malarial drugs in their last pregnancy toward

preventing malaria in pregnancy. Our findings are somewhat similar as only 39.1% made use of prophylactic drugs.

However, there are no significant association between any of the socio-demographic characteristics and the practice of malaria preventive measures: among the respondents in our study.

It was revealed that practice of malaria prevention by respondents in secondary health facility in Calaba. One hundred and thirty eight respondents (69%) practiced malaria prevention while 62(31%) respondents were not practicing malaria prevention strategies. This is very similar to the seen practice level among the respondents.

5.2 Conclusion

This institutional-based cross-sectional study design was conducted to assess the Knowledge and practice of malaria preventive measures among pregnant women attending PHC centers in Ijebu Ode Ogun state. All pregnant women seeking antenatal treatment in the public primary health care facilities in Ijebu Ode Ogun state comprised the study population. All surveys were properly distributed and retrieved. Frequency counts and percentages were used to present the research questions of this study, while descriptive tools like bar charts and pie charts were used to present the demographic data of respondents. SPSS was used to analyze the data collected from the field work of this study. The three research questions posed for this study were addressed by the analysis. Based on the result data analyzed, it was concluded that pregnant women had a good knowledge of malaria preventive measures; majority had good access to malaria preventive measures. However, they do not good practice of malaria preventive measures as majority do

not sleep under ITN, stay in clean and non bushy environment, or use insecticides etc.

5.3 Recommendations

Considering the findings of this study the following recommendations were made:

1. Pregnant women attending ante natal care can be scheduled for compulsory evaluation classes on their knowledge of malaria preventive measure in a bid to further bolster their knowledge and promote their ability to emphasize malaria prevention methods practice on their own.
2. Free Insecticide Treated Nets which has been in place should be given continued and given priority especially to mothers of under five children in the clinic to promote the practice of malaria prevention and prevent complications that may occur as a result of malaria in pregnancy.

5.4 Contribution to Knowledge

The intention is to encourage family involvement in malaria prevention methods and serves as a form of education to the public. Also, the result carried out from this study will be published and can be used for further research.

5.5 Suggested Areas for Further Research

1. Effectiveness of malaria preventive measures

2. Malaria prevention and control strategies

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Appendix I

Informed Consent

Title of Study

Assessment of Knowledge and Practice of Malaria Preventive Measures among Pregnant Women in Ijebu-Ode, Ogun State.

Principal Investigator

Lasisi Sikirat Olufunmilayo

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Purpose of Study

My name is Sikirat Olufunmilayo LASISI, a Master of Public Health, Lead City University, Ibadan. I am conducting a study on the Assessment of Knowledge and Practice of Malaria Prevention Measures.

I am interested in assess the knowledge and practice of malaria preventive measures in Ijebu, weather women in Ijebu having knowledge and practice of Malaria Preventive Knowledge. I also want to know accessibility of malaria preventive measures and study, it assist me to understand the pattern of practice of Malaria Preventive.

Research Procedure

If you agree to be in this study, you will be asked to answer questions about yourself as well as questions about the knowledge practice of malaria preventive. These questions will be asked using structured questionnaires. To fill the questionnaires will take about 5 – 10 minutes of your time.

Risk and Benefits

There are minimum or no risk if you take part in this study. There is also no incentive but the information you provide will help you improve on your Health and that of your loved ones.

Compensation

There is no monitory compensation or incentive for this study. Participation is voluntary.

Confidentiality

Like it's stated above, your comments will not be anonymous. Every effort will be made by the researcher to preserve your confidentiality. Only the research team will have access to the answered questionnaire.

Confidentially and privacy will be maintained by keeping up materials under lock and key.

Your name will not be recorded.

Participant's Initials_____

Contact Information

If you have questions at anytime about this study or you experience adverse effect as the result of participating in this study, you may contact the researcher whose contact information is provided on the first page. If you have questions regarding your right as a research participant or if problem arise which do not feel you can discuss with the primary investigator, please contact the institutional review board of the Lead City University, Ibadan.

Consent

I have read and I understand the provided information and have had the opportunity to ask questions. I understand that my participation is voluntary and

that I am free to withdraw at anytime without giving a reason and without cost. I understand that I will be giving a copy of this consent form.

I voluntarily agree to take part in this study.

Participant's Initials_____

Participant's Signature _____ Date _____

Investigator's Signature: _____Date_____

Appendix II

Questionnaire

Faculty of Public Health, Lead City University, Ibadan.

Knowledge and Practice of Malaria Preventive Measures among Pregnant Women Attending PHC Centers Questionnaire

Dear Respondent,

I am a Postgraduate student of the above named department and school. I am conducting a study on Knowledge and practice of malaria preventive measures among pregnant women attending PHC centers in Ijebu Ode Ogun state. I humbly solicit for your consent and honest response in this questionnaire which is strictly for academic purpose, all information supplied will be treated with utmost confidentiality and you do not need to put your name on the instrument thank you.

Section A: Demographic Data

Instruction: Kindly tick (√) or fill in the space which best represent your response(s) to the questions

1. Age as at last birthday : ----------
2. Level of Education (a) No education ( ) b.) Primary ( ) (c) Secondary (d) Higher Education
3. Marital status: a.) Single () b.) Married ( ) (c) Widowed (d) Divorced (e) Separated ( )
4. Family type: (a) nuclear family ( ) (b) polygamous family ( )
5. Religion: a.) Christian ( ) b.)Islam ( ) c.)Traditionalist ( ) (d.) Others ()
6. How many time have you treated malaria in the last 2months -------
7. Place of residence: (a) Rural ( ) (b) Urban ( )
8. Number of children_____

9. Family size_____

10. Occupation: (a) Professional/Manager (b) Clerical Job (c) Sales & services (d) Skilled manual job (e) Agricultural (f) House wife (g) Student (h) Others

Section B: **Knowledge of Malaria Preventive Measures among Pregnant Women**

Pls. **(**√) Yes or No for the beneath questions

Knowledge of Malaria Preventive measures		**Yes**	**No**	**Do not know**
11	Sleeping under Insecticide Treated Bed Net can prevent malaria			
12	Spraying the house with (Mosquito) Insecticide/ Repellants can prevent malaria			
13	Ensuring all rooms and doors in the house is screened with mosquito net can prevent malaria			
14	Maintenance of no bushes or crevices around the home one stay through constant environmental cleaning can prevent malaria			
15	Reporting early enough to the clinic can prevent opportunistic malaria infections			
16	Painting and repainting of the walls of rooms in the house with mosquito repelling paint can prevent malaria			
17	Ensuring that drainage is covered always can prevent malaria			
18	Not allowing open stagnant water where mosquitoes can breed in and around the surroundings of the house by pouring kerosene or DDT to the water can prevent malaria			

Section C: **Accessibility to Malaria Preventive Measures**

Please read the under listed statements carefully and indicate by ticking under Available (A) Unavailable (U)

19	**Which of the beneath is accessible in attempt to prevent malaria**	**Accessible**	**Not Accessible**
20	I have access to getting a long lasting insecticide treated net		
21	I have access to getting a malaria prophylactic drug to prevent malaria		

22.	I have access to a neat and clean environment without bush or breeding places for mosquitoes		
23.	I have access to getting insecticide spray		
24.	Painted room/house with mosquito repelling paint		
25.	Prompt treatment of opportunistic infection		

Section D: **Practice of Malaria Preventive Measures**

Please read the under listed statements carefully and indicate by ticking as appropriate

		Always	**Sometimes**	**Never**
26.	I sleep under ITN			
27.	I stay in a clean and non bushy environment			
28.	I spray my room with insecticide			
29.	I make sure my doors and windows are closed with screened net			
30.	I make sure that I use malaria prophylactic drug			

Appendix III

IJEBU-ODE LOCAL GOVERNMENT
P.M.B. 2026, ITORO, IJEBU-ODE, OGUN STATE OF NIGERIA
Office of The Executive Chairman

Our Ref No IOLG.1451/T/26 — 27th Sept., 2022

Head, Department of Public Health,
Lead City University,
Ibadan.

RE: LASISI SIKIRAT OLUFUNMILAYO

This is to inform you that **MRS. LASISI SIKIRAT OLUFUNMILAYO,** a Post Graduate Student in the Faculty of Public Health conducted her research work at Ijebu Ode Local Government.

Thank you.

Balogun O.M. (Mrs.)
Principal Administrative Officer,
For: Executive Chairman

Sign..... Date.....

Bio-data

A. Personal Data

Name:	Sikirat Olufunmilayo Lasisi
Home Address:	No 8, Awoyelu Str, Ibadan Garage, Ijebu Ode
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Date of Birth and Place of Birth:	May 2nd, 1982, Ijebu Ode
Nationality:	Nigerian
Marital Status:	Married
Sex:	Female

B. Educational Background with Dates

Masters of Public Health 2021 – current

Lead City University, Ibadan, Oyo State

Diploma in Primary Health Care Tutor 2019 – 2020

University College Hospital, Ibadan, Oyo State

Higher Diploma in Community Health (CHO) 2014 – 2016

Lagos University Teaching Hospital, Lagos State

B.Sc Health Education 2006 – 2011

Tai Solarin University of Education, Ogun State

Diploma in Community Health ***(Abridgement Program)*** 2010

Ogun State College of Health Technology, Ilese – Ijebu

Certificate in Community Health 2001 – 2004

Ogun State College of Health Technology, Ilese – Ijebu

West African Senior Secondary School Certificate 2006

Idowa Comprehensive High School, Idowa, Ogun State

Secondary School Leaving Certificate 1993 – 1999

Ansar-ur-deen High School, Ijebu Ode, Ogun State

Primary School Leaving Certificate 1987 – 1993

Moslem Primary School, Eti – Itale, Ijebu Ode

C. Work Experience with Dates

Ogun State College of Health Technology Ilese 2006 – Till Date

Community Health Nurse

Folakemi Pharmacy Store New Road Ijebu Ode 2000 – 2002

Allison Patient Medicine Store 2004 – 2006

D. Referees

Dr. Arowolo, O.O

Former Deputy Provost

Ogun State College of Health Technology,

08039765498

Mrs Odunuga B.A

Dean School of Community Health

Ilese – Ijebu

08032803328

Signature **Date**

The University Compliance Certification

This is to certify that this thesis by Sikirat Olufunmilayo LASISI with the Matric No. LCU/PG/002257 in the Department of Public Health, Faculty of Basic Medical and Health Sciences, Lead City University, Ibadan is in full compliance with the approved university format.

Signature **Date**