KNOWLEDGE AND UTILISATION OF INSECTICIDE-TREATED NET IN THE PREVENTION OF MALARIA AMONG PREGNANT WOMEN ATTENDING ST. PHILOMENA'S CATHOLIC HOSPITAL

BY

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BMS1702182

DEPARTMENT OF NURSING

SCHOOL OF BASIC MEDICAL SCIENCES

COLLEGE OF MEDICAL SCIENCES

UNIVERSITY OF BENIN,

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EDO STATE.

IN PARTIAL FULFILLMENT OF THE RERQUIREMENT FOR THE

AWARD OF BACHELOR OF NURSING SCIENCE

SEPTEMBER, 2023

DECLARATION

This is to declare that this research project titled: "**KNOWLEDGE AND UTILISATION OF INSECTICIDE TREATED NET IN THE PREVENTION OF MALARIA AMONG PREGNANT WOMEN ATTENDING ST. PHILOMENA'S CATHOLIC HOSPITAL** will be carried out by OMORAGBON NAOMI OSAMAGBE and is solely the result of my work except where acknowledged as being derived from other persons or resources.

MATRICULATION NUMBER: _____

In the Department of Nursing, School of Basic Medical Sciences, College of Medical Sciences, University of Benin.

Signature: _____

Date: _____

CERTIFICATION

This is to certify that this research project by: **OMORAGBON NAOMI OSAMAGBE**

With the matriculation number: **BMS1702182** has been examined and approved for the award of a 'Bachelor of Nursing Science

_____ _____

Dr. (Mrs) J. A AFEMIKHE **Date**
(Project Supervisor)

_____ _____

DR(MRS)R.E. ESEWE **Date**
(HEAD OF DEPARTMENT)

ABSTRACT

Malaria continues to be a major public health and development issue. Pregnant women, their developing foetus, and new babies are all at increased risk of malaria infection, which is a serious public health issue. The most severe symptoms and results of malaria typically affect pregnant women; they include greater rates of miscarriage, intrauterine mortality, early delivery, low-birth-weight infants, and neonatal death. They are also more likely to experience severe anaemia and pass away during pregnancy. The aim of this study was to assess the knowledge and utilization of insecticide-treated nets in the prevention of malaria among pregnant women attending St. Philomena's Catholic Hospital, Benin City. A cross-sectional descriptive survey design was used for this study. The sample size was 262 pregnant women attending antenatal at St. Philomena's Catholic Hospital and a non-probability accidental sampling technique was used with a self-administered questionnaire. Pregnant women in this study were quite knowledgeable about malaria and its causes, prevention, and control. Pregnant women in the study could identify some symptoms and causes of malaria. Only a considerable number of pregnant women in the study had the insecticide-treated net while only a minimal number were making use of it. The primary source of the insecticide-treated net was the government, with the study being carried out at a privately-owned hospital being a potential reason for the rather low ownership of ITNs by pregnant women. There was a moderate level of knowledge of malaria and ITN among pregnant women. However, there was poor utilization of ITNs in the prevention of malaria among pregnant women. Barriers to the use of insecticide-treated nets ranged from a lack of awareness to insecticide-treated nets being uncomfortable to sleep under.

Key Words: *Malaria, Knowledge, Insecticide-treated nets, Prgenancy.*

DEDICATION

This research is specially dedicated to God almighty for his love, grace, and stronghold upon my life, family, and academics.

I am dedicating it to my loving and fabulous parents Mr. and Mrs. OMORAGBON who have been more than awesome in their love and support. I love you both dearly.

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CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND TO THE STUDY

Malaria has been a world health burden and a major public health problem in tropical and subtropical regions of the world. It affects an estimated 350 to 500 million people annually and accounts for 1 to 3 million deaths per year worldwide (Isah & Nwobodo, 2019; Agu et al., 2022). In its periodic health report, the World Health Organization (WHO) stated that more than 85% of the world's malaria cases (an estimated 0.93 million annually) are unreported (WHO, 2019). With 90% of cases and 92% of malaria deaths, Sub-Saharan Africa bears a disproportionate share of the global burden of malaria, making malaria a severe public health problem and a huge epidemiological burden for Africa. Igbasi & Oyibo, (2022) report that malaria is endemic in Nigeria with 97% in high malaria risk zones.

Further research suggests that Nigeria bears a major share (25%) of Africa's malaria burden, with an estimated 110 million clinically diagnosed cases and 110,000 malaria-related fatalities in 2015 (Eboreime et al., 2022). In addition, it is responsible for 60% of all outpatient visits and 30% of all hospital admissions (Ezire et al., 2018). It has

been estimated that malaria in pregnancy has a prevalence of about 48% in health facilities in Nigeria. This figure is likely an underestimation considering the fact that 40% of pregnant women in Nigeria do not attend health facilities for antenatal care (Latif et al., 2022). Furthermore, 70% of pregnant women in Nigeria suffer from malaria, thereby putting them at risk of negative pregnancy outcome (Abiodun & Ilori, 2022). Nigeria has one of the highest maternal mortality in the world with 814 maternal deaths per 100,000 live births and an estimated 58,000 maternal death with malaria in pregnancy being responsible for 33% (Onyeneho et al., 2019; Latif et al., 2022; Abiodun & Ilori, 2022; Ezire et al., 2018). Other major causes of maternal mortality in Nigeria include; Obstetrics hemorrhage, eclampsia, obstructed labour and complications from unsafe abortions. It is also responsible for 12-30% of under-five mortality thus making it one of the most serious public health problem in Nigeria.

Pregnant women, their developing foetus, and new babies are all at increased risk of malaria infection, which is a serious public health issue. The most severe symptoms and results of malaria typically affect pregnant women; they include greater rates of miscarriage, intrauterine mortality, early delivery, low-birth weight infants, and neonatal death. They are also more likely to experience severe anaemia and pass away during pregnancy (Ujuju et al., 2022). Pregnant women have attacks of malaria more often and more severely than non-pregnant women from the same area, and are more likely to die from malaria. This is because pregnancy reduces women's ability to fight malaria, especially during a woman's first pregnancy (U.S. Department of Health & Human Services, 2020). It is estimated that about 25 million pregnant women are currently at risk

for malaria according to the world health organisation of 2017. The illness has a record of over 10,000 maternal and 200,000 neonatal deaths per year (WHO, 2019). Insecticide-treated mosquito nets (ITNs) are a form of personal protection that repel and prevent mosquito bites that would cause malaria. Insecticide-treated nets (ITNs) are the most cost-effective method in the control of malaria, according to Konlan et al. (2022). Malaria prevention during pregnancy with ITNs is without a doubt one of the most important interventions for lowering mother and newborn morbidity and death rates and reaching the 4th, 5th, and 6th Millennium Development Goals (MDGs) (Tella et al., 2022). It has remained a highly effective and cost-effective technology in global and national malaria control strategies, and it is anticipated to be twice as effective as untreated nets (Yahaya, 2022).Additionally, it has been demonstrated that ITNs reduce malaria mortality in children under the age of five by 17%. An estimated $12 billion in lost output is attributed to malaria in Africa (Tella et al., 2022; Mwangu et al., 2022; Osarfo et al., 2022). Around the world, ITNs were used 70–73% of the time, with 85% in urban areas and 52%–77% in rural areas (WHO, 2019).

There was a substantial link between the use of ITNs and a reduction in stillbirths, improvements in baby birth weights, and a decrease in the prevalence of parasitaemia and anemia in pregnant women, according to Mwangu et al. (2022). In some cases, ITNs have been shown to have a communal protective impact as well as a reduction in total vector density. Furthermore, effective malaria prevention and treatment during pregnancy will reduce the number of pregnant women who require blood transfusions due to severe anaemia, lowering their risk of transfusion-related diseases including HIV and Hepatitis

B. (Osarfo et al., 2022). Furthermore, studies have shown that efficient malaria infection prevention with intermittent presumptive treatment and the use of ITNs reduces the risk of severe maternal anaemia by 38%, perinatal mortality by 27%, and low birth weight (a primary cause of infant mortality) by 45% (Onyeneho et al., 2019). It also lowers the chances of spontaneous abortion, premature birth, or a stillbirth (Latif et al., 2022). Pregnant women and their unborn children are an especially vulnerable population when it comes to malaria and its implications. As a result, a research to analyze the understanding and use of insecticide-treated nets in malaria prevention among these pregnant women would be beneficial (Elele & Anwuri, 2022).

1.2 STATEMENT OF THE PROBLEM

Malaria continues to be a major public health and development issue. The impact of malaria is felt not only in the health sector, but in every part of our social and economic lives as well. Malaria has remained a serious health problem in Sub-Saharan African countries despite efforts to combat the disease in the region (WHO, 2017). Eboreime et al. (2022) in their retrospective analysis of malaria cases reported between 2000 and 2020, report that 90% of malaria-related deaths occur in Sub-Saharan Africa.

Malaria during pregnancy is still a major problem in Nigeria. Malaria in pregnancy has been reported to be on the rise around the world, with Sub-Saharan Africa bearing the brunt of the disease's consequences (Ayedun & Bello, 2022). Rothschild & Haase (2022) in their report highlighted that malaria is three times more likely to be a serious disease in pregnancy than it is in non-pregnant women, with a death rate nearing 50%. In malaria-endemic parts of Sub-Saharan Africa, it is estimated that 25% of

pregnant women, especially primigravida, adolescents, and those with co-infections such as HIV, are at high risk of malaria and morbidity. According to Babalola et al. (2022), the largest risk of infection appears to be in the second trimester, highlighting the necessity for antepartum care as part of malaria prevention and treatment initiatives.

Although government organisations have increased their health education and awareness programmes, few pregnant women use insecticide-treated nets (Okumu et al., 2022). It is still necessary to address a potential knowledge and practise gap regarding the use of insecticide-treated nets to continue malaria control in pregnant women (Babalola et al., 2022). Majority of the world's efforts to control malaria are showing signs of change, with a focus on both community and individual participation. The introduction of health education has addressed individuals' knowledge, usage, and attitude gaps.

According to Antonio-Nkondjio et al. (2021), despite efforts to address the issue of malaria prevention based on knowledge and utilisation, a high preventive measure of 93% still exists, which is poorly reflected in terms of practise as 20%. This is because the majority of people in the study area have poor knowledge and utilisation of malaria prevention measures as Dirontsho et al., (2022) reports. In the area and other regions of the country where the same issue is present, pregnancy difficulties and even mortality could rise if sufficient attention is not given to the use of insecticide-treated nets. Positive action could promote the social and economic prosperity of communities.

1.3 AIM OF THE STUDY

The general objective of this study is to assess the knowledge and utilisation of insecticide treated net in the prevention of malaria among pregnant women attending St. Philomena's Catholic Hospital, Benin City.

Objectives of the Study

The specific objectives of the study are to;

- Assess the level of knowledge of prevention of malaria using ITN among pregnant women attending antenatal care at St. Philomena's Catholic Hospital.
- Determine the extent of the utilisation of ITN in the prevention of malaria among pregnant women attending antenatal care at St. Philomena's Catholic Hospital.
- Identify the barriers to the use of ITN in the prevention of malaria among pregnant women attending antenatal care at St. Philomena's Catholic Hospital.

1.4 SIGNIFICANCE OF THE STUDY

The findings of this study will be useful for researchers and health evaluators, as well as for health care facility management, Government and maternal and child health stakeholders; and Mothers of reproductive age and caregivers.

The findings of the study will assist the Ministry of Health in gathering additional information regarding ITN use, which will aid in allocating suitable resources to increase

ITN coverage and use. This will entail providing additional free ITNs to communities, particularly those most affected by malaria.

The ministry will also use the findings to strengthen information dissemination about malaria prevention through the use of ITNs. This could be accomplished by utilizing various mass media platforms, such as televisions, radios, and newspapers, to empower citizens' knowledge, attitudes, and practices on insecticide-treated net use in malaria prevention.

The findings of the study will aid policymakers in developing appropriate policies to enhance insecticide-treated net adoption. The findings will also assist health-care providers in assessing pregnant women's knowledge and habits about the usage of mosquito nets in the prevention of malaria and applying for the equired assistance. This could include counselling them on better ways to use ITNs, such as when to display the net, how to hang it, and when and how to withdraw, among other things. Members of the public who have access to the study's findings will be more aware of the knowledge and utilization gaps that impede them from efficiently using ITNs to prevent malaria. The findings will serve as a reference for other researchers, students, and others who may conduct comparable studies on ITN use and malaria prevention.

1.5 RESEARCH QUESTIONS

- What is the level of knowledge of prevention of malaria using ITN among pregnant women attending antenatal care at St. Philomena’s Catholic Hospital?
- What is the extent of the utilisation of ITN in the prevention of malaria among pregnant women attending antenatal care at St. Philomena’s Catholic Hospital?

- What are the barriers to the use of ITN in the prevention of malaria among pregnant women attending antenatal care at St. Philomena's Catholic Hospital?

1.6 SCOPE OF STUDY

The participants in this study are all pregnant women of reproductive age (18 years and 45 years) who are receiving antenatal care at St. Philomena's Catholic Hospital in Benin City, Edo State, regardless of their gestational age, place of residence, or level of education.

1.7 OPERATIONAL DEFINITION OF TERMS

Knowledge: the sum of what is known; the body of truth, information, and principles acquired by humankind i.e. the range of one's information or understanding.Level of knowledge is categorized as "good" (indicating a score above the average of correct responses), "fair" (an average score of correct responses) or "poor" (indicating a score below the average of correct responses).

Utilisation: to make use of: turn to practical use or account.the extent of utilization is categorized as "good" (indicating a score above the average of correct responses), "fair" (an average score of correct responses) or "poor" (indicating a score below the average of correct responses).

Insecticide-treated Net: is a net (usually a bed net), designed to repel mosquitoes physically, that has been treated with safe, residual insecticide for the purpose of killing and repelling mosquitoes, which carry malaria.

Malaria: an intermittent and remittent fever caused by a protozoan parasite which invades the red blood cells and is transmitted by mosquitoes in many tropical and subtropical regions.

Pregnant Women: a human biological female reproductive condition of having s living unborn child within her body throughout the entire embryonic and foetal stages of the unborn child from fertilization to full gestation and childbirth.

CHAPTER TWO

LITERATURE REVIEW

In this chapter, a cursory look at relevant research and literature in an attempt to aid understanding as it relates to the knowledge and utilization of ITNs among pregnant women and its implication.

2.1 CONCEPTUAL REVIEW

2.1.1 Concept of Malaria

Malaria is undoubtedly the most dangerous tropical disease in the world and one of the most critical and complex public health problems of the 21st century. According to the latest WHO estimates, 40% of the world's population lives in malaria-endemic areas, and

only a third of the 300 million infected people develop the clinical disease (WHO, 2019). "Mal'aria", which is Italian for "bad air", is the origin of the word malaria. Malaria was previously believed to originate in fetid wetlands (Mandell et al., 1995) due to the association between malaria infection and wetlands hence the name (Mehlhorn, 2022; Moita et al., 2022).

Five (5) distinct Plasmodium parasite species are answerable for malaria. *P. falciparum, P. vivax, P. ovale, P. malariae,* and *P. Knowlesi* are among the species (Tseha, 2021; Müller-Sienerth et al., 2020; Kayiba et al., 2021). The foremost dangerous strain of malaria, Plasmodium falciparum, is the one that's most current in several African nations (Snow et al., 2020; Müller-Sienerth et al., 2020). Infection with malaria is caused by the species Plasmodium falciparum in up to 98% of cases in an African country (Kayiba et al., 2021; FMOH, 2020). Humans contract the malaria parasites through the bite of feminine arthropod genus mosquitoes carrying the sickness whereas they feed their eggs by suction blood.

2.1.2 Life Cycle of Malaria

Malaria researchers commemorated the 100th anniversary of proving that the two-winged, feminine arthropod genus transmits malaria in 1998. The female anopheles mosquito is infected by the parasite, which then completes its organic life cycle. The female mosquito injects plasmodia sporozoites from its secretion gland throughout a blood meal (Mehlhorn, 2022). These minute motile organisms (sporozoites) circulate in the circulation for thirty minutes before settling inside the hepatocyte. Here, sporozoites

reproduce individually and go on to produce thousands of merozoites by a process known as intrahepatic or pre-erythrocytic schizogony (Moita et al., 2022).

The infection's blood stage eventually began when the enlarged liver cell ruptured, releasing sporozoans into the bloodstream. A portion of the intrahepatic sort of P. vivax and P. ovale infection doesn't divide in real time but instead lies latent for months before copying starts (Ya-Umphan, 2019). The cause for the relapse that distinguishes infection between these two species is these sleeping forms or hypnozoites. Every merozoite that enters the blood transforms into a sporozoan (ring form), which enlarges to create a schizont. This then explodes, releasing six to twenty-four female merozoites as progeny. Each of those merozoites can invade a fresh red cell and carry out the cycle (Perrin et al., 2021; Moita et al., 2022; Mehlhorn, 2022; Ya-Umphan, 2019).

This cycle keeps going until the infection is eliminated by the body's immune system, chemotherapy, or—as in some P. falciparum infection cases—until the patient passes away. In the case of *P. malariae*, synchronous rupture of the ring forms every 48 or 72 hours, which corresponds to the symptom paroxysm (Sinden & Gilles, 2021). Some trophozoites are transformed into anatomically separate sexual forms (gametocytes), which are long-lived and relatively inert, after a succession of such intra-erythrocytic (asexual) cycles. The gametocytes of a female arthropod genus of two-winged insects mature into male and female gametes and undergo the process of amphimixis within the biological system of the mosquito after ingesting erythrocytes from an infected human (Rocha, 2021). This cycle results in the exocrine gland of the mosquito producing sporozoites, which are contagious to humans. The cycle keeps going (Bettencourt, 2020).

2.1.3 Malaria and Pregnancy

30 million women become pregnant each year in malaria-endemic areas of Africa, and malaria poses a potential risk to them and their babies (Bukar et al., 2020). In addition, 200,000 infant deaths can be attributed to malaria during pregnancy (Henry et al., 2022). In malaria endemic countries, immunity against plasmodium falciparum can be achieved within the first 10 to 15 years of life (Griffin et al., 2021). However, pregnant women are at risk of contracting malaria because their immunity declines during malaria, putting them at risk for anaemia and other health problems, including even death (Bukar et al., 2020; Griffin et al., 2021). Women are more susceptible to malaria during their first and second pregnancies, and immunity can be achieved after multiple pregnancies (Bauserman et al., 2019).

In areas where malaria is not endemic, women have lower levels of immunity and are more likely to show symptoms during illness and are at greater risk of severe illness or death (Kurup et al., 2020). Malaria can double the risk of severe anaemia, triple the risk of preterm birth, and quadruple the risk of fetal growth retardation (Griffin et al., 2017). During the first pregnancy, malaria is reported in 16% to 63% of pregnant women and only 12% to 33% of previous pregnancies (Saito et al., 2021). Malaria can cause spontaneous abortion, stillbirth, preterm birth and low birth weight (Zango et al., 2021). Severe anaemia causes 10,000 deaths in pregnant women each year in Africa; malaria causes 3-15% anaemia, 8-14% low birth weight and 3-8% newborns mortality (Chersich et al., 2020). Other conditions like HIV can lower immunity in pregnant women, leading

to infections with more symptoms and an increased risk of side effects for both mother and baby (Chersich et al., 2020; Saito et al., 2021; Zango et al., 2021).

2.1.4 Pathophysiology of Malaria in Pregnancy

The pregnant woman's risk of contracting malaria is significantly increased by the physiological changes of pregnancy. This may be primarily due to the placenta, a novel organ with improved immunity and convenience. The most vulnerable women to malaria infection are those who are pregnant for the first or second time. There is compelling evidence that suggests a bilateral connection between the neuroendocrine system and the immune system, with a high level of corticoid inhibiting the immune system. The cell-mediated system is thought to be particularly important in the establishment and maintenance of immunity to malaria (Kurup et al., 2020; Bediako et al., 2022). Furthermore, natural killer cells are crucial for preserving pregnancy and play a significant role in the human immune system. There is a link between heightened susceptibility to infections and sporadic cytotoxic activity of the natural T lymphocyte, which is partially stored by endogenous glucocorticoids (Nobre et al., 2019; Maschmeyer et al., 2020).

Likewise, there is a connection between the level of serum cortisol and the suppression of malaria immunity throughout pregnancy, with the loss of immunity occurring during the second half of pregnancy at a time when plasma cortisol levels are elevated (Feeney, 2020). It is thought that the placenta, a distinct organ in pregnant women, either enables the parasite to evade the host's defences or promotes the spread of the plasmodium falciparum strain that is particular to the placenta.

Through the production of a specific variant surface antigen (VSA) with an affinity for proteoglycan-like chondroitin sulphate-A (CSA) (Tomlinson et al., 2021; Cheˆne, 2022), Plasmodium falciparum can invade the placenta.

The parity and previous placental infection are related to the cellular immune response to Plasmodium falciparum after pregnancy (Ataíde et al., 2022). Recent research has shown that multigravida can develop strain-independent antibodies against parasites that are specific for chondroitin sulphate-A, and that their parasite loads are significantly reduced (Umemmuo, 2020).

Protection is linked to anti-adhesion antibodies against CSA-binding parasites, and these antibodies grow throughout several pregnancies. The lack of immunological experience in the parasite subpopulation can be used to explain the particular sensitivity of primigravida to placental infection (Kim et al., 2021; Umemmuo, 2020). Recent studies have revealed that pregnant women are attractive to mosquitoes twice as much as non-pregnant women (Gonçalves et al., 2022).

2.1.5 Clinical Features

The clinical features of malaria infection during pregnancy depend largely on the immune status of the woman. For women who have long resided in areas with moderate to high malaria transmission, including much of sub-Saharan Africa, high levels of malaria immunity often have developed by the time they are old enough to get pregnant. Consequently, malaria infection is usually asymptomatic and severe illness is rare (Gutman et al., 2020).

During pregnancy, immunity to malaria is reduced. However, the infection remains often asymptomatic; so many people pass unsuspected and undetected. In pregnant women with little or no pre-existing immunity, such as women from endemic areas or travellers to malaria prone areas, the infection is at increased risk of severe illness and even death (maternal and perinatal death) (Pantoja et al., 2021; Bovay et al., 2020). These women are particularly at risk for haemolytic anaemia, cerebral malaria, and pulmonary oedema. Symptomatic patients may have a fever with chills and chills, headache, and muscle aches. Before this, fever may be erratic before developing in a synchronized time-related cycle of schizophrenia. Between paroxysmal chills and chills, patients usually feel well. Other nonspecific symptoms presented include; dry cough, abdominal pain, nausea, loss of appetite, and vomiting (Kapulu et al., 2021; Gutman et al., 2020).

2.1.6 Malaria complications during pregnancy

Anemia is a significant and frequent complication of *P. falciparum* malaria (Punnath et al., 2020). Although it can happen at any time throughout pregnancy, anaemia typically develops in 30–60% of those with blood parasites that last for 2 to 3 weeks (Cappellini et al., 2020). Malaria anemia is more common in African women who become pregnant several times earlier than in multi-pregnant women (Mwangi et al., 2021) and depends on the weight (Punnath et al., 2020). Anaemia, usually chromosomally normal, can result from erythropoietic dysplasia of varying severity and duration. Hemolysis is usually due to the direct destruction of red blood cells, splenic sequestration, DIC/fragmentation hemolysis, or autoimmune destruction (Iwafuchi, 2022). Other causes of anemia include

anemia due to chronic diseases and blood thinning (Vannier & Krause, 2020; Iwafuchi, 2022; Mwangi et al., 2021).

In response to the red blood cell disorder, the bone marrow becomes proliferative, further increasing the need for folic acid (Koury & Blanc, 2022; Iwafuchi, 2022; Kapulu et al., 2021). If this folic acid requirement is not met, the bone marrow becomes megaloblastic, leading to rapidly worsening anemia (Green & Mitra, 2022). If anemia is very severe (hematocrit < 15% or hemoglobin at 39C), exhaustion, acidosis and circulatory failure occurs (Taylor & Molyneux, 2021; Song, 2020). Malaria parasites increase the risk of preterm birth, which is further. Malaria during pregnancy can lead to low birth weight babies weight gain, a major cause of infant mortality (increased by the severity of the parasite and the number of malaria cases (Mahamar et al., 2021; Brabin et al., 2021).

2.1.7 Malaria Prevention - Use of insecticide treated net (ITN).

The World Health Organisation currently recommends a three-pronged approach to prevention of malaria in endemic areas viz;

- Intermittent preventive treatment (IPT) with antimalarial drug.
- Use of insecticide treated net (ITN).

During pregnancy in endemic areas, maternal protection against malaria is essential. Previously, the World Health Organisation recommended that pregnant women in malaria-endemic areas receive adequate antimalarial treatment when in contact with antenatal services, followed by weekly prophylaxis (World Health Organisation, 2019; Saito et al., 2021). The drug most commonly used for chemoprophylaxis is chloroquine, but Plasmodium falciparum's increasing resistance to this drug has significantly reduced

its effectiveness as a prophylactic agent. In northeastern Nigeria, the prevalence of drug resistance increased from 18.7% in 1988 to 24.4% in 1995 (Ibraheem et al., 2022). Pyrimethamine has been widely used but resistant strains of *P.falciparum* and *P.vivax* have limited its use, studies have shown that weekly pyrimethamine lacks prophylactic effect in some endemic areas of Nigeria (Agu et al., 2022). Intermittent sulfadoxine-pyrimethamine prophylaxis with a two-to-three-dose regimen once in the second trimester (after dose escalation) and once or twice in the third trimester is practiced in some countries in Africa (Ayedun & Bello, 2022). The use of IPT was effective in eliminating the malaria parasite and also reduced the risk while improving maternal hematocrit (Saito et al., 2021). IPT will reduce the frequency of clinical disease, but allow blood sorting between treatments, allowing for the development of parasite-specific immunity (Elele & Anwuri, 2022).

Sleeping under **insecticide-treated nets (ITN)** remains an important strategy for protecting pregnant women and their infants from malaria-carrying mosquitoes. This method has been practiced for 15 years (World Health Organization, 2017). A recent survey of endemic areas found that less than 10% of those who are at risk of malaria sleep under **ITN** (Chaccour et al., 2021). However, several insecticide-treated netting programs have claimed to have some impact on pregnancy outcomes, including a reduction in the rate of premature births in the primigravidae group (Fried & Duffy, 2020). Other general measures such as clearing bushes and standing water that are breeding grounds for mosquitoes are also recommended.

According to studies, if ITNs are used properly, serious pregnancy problems like anaemia, preterm birth, and infant mortality are reduced. In endemic regions of Africa, such as the aforementioned Nigeria, similar research on the effectiveness of ITNs in preventing malaria have shown that they offer about 80% protection against an attack. According to Najera et al. (2021) and Njoroge et al. (2019), if ITNs are extensively utilized in the neighbourhood, the density of the neighbourhood's mosquito population may decline, shortening the mosquitoes' ability to survive in the environment. The prospective result was a considerable decrease in mosquito populations and the risk of human host illness. As a result, the mosquito life cycle and disease transmission to human hosts are disrupted (Yukich, et al., 2019).

According to research, the widespread usage of ITNs in the community reduces the mosquito population density, protecting not only those who wear them but also those who do not. According to several studies, pregnant women who have experienced severe consequences from malaria infection either lack access to ITNs or do so but do not utilize them properly (Najera et al., 2021; Njoroge et al., 2022). The government and donor organizations have addressed these issues in order to expand accessibility for people who require ITNs, raise awareness of their significance, and promote ITN use and maintenance (Elele & Anwuri, 2022).

Insecticides used on ITNs have been found in studies to be very poisonous to insects, particularly mosquitoes, repelling or killing them even at low doses while also remaining active in the nets for six months (Yukich, et al., 2019 and Lengeler, 2019). When it is forcefully washed or exposed to sunshine, it loses some of its power. (Winch, et al.,

2020). When the bed net gets dirty, it is advised that one simply immerses it in a solution of insecticide and water, then lets it air dry in the shade. (Azondekon, et al., 2020; Hunter, et al., 2019; Yukich, et al., 2019).

Due to frequent washing of nets caused by a significant increase in dust in Africa, the nets quickly became infected (Winch, et al., 2020). Hunter, et al. (2019) proposed giving net users adequate instruction on net maintenance, cleaning, and repair. They made the case that worries about nets losing their effectiveness via washing could lead to extra infectious diseases brought on by dust buildup on the nets. If often washed, bed net users must treat their nets again every six to twelve months (Atieli, et al., 2020).

The majority of African countries have found it difficult to utilize mosquito nets since they must be often retreated. However, the WHO introduced the use of long-lasting insecticide treated nets (LLINs) to provide relief from regular and frequent washing and re-treating of nets (Iriemenam et al., 2020). They offer a durable remedy for lowering malaria incidence. These nets maintain efficient biological activity for at least three years of suggested usage in the field without re-treatment (Atieli, et al., 2020).

2.2 EMPIRICAL REVIEW

2.2.1 Knowledge of Insecticide Treated Nets

Malaria is preventable, curable, and easy to treat; however, the disease can be deadly when it occurs in pregnancy if not promptly managed (Ezeama & Ezeama, 2019). Pregnant women's knowledge about the health effects of malaria is important because with adequate knowledge, women can better understand the problems they face and can

improve their health better. Increasing knowledge is also important for the rational use of means of prevention (Kassim, 2021; Arnaldo et al., 2021).

Many studies have been carried out in Nigeria to assess the knowledge of pregnant women about the health effects of malaria. In a cross-sectional study in Ibadan, Nigeria, 37% of women had good knowledge about malaria during pregnancy (Awosolu et al., 2021). Knowledge that ITN prevents against malaria is the best predictive power on ITN ownership (Ankomah, et al., 2022). According to Akaba et al., (2019), malaria preventive health behaviors as well as knowledge about malaria and the treatment seeking behaviors among pregnant women have been found to be generally poor in the rural communities of Nigeria. These factors also posed as challenges in the Roll-back Malaria implementation in Nigeria (Akaba, et al., 2019). Akaba et al (2019) conducted a study to determine the knowledge about the prevention of malaria and the use of malaria preventive measures among pregnant women at an antenatal clinic.

Out of the 403 pregnant women studied, only 9 did not have any form of education. The study revealed that pregnant women book late for antenatal clinic. These late bookings prevent women from getting the maximum benefits of antenatal care which includes improving their knowledge on malaria preventive measures such as the utilization of ITNs in pregnancy and after child birth (Akaba, et al., 2019). Despite the late bookings, a large proportion of the study population was aware that malaria was preventable, with ITN being the most common preventive measure known (Akaba, et al., 2019). The educational level of the women may have played a role in the increased awareness (Akaba, et al., 2019). A study was conducted to assess the knowledge, attitude and

practice of malaria management among pregnant women attending antenatal clinics in southern Nigeria (Enato, Okhamafe, & Okpere, 2020). The study population included 875 pregnant women and a majority of them reported contracting malaria during pregnancy (Enato et al., 2019). Findings from the study revealed that knowledge of the consequences of malaria among the pregnant women studied was poor and this was likely to impair the utilization (Enato et al., 2019).

In a study conducted by Singh, Musa, Singh, & Ebere (2021), the participants had a good knowledge of malaria preventive measures but the knowledge did not translate into improved practice of preventive measures. An interview was conducted with a structured questionnaire administered to 200 randomly selected households. About 90% of the respondents reported any bed-nets as the most common protective method against malaria, while 64% of them had knowledge of ITNs. With the awareness of ITNs being 34 high among the respondents, only 31.9% of them were actually using it (Singh et al., 2014). Similar findings were obtained in a study conducted by Adebayo et al., 2015, where 69.4% of the study population had knowledge of ITN use. While some studies showed low knowledge of ITN use, other studies showed increased knowledge of ITN use. This creates a gap that this study addressed. Malaria contributes to low productivity, poverty, and reduced school attendance in Nigeria (MAPS, n.d.). In the effort to combat the burden of the disease on the country's economy, the Ministry of Health along with other partners are implementing control strategies that include the use of ITNs, prompt malaria case treatment, and intermittent preventive therapy (IPT) for pregnant women (MAPS, n.d.).

A cross sectional study conducted by Esse et al., 2008 showed that health seeking behaviors and preventive measures in malaria control can help reduce this burden. A survey was carried out on 476 households in Zatta and 110 households in Adibrobo. The results showed that effective and access to health care systems is important in the prevention and treatment of malaria (Esse et al., 2019). Lack of knowledge and preventive practices of the villagers, and the differences in management and control of malaria across villages are some of the factors that contributed to the malaria burden (Okech et al., 2019). Okech et al (2019) further confirmed the need to utilize malaria preventive measures, such as ITNs, which can be done by access to resources.

In another study from Ekiti State, Nigeria, assessing the knowledge of pregnant women during antenatal care visits, they found that knowledge about malaria was at a very good level (out of 1.0%), moderate (out of 78.9%) and poor (out of 20.1%) participants (Iriemenam et al., 2020). A study in Edo State, Nigeria found that 69% of pregnant women had good knowledge; however, 2.3% of women knew how malaria affects the fetus (Wagbatsoma et al., 2020).

Another study conducted in Edo, found that 89% of respondents knew that malaria bites causes malaria and 75% of them considered malaria a significant health risk when pregnant. They also assessed their knowledge of malaria and found that women had poor knowledge of the consequences of malaria, with an average score of 3.5 on a scale of 0 to 7, 59% of the participants scored between 3 and 4. They also concluded that women had a bad idea of how to prevent malaria with insecticide-treated bed nets and intermittent preventive therapy (Enato et al., 2021). These studies suggest that general knowledge

about malaria is moderate and knowledge about the consequences of malaria on maternal and fetal health is very low.

2.2.2 Utilisation of Insecticide Treated Nets

Marchie & Akerele (2022) provided further information on trends of malaria infection during pregnancy and the different prevention and treatment measures utilized by pregnant women. In a survey involving 755 pregnant women selected from a state government hospital and a mission hospital during clinic visits descriptive statistics were used. Majority of the women suffered from malaria in the first trimester (Marchie & Akerele, 2022). Results revealed that 29.2% used ordinary untreated net, 24% used insecticide, and only 25% of the women surveyed used ITNs while some of the women used combination of herbs for the treatment of malaria (Marchie & Akerele, 2022). The authors suggested that there was low use of the ITNs which contributed to the high prevalence of malaria among pregnant women. Findings of the study also revealed that the ITNs were costly and the women were not aware of the importance of early antenatal visits and ITN use for the prevention of malaria (Marchie & Akerele, 2022).

Another study conducted by Onabanjo and Nwokocha (2021), narrated the increase in maternal mortality in Africa particularly in rural and urban areas of the Ondo state in Nigeria where malaria among pregnant women was highly prevalent. The study discussed how the low use of ITNs among pregnant women contributed to the high prevalence of malaria. It also discussed other factors that contributed to the transmission, prevention, and treatment of malaria. Findings from this study suggested that the strategies to reduce the burden of malaria and maternal mortality must be based on the cultural changes at the

community level. In another study, the low use of ITN was associated with the belief that the ITNs do not provide good personal protection and disturb the sleeper from getting air (Sam-Wobo, Akinroboye, Anosike, & Adewale, 2019). Gaps identified in these studies included the need to improve the educational status of the women in the effort to improve malaria prevention through adult literacy programs.

In contrast to the Marchie & Akerele (2022) study findings described earlier, Adebayo, Akinyemi & Cadmus (2019) conducted a survey showing that 75% of the pregnant women used ITN (Adebayo et al., 2019). The inconsistencies in the percentage of use of ITN among pregnant women has been explored in this study. Treated bed nets with an insecticide are more protective against malaria than untreated nets. The insecticide does not only kill mosquitoes, it also kills other insects.

These treated nets repel mosquitoes, reducing the number that enters into the house. Thus, if a high use of the nets can be achieved within a community, the life span of the mosquitoes will shorten (CDC, 2021). A study by Hwang et al. (2019) addressed the effects of combinations of malaria control resources such as access to artemisinin combination therapy (ACT) and ITNs to reduce malaria morbidity and mortality. Findings from this study showed that only a small proportion of the women surveyed knew the cause, signs or symptoms, and preventive measures of malaria (Hwang et al., 2019). Furthermore, women belonging to the poorest wealth quintile, without formal education, and living in the rural regions had the lower levels of malaria knowledge (Hwang et al., 2007). Thus, the authors concluded that packaging effective messages that include the use of ITNs is essential for gaining increased use of ITNs (Hwang et al.,

2019). With malaria being highly endemic in Nigeria and its association with high maternal and childhood morbidity and mortality among pregnant women, the WHO launched the Roll Back Malaria (RBM) initiative in 1998. A major focus of this initiative was the prevention and management of malaria during pregnancy by using ITNs along other measures (Ezeama & Ezeama, 2019).

To ascertain the frequency of the use of ITNs among pregnant women, a study was conducted in an antenatal clinic in a tertiary health facility in Imo State Nigeria (Ezeama & Ezeama, 2019). A total of 201 women between 18 and 50 years of age were interviewed. Results of the study showed that about 75% of the women surveyed were aware that ITNs could prevent malaria in pregnancy, but less than 50% of these women were using ITNs. Furthermore, pregnancy studies from different African nations have demonstrated the efficacy of ITNs in malaria infection prevention and its benefits in pregnancy (Singh et al., 2018). Results of such studies showed a strong correlation between the use of ITNs and the reduction in stillbirths, improvements in birth weight of babies and a reduction in anaemia in pregnant women (Singh, et al., 2018).

Consistent use of ITNs among pregnant women has been shown in randomized controlled trials to produce favorable maternal and infant outcomes (Ankomah et al., 2022). Along with other evidence-based interventions, the country of Nigeria promotes ITN use in pregnancy. However, the level of ITN utilization remains low at rates below 10% (Ankomah, et al., 2012). The Akomah's study (2022) on ITN use by pregnant women in Osogbo southwest Nigeria showed low rate of ITN ownership with 29% of pregnant women reporting it (Ankomah, et al., 2022). Out of those who owned ITNs, only 25%

reported that they slept under the ITN; therefore, the ownership of ITNs does not translate to use (Ankomah, et al., 2022).

ITN utilizations rates in Nigeria among pregnant women increased from 1.3% in 2003 to 2.9% in 2006 (Ankomah, et al., 2022). By 2008, the utilization rate was below 10% which further confirms that ITN utilization has remained consistently low (Ankomah, et al., 2012). Pregnant women who perceived malaria to be harmful during pregnancy or who were aware of malaria risks were more likely to use ITNs. Registration at antenatal clinics ensured that pregnant women will own ITNs probably as a result of free or subsidized distribution of ITNs at these clinics (Ankomah, et al., 2022). However, it was found that among pregnant women who own ITNs, there was no significant difference in ITN use between pregnant women who registered for antenatal care (presumably obtained free bed-nets) compared with those who did not register. The study showed that ITN use was lagging behind ownership by a wide margin since access to ITN was not commensurate with ITN utilization in the study (Ankomah, et al., 2022). Only 25.7% of pregnant women who owned ITN used them (Ankomah, et al., 2022). Therefore; there was a wide gap between ITN ownership and ITN utilization that needs to be reduced in order to increase malaria prevention among pregnant women in rural Nigeria (Ankomah, et al., 2022).

Many studies have evaluated knowledge and use of ITNs separately; Very few studies have analyzed the link between knowledge and network usage. A recent study was conducted in the Nigerian capital Abuja and found that 43.7% of participants had good knowledge about malaria and its prevention, 12.9% had good knowledge, 14.9%

have average knowledge, 13.9% have good knowledge and 14.6% have poor knowledge. They also found that there was no statistically significant association between knowledge of malaria and ITN use. The reasons participants gave for not sleeping under the net included the warmth of the net and fear of suffocation, and many participants believed that the net was not effective in preventing malaria (Akaba et al., 2021; Chola, 2020; Aisiri et al., 2022).

Another study in Ekiti, Nigeria found that knowledge significantly affects the use of insecticide-treated nets and of the 69% of participants who knew about the use of nets, 95% of them agreed. Scores "good" on knowledge (Babalola et al., 2020; Aisiri et al., 2022; Ibrahim et al., 2021). Two studies analyzed the link between knowledge and Insecticide treated net usage, but their conclusions differed.

Insecticide Treated Nets reduce human contact by repelling or killing mosquitoes that land on them. ITNs help pregnant mothers by lowering low birth weight and maternal anaemia (Fondjo et al., 2020). According to WHO, pregnant women should begin using insecticide-treated nets as soon as possible. ITNs have been advocated as a tactic to reduce the negative impacts of malaria as studies have demonstrated their efficacy (Tizifa et al., 2022; Ruiz-Castillo et al., 2021).

Despite being the most efficient technique for preventing malaria in areas where it is endemic, insecticide-treated nets are underutilized and under-recommended. Only 12% of pregnant women used ITNs when the 2008 National Demographic and Health Survey (NDHS) of Nigeria were conducted to determine the prevalence of bed net use before the

survey day. The use of ITNs among pregnant women in Nigeria has been the subject of numerous further researches (Akaba et al., 2021; Yaya et al., 2018; Noguchi et al., 2020). In Ibadan, Nigeria, a cross-sectional study indicated that 82.4% of participants had heard of ITNs, 32.0% had never seen ITNs, 44.2% owned ITNs, and only 20.9% had a favourable attitude about using ITNs. Additionally, they discovered that the majority of expectant mothers lacked ITNs due to a lack of access to free distribution. ITN information was also provided to several of the participants by antenatal clinics (Aluko & Oluwatosin, 2019). Another study in the Nigerian state of Edo found that just 8% of the pregnant women who had ITN were actually using it, even though 9.3% of them had it. They also discovered that factors including the availability of nets, belief in the ITN's efficacy, level of education, and family size all led to the low use of bed nets (Wagbatsoma et al., 2020). A study that examined how ITNs were seen to be utilized in Imo State, Nigeria, found that their high cost, the assumption that the chemicals used to treat the nets were hazardous, and the absence of husband support were the main factors preventing their use (Chukwuocha et al., 2021).

2.2.3 Barriers to the Utilisation of Insecticide-Treated Nets

Despite the substantial efforts made to distribute ITNs, there are still several barriers that hinder their optimal utilization among pregnant women and the general population. One of the primary barriers to ITN use as highlighted by Yirsaw *et al.,* (2021) in their report is the lack of awareness and knowledge about malaria and the benefits of ITNs. Their study showed that in many malaria-endemic regions, communities may have limited understanding of the link between mosquito bites and malaria transmission. Consequently,

pregnant women may not perceive the necessity of ITN use and may not prioritize its adoption as a preventive measure.

Chuma *et al.,* (2020) as well as Hill *et al.,* (2019), in their studies also reported that the availability and accessibility of ITNs are critical factors influencing their utilization. They reported that in many low-income and rural areas, pregnant women often face challenges in accessing ITNs. Supply chain issues, limited distribution networks, and financial constraints can restrict the availability of ITNs. Additionally, even when ITNs are available, they may not be affordable for some pregnant women.

A study carried out by Sundararajan *et al.,* (2023) reported that most respondents (70%) claimed that ITNs were uncomfortable to sleep under due to factors such as heat, restricted movement, or the feeling of confinement. Asumah *et al.,* (2021) reports that this discomfort can deter pregnant women from using ITNs regularly as pregnant women, in particular, may experience physical discomfort more acutely, which could lead to reduced compliance with ITN use. Environmental factors, such as extreme heat or inadequate ventilation in sleeping spaces, can make it uncomfortable to use ITNs. This discomfort can discourage pregnant women from sleeping under ITNs consistently (Asumah *et al.,* 2021). Asumah *et al.,* (2021) also pointed out that in some cases, pregnant women may doubt the efficacy of ITNs, particularly if they have experienced malaria despite using them. This can lead to skepticism about the effectiveness of ITNs as a preventive measure and may result in reduced compliance. Concerns about the safety of ITNs, especially during pregnancy, can be a significant barrier. Some pregnant women and their families may worry about the potential health risks associated with exposure to

insecticides used in ITNs. Clear and accurate information about the safety of ITNs, particularly for pregnant women, is essential to address these concerns (Akaba *et al.,* 2023).

Cultural beliefs and behaviors can influence ITN use. In some communities, traditional practices and beliefs may conflict with the use of ITNs. Additionally, decision-making within households, where women may have limited autonomy, can affect the adoption of ITNs as pointed out by Mwangu *et al.,* (2022), in their study. They also reported that pregnant women who perceived themselves to be at low risk of contracting malaria may not prioritize ITN use. This perception can be influenced by factors such as the absence of recent malaria cases in the community or a belief that malaria is not a severe threat (Mwangu *et al.,* 2022).

Another barrier reported by Mwangu *et al.,* (2022) in their study is that lower levels of education are associated with lower ITN utilization. Women with limited formal education may have less knowledge about malaria prevention and may not fully understand the importance of ITNs (Mwangu *et al.,* 2022).

ITNs must be properly maintained to remain effective. Chukwuocha, *et al.,* (2020) reported that in some cases, ITNs may deteriorate quickly, reducing their efficacy and discouraging use. Proper usage instructions and maintenance guidance are critical for ITN effectiveness. Pregnant women may not receive clear, practical information on how to hang, care for, and repair ITNs when necessary. Insufficient guidance can lead to misuse or early wear and tear of ITNs, reducing their effectiveness and discouraging their use (Chukwuocha, *et al.,* 2020).

Accordinin g to Asumah *et al.,* (2021), regions with high levels of population mobility or nomadic communities, consistent ITN use can be challenging. Pregnant women who frequently move may not carry ITNs with them or may not have access to new nets in their new location, reducing their ability to use ITNs consistently.

The nightly ritual of setting up and taking down ITNs can disrupt the daily routines of pregnant women, especially those with multiple responsibilities such as caring for children or performing household chores. This inconvenience can lead to sporadic use or abandonment of ITNs. They also pointed out that financial constraints can prevent pregnant women from purchasing ITNs or investing in their maintenance. The cost of ITNs, even if subsidized, can still be a burden for households with limited resources. Economic considerations can deter some from using ITNs regularly (Asumah *et al.,* 2021).

2.3 THEORETICAL REVIEW

2.3.1 Health Belief Model (HBM)

This study is based on the Health Belief Model (HBM). HBM is a psychological model that attempts to define and predict health behaviors according to certain belief patterns. The theory was first put forward by Hochbaum, Rosenstock and Kegels, in the 1950s, who worked in the US public health service.

The Health Belief Model holds that health behavior is a function of an individual's socio-demographic characteristics, knowledge, and attitudes. HBM suggests that individual health behavioral threat perceptions are influenced by at least three factors,

- General health values, including health concerns and interests;
- Specific health beliefs about vulnerability to a particular health threat;
- Beliefs about the consequences of health problems (Hochbaum & Rosenstock, 1952).

Individuals will likely take action when experiencing a personal threat or risk, but only if the benefits of taking action outweigh the barriers, whether real or perceived. Being able to take action is also crucial. According to this model, a person must hold the following beliefs in order to change behaviour:

- **Perceived Susceptibility**

A person's subjective judgement of the likelihood of having a health issue is referred to as perceived susceptibility. A person must feel they are at risk for disease, illness, or unfavourable health consequences in order to take action. According to the Health Belief Model, people who believe they are prone to a certain health problem will act in a way that lowers their risk of having the condition.

Conversely, those with low perceived susceptibility may not believe they are at danger of getting a specific disease. Others may be aware of the possibility of developing the sickness, but they believe it is unlikely. Individuals that believe they have a minimal risk of sickness are more inclined to participate in risky and unhealthy behaviours. People are more inclined to engage in behaviours to lower their risk of developing a disorder if they believe there is a strong probability they will be exposed to it. Often, the perception of vulnerability is insufficient to alter behaviour.

- **Perceived Severity**

A person's subjective evaluation of the severity of a health issue and its potential effects is referred to as perceived severity. Medical outcomes, such as death or disability, or individual perceptions about how the illness might affect their life can also be used to determine severity. According to the Health Belief Model, people who consider a particular health issue to be significant are more likely to take action to prevent it from happening (or reduce its severity).

Beliefs about the disease itself are included in perceived seriousness (i.e. whether it is life-threatening or may cause disability or pain). People are more likely to act when the perceived severity and vulnerability are increased.

- **Perceived Benefits**

A person's perception of the worth and effectiveness of engaging in a behaviour that promotes their health to lower their risk of disease is referred to as perceived benefits. To change, a person needs to have the belief that the change will be beneficial. Regardless of the objective facts regarding the efficiency of the action, a person is likely to engage in that behaviour if they believe it will minimise their vulnerability to a health problem or lessen its severity. Even when an individual feels vulnerable, there are situations when the advantages of altering behaviour are not substantial enough to prompt a change. The apparent barriers may outweigh the alleged benefits.

- **Perceived Barriers**

The most important component in determining behaviour change is perceived barriers. The term "perceived barriers" refers to how a person perceives the challenges to behaviour change. Barriers may well be physical or abstract. Barriers may limit

participation in health-promoting behaviour even if a person considers a health state as severe and feels that a certain activity will effectively lower the threat. Therefore, for behaviour change to occur, the perceived benefits must outweigh the perceived barriers. Change won't happen if benefits outweigh barriers.

- **Cues to action**

According to the Health Belief Model, engaging in behaviours that promote health requires a cue or trigger. Both internal and external cues can prompt action. Internal signals to action are one example of psychological cues, such as discomfort and symptoms. Events or information coming from family members, the media, or healthcare professionals that encourage participation in health-related behaviours are examples of external cues.

- **Self-efficacy**

Self-efficacy is the term used to describe an individual's confidence and belief in their capacity to act or carry out a specific behaviour. People typically do not attempt to acquire new behaviours unless they have confidence in their ability to do so. A person who believes changing their behaviour would be beneficial (perceived benefit), but is sceptical of their abilities to make a change, is unlikely to try changing their way of life. Meaning that even if a person thinks changing to healthy behaviours will have a big impact, they are less likely to make the change if they have doubts about their ability to overcome the barriers. With support, training, and other encouragement, self-efficacy can be raised.

This theory (HBM theory) plays a key role in this research as it will aid in explaining the variables at play in the knowledge and utilisation of insecticide treated nets among pregnant women attending antenatal care services at Central Hospital, Benin City, Edo State. It will also help in assessing the level of knowledge and utilisation of Insecticide treated nets by these women.

2.3.2 Ecological Model

The study can be framed with the ecological model to help understand influences on health behavior of pregnant women in Nigeria. Specifically, the social ecological model (SEM) emphasizes the interaction between individuals and the environment (Glanz, Rimer, & Viswanath, 2008) and, in this case, how it influences the uptake of ITN among pregnant women. The model considers the individual, community, societal, and environmental contexts of behaviour and social change (Diala, Pennas, Marin, & Belay, 2019). The contexts of behaviour and social change are impacted by cultural norms, traditions, societal and religious beliefs, gender roles, institutional and environmental factors (Diala et al., 2019). SEM helps with examination of the exchanges or interactions among people within their social and physical settings, over time and across levels such as personal, familial, cultural and institutional (Panter-Brick, Clarke, Lomas, Pinder & Lindsay, 2018). The first of the multiple levels of influence is the intrapersonal level or individual level. This level analyzed the variables knowledge of ITN and education level of pregnant women as they relate to individual personality that can affect the use of ITN. Biological and personality characteristics of the pregnant women are shaped by their social and physical settings. These characteristics are related to the level of education

attained and the knowledge of ITN as it pertains to the use of ITNs. The 13 intrapersonal levels can be used to examine close relationships that may increase the risk of contracting malaria. With the intrapersonal level, emphasis is placed on the individual characteristics that influence behavior such as knowledge, attitudes, beliefs, and personality traits. Women do not act alone but are heavily influenced by their families and peers who contribute their range of experiences and practices towards malaria prevention among the pregnant women (Diala et al., 2019). SEM includes economic factors such as family income and women's willingness to follow advice of the provider (Diala et al., 2019) in the interpersonal level of the model. This level may include examination of close relationships of the pregnant women that may or may not increase the use of ITNs.

2.3.3 Health Care Utilization Model

The study was informed by the Health Care Utilization Model also referred to as the generic behavioural model. It established and examined factors that facilitate mosquito net utilization within households with children under five years. It was used to investigate intrahousehold practices, perceptions, knowledge, beliefs and attitudes of caregivers towards ITNs in preventing malaria among children under five years. Andersen's (1968) generic behavioural model is the most widely adopted and empirically assessed model of health service utilization.

In Andersen's original behavioural model, there are three major categories of health service utilization determinants. These include; predisposing factors, enabling factors and need factors. The category of predisposing characteristics was used to reflect the fact that

some individuals have a propensity to use services than other individuals. These characteristics include age, gender, occupation, ethnicity, religion, formal education, global health services and knowledge about the illness. The enabling factors reflect the fact that while the individual may be predisposed to use health services, he or she does not use them unless he or she is able. Enabling factors include; availability of services, financial resources to purchase services, health insurance and social network support. The need factors refer to the basic and direct stimulus for the use of health services. The individual must perceive some need for use of health services. This depends on perception of severity, total number of days in bed, days missed from work or school and help from outside for caring.

The concept of predisposing characteristics was used to assess the relationship between age, gender, occupation, income, education and the ability of households to use ITNs. Enabling factors investigated whether there were ITNs readily affordable, financial resources to purchase ITNs for all children under five years, capacity to have supportive facilities that enabled net hanging and net re-treatment. The concept of need factors was used investigate how individuals in the household perceive ITNs in preventing malaria and how it affected the household in case a child does not sleep in the ITN. This found out factors that influence the household into acquiring or using ITNs. The need to acquire a mosquito net was based on the fact that individuals hold a belief that buying or sleeping in a mosquito net one can avoid contraction of malaria.

2.4 APPLICATION OF THE THEORY TO THE STUDY

For a change to occur in health behaviour (in this case, for pregnant women to use insecticide treated nets to prevent malaria), HBM holds that a person must hold the following beliefs:

- Perceived susceptibility to a particular health problem, in this case malaria – whether the pregnant women are at risk of malaria.
- Perceived seriousness of the health condition - how severe is malaria in pregnant women? What are the social and health consequences of malaria?
- Belief in effectiveness of the new behaviour – whether insecticide treated nets are effective against malaria transmission.
- Cues to action - witnessing the death or illness of a relative due to malaria.
- Perceived benefits of preventive action - if using insecticide treated nets can prevent malaria infection in pregnant women.
- Barriers to taking action – impediments to using insecticide treated nets.

Therefore, the health belief model appears to be a landmark and powerful theoretical framework in social psychology capable of predicting and understanding health behaviour change, particularly where the individuals weigh the benefits against the perceived costs and barriers to change, to the extent that, the benefits outweigh costs. Although, there are numerous malaria studies in Nigeria where HBM has been used to understand and predict the use or non-use of insecticide treated nets in the prevention of malaria in pregnant women; this study attempts to add to the available pool of researches.

Within the context of the current study, perceived threat and severity of malaria to pregnant women is overwhelmingly acknowledged. Several studies show that a significant number of the pregnant women are of the opinion that malaria is a serious health problem and a major threat to pregnancy. One of the most important variables in the HBM is 'cues to action'. Apart from exposure to information through the mass media, witnessing the death of a relative due to a particular health problem (e.g. malaria) could promote positive health behaviour change (in this case the use of insecticide treated nets).

2.5 SUMMARY OF LITERATURE REVIEW

Malaria remains a public health threat globally (Akaba et al., 2019). It is important to increase efforts in addressing and reducing the transmission of malaria in developing countries, particularly among pregnant women (Akaba et al., 2019). In an effort to do so, there are malaria preventive measures that have been put in place to help alleviate the burden of malaria among pregnant women in Nigeria (Ankomah et al., 2022). Among several other malaria preventive measures, the utilization of ITNs has shown to be an important strategy for protecting pregnant women from contracting malaria; however, the uptake of such preventive measures is low (Ankomah et al., 2022). The review of the literature provided an overview of factors that may be linked to the knowledge and utilization of ITNs. The review of the literature analysed the different variables linked to ITN knowledge and use among pregnant women. This study intended to assess the

knowledge and utilisation of insecticide treated net in the prevention of malaria among pregnant women.

CHAPTER THREE

RESEARCH METHODOLOGY

This chapter explains in details the methods and procedures that were employed in this research. Methodology refers to ways of obtaining, organizing and analysing data. Also discussed in this chapter include background of Study area, Study Population, Research Design, Sample Size Determination, Data Collection Tools, Validity of the instrument, Data Collection Technique, Data Analysis and Ethical consideration.

3.1 RESEARCH DESIGN

A cross-sectional descriptive survey design which assesses the knowledge and utilisation of insecticide treated net in the prevention of malaria among pregnant women attending antenatal care at St. Philomena's Catholic Hospital, Benin City, Edo State was carried out.

The design was appropriate for this study as it describes objectively the actual situation under study.

3.2 STUDY SETTING

This study was carried out at St. Philomena's Catholic Hospital, Benin City. It is a privately-owned (managed and owned by the Catholic mission) hospital located in Oredo Local Government Area of Benin City, Edo State. St. Philomena's Catholic Hospital offers medical services as well as gynaecology, obstetrics, internal medicine, surgery, ophthalmology, dermatology and physiotherapy. These departments are overseen by a designated professional. It offers both outpatient and in-patient services.

3.3 STUDY POPULATION

The study was conducted among pregnant women attending Antenatal Care service at St. Philomena's Catholic Hospital, Benin City, Edo State during the study period. All pregnant women registered for antenatal care at St. Philomena's Catholic Hospital, Benin City within the study period will serve as the study population.

Month	November	December	January	February
Population	205	130	258	168
			TOTAL	**761**

3.3.1 Inclusion criteria

i. **Age** – Women between the ages of 18-49 years.

ii. **Registered:** Women who registered for Antenatal Care at St. Philomena's Catholic Hospital.

iii. **Interest:** Women interested in participating in the study.

3.3.2 Exclusion criteria

i. Women Below 18 years or above 49 years of age.

ii. Women not interested in participating in the study.

iii. Those who are mentally or physically ill.

3.4 SAMPLING TECHNIQUE

Non-probability accidental sampling technique was used for selecting a representative sample from the population. The target population as obtained from St. Philomena's Catholic Hospital, Benin City, Edo State. The sample size for this study was calculated using the Taro Yamane Formula as stated below:

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

Where:

N = Population

e = Margin of error

n = Sample size

$$n = \frac{761}{1 + 761 \times (0.05)^2}$$

$$n = \frac{761}{}$$

$$n = \frac{1 + 1.9025}{\frac{761}{2.9025}}$$

n = 262.188

Sample size = 262

3.5 INSTRUMENT FOR DATA COLLECTION

The instrument used for this study is a self-structured questionnaire based on the literatures reviewed and study objectives. The questionnaire was divided into socio-demographic section, knowledge on malaria, knowledge on ITNs and utilisation of ITNs. The instrument used for collection of data for this study was questionnaire containing 34 questions was used to elicit information on knowledge and utilisation of ITNs by pregnant women attending antenatal care. The questionnaire was including questions on the Socio-demographic data of participants, Knowledge of malaria among women attending antenatal care, Knowledge of ITNs among pregnant women attending antenatal care and Utilisation of ITNs among women attending antenatal care.

3.6 VALIDITY AND RELIABILITY OF THE INSTRUMENT

Face and content validity by an experienced statistician was used in the instrument's validity. This scrutiny was necessary in order to ensure that it measures what it is intended to. Comments and corrections made were used in updating the instrument and thus a final draft of the instrument was produced and administered. The reliability of the instrument will be established using a test re-test reliability technique.

3.7 METHOD OF DATA COLLECTION

The purpose of the study was explained to the respondents and questionnaire was administered to the respondents who will give their consent to participate. In other to ensure clarity and objectivity, explanations will be made about any item statement that may prove difficult for respondents understanding. Therefore, completed questionnaires will be retrieved immediately in order to minimize incidence of loss of instrument.

3.8 ETHICAL CONSIDERATION

Permission to undertake this study was obtained from the Department of Nursing Science, University of Benin, Benin City, Edo State. A written permission was obtained from the Ethics and Research Committee of the University of Benin. Informed consent will be sought and obtained from the participants in the study.

The ethical principles of research include certain requirements for the researcher: the research information given to the participants, voluntary and autonomous participation and the possibility to withdraw at any time they wish. The principle of voluntary participation, maintenance of anonymity and confidentiality was maintained throughout the study. The principle of maintenance of anonymity, confidentiality and voluntary participation was maintained throughout this study. The following ethical considerations was maintained throughout the duration of the research exercise.

Participants: All participants was duly interviewed and reassured of no risk attached for participating in the study. The purpose of this study was explained to the respondents to obtain their informed consent.

Voluntary participation: The right of the respondents to voluntarily decide whether to participate in the study or not, without the risk of incurring any penalty or prejudicial treatment was ensured. They was given the right to withdraw their participation at any point in time or refuse to provide any information on any point that is not clear to them.

Confidentiality: Information provided by respondents was treated with topmost and utmost confidentiality by the researcher. No name or address will be requested for, in the questionnaire.

3.9 METHOD OF DATA ANALYSIS

The data when obtained was analysed using the statistical package for social sciences (SPSS) software version 23. Descriptive statistics – measures of frequency and percentage (%) - was performed to summarize the demographic characteristics, knowledge and utilisation of insecticide treated net in the prevention of malaria. Hypothesis will be analysed and interpreted. The information was presented in form of tables, percentage, and mean statistical tools.

CHAPTER FOUR

RESULTS

This section presents results of the study which are presented in tables and summarized as frequencies and percentages.

4.1 SOCIO-DEMOGRAPHIC CHARACTERISTICS

Demographic characteristics		N = 262	
		Frequency (n)	Percentage (%)
Age	18-28 years	120	45.8%
	29-39 years	97	37%
	40-50 years	30	11.5%
	51 years and above	15	5.7%
Marital status	Not Married	54	20.6%
	Married	158	60.3%
	Widow	24	9.2%
	Divorced/Separated	26	9.9%
Highest Level of Education	Primary	38	14.5%
	Secondary	163	62.2%
	Tertiary	34	13%
	None	27	10.3%
Religion	Christianity	222	84.7%

	Islam	37	14.1%
	Traditional	2	0.8%
	Others	1	0.4%
Occupation	Trader	73	27.9%
	House wife	21	8%
	Civil Servant	31	11.8%
	Business	107	40.8%
	Others	30	11.5%

Table 4.1: Shows the Socio-Demographic characteristics of respondents

The study surveyed 262 pregnant women attending antenatal care at St. Philomena's Catholic Hospital, Benin City to illicit their knowledge and utilization of insecticide treated nets. The minimum age of the women was 21 years while the maximum age was 52 years. Majority of the pregnant women (45.8%) were in age group 18-28 years, 37% were in age group 29-39, 11.5% were in the age group 40-50 years, while 5.7% were in age group 51 years and above.

More than half of the pregnant women (84.7%) were Christians. Majority of the pregnant women (95%) reported having attended school before; of which they were of varying educational levels with secondary school being the highest level of education recorded (62.2%). More than half of the pregnant women (60.3%) were married while 20.6% were not married. Most of the pregnant women in the study were Business women (40.8%) and traders (27.9%), while 11.8% were Civil Servants. However, 11.5% reported other types of occupations.

4.2 KNOWLEDGE OF MALARIA AMONG PREGNANT WOMEN

		Frequency (n)	Percentage (%)
How did you come to know about malaria?	Home/Neighbours	22	8.4%
	Radio/TV/Newspapers	18	6.9%
	Hospital/ Health workers	108	41.3%
	I suffered from malaria	114	43.4%
Do you know the causes of malaria?	Yes	238	90.8%
	No	24	9.2%
What do you think causes malaria?	Cold	10	3.8%
	Virus	8	3.05%
	Bacteria	98	37.4%
	Protozoa/plasmodium	87	33.2%
	Witchcraft	-	-
	Others	30	11.5%
	Don`t know	29	11.1%
How is malaria transmitted?	By mosquito bite	260	99.2%
	By air	-	-
	By dirt water	-	-
	Others	-	-
	Don't know	2	0.8%
Do you know the signs and symptoms of malaria?	Yes	252	96.2%
	No	10	3.8%
What are the common symptoms of having malaria?	Fever	107	40.8%
	Painful joints	15	5.7%
	Sweating at night	2	0.8%
	Vomiting	-	-
	Stomach ache	-	-

	All the above	128	48.9%
	Don`t know	10	3.8%
Can malaria be prevented?	Yes	261	99.6%
	No	1	0.4%
Do you know ways to prevent and control malaria?	Yes	260	99.2%
	No	2	0.8%
The best way to protect against malaria?	Keep house clean	60	22.9%
	Insecticide treated nets	83	31.7%
	Drink clean water	-	-
	Avoid drinking dirty water	-	-
	Spray insecticide	52	19.8%
	Take medicine	65	24.8%
	Avoid exposure to the sun	-	-
	Others	-	-
	Don't know	2	0.8%

Table 4.2 shows the level of Knowledge of Malaria among pregnant women

Majority pregnant women in this study, 99.65% have heard of malaria. The source of which 114 (43.4%) have the knowledge of malaria having suffered from it, while the hospital, 23% accounts for most of the other sources of information about malaria. Majority of these women 90.8% knew the causes of malaria, while 9.2% did not.

Only some of these pregnant women 33.2%, could identify plasmodium as the cause of malaria. However, 99.2% were well aware of the fact that malaria was spread through mosquito bite. In spite of the fact that pregnant women mentioned more than one symptom of malaria, the most prevalent symptom of malaria was fever as reported by 40.8% of the respondents after being prompted. However, 3.8% of the pregnant women were unaware of common symptoms of having malaria.

Although 261 (99.6%) of the pregnant reported that malaria could be prevented, of which 99.2% said they knew how malaria could be prevented and controlled. Although many of

the women chose multiple ways to protect against malaria, the use of insecticide treated net, 31.7% was the most prevalent choice.

4.3 KNOWLEDGE OF INSECTICIDE TREATED NETS AMONG PREGNANT WOMEN

		Frequency (n)	Percentage (%)
Do you know about ITNs?	Yes	262	100%
	No	-	-
How did you get to know about ITNs?	Antenatal care centres	60	23%
	Health education	169	64.5%
	Radio/TV/Newspapers	20	7.6%
	Friends/colleagues/neighbours	10	3.8%
	Family	4	1.5%
Why do you think ITNs are important during pregnancy?	They reduce the contact between the pregnant woman and mosquitoes	190	72.5%
	They provide a house for the mosquitoes to stay in	-	-
	They drive away mosquitoes from the room	60	22.9%
	It is an instruction from the antenatal clinic that must be followed	12	4.6%
How long does ITN effectiveness last?	< 6 months	71	27%
	6 – 12 months	83	31.7%
	More than a year	24	9.3%
	3 years	12	4.6%
	< 5 years	1	0.4%
	Don't know	71	27%
What is done	Dry it in the shade	95	36.3%

before first usage of an ITN?	Dry it in the sun	110	42%
	Wash it	57	21.7%
Can ITNs be retreated?	Yes	145	55.4%
	No	52	19.8%
	Don't know	65	24.8%
When do you retreat the ITNs?	After washing once	36	13.7%
	After you have a mosquito bite despite sleeping in an ITN	60	22.9%
	After 3 to 5 years of usage	24	9.2%
	After washing 3 times	24	9.2%
	When it is dirty	36	13.7%
	Don't know	82	31.3%

Table 4.3 shows the level of Knowledge of Insecticide Treated Nets among pregnant women.

All the pregnant women in the study reported that they have heard of ITNs, with their primary source being via Health education, 64.5%, and Antenatal care centres, 23%. Only a small percentage of them reported their source was from the mass media, 7.6%. Most of the pregnant women were aware of the importance of ITNs to pregnant women as 72.5%, reported that it reduced the contact between the pregnant woman and mosquitoes. Some of the pregnant women reported that the ITNs had an effectiveness of 6-12 months (31.7%), while some others reported <6 months (27%). Only a few of them had other options, with 27% of them reporting that they did not know. Although many of the pregnant women, 55.4% reported that ITNs could be retreated, they had varying reports for when to retreat the ITNs, as only a few, 9.2%, reported after washing 3 times. The others reported when dirty,

13.7%, after washing once, 13.7%, after 3-5 years of usage, 9.3%, while the remaining women, 31.3%, reported lack of knowledge.

4.4 UTILISATION OF INSECTICIDE TREATED NETS AMONG PREGNANT WOMEN

		Frequency (n)	Percentage (%)
Do you own an ITN?	Yes	83	31.7%
	No	179	68.3%
If yes, for how long have you had bed nets?	Days	34	13%
	Weeks	34	13%
	Months	4	1.5%
	Years	11	4.2%
What was the source of the ITN?	Hospital	8	3.1%
	Purchased from shops	15	5.7%
	Government	30	11.5%
	NGO	4	1.5%
	Others	26	9.9%
Have you ever used an ITN?	Yes	167	63.7%
	No	95	36.3%
Do you currently sleep under an ITN?	Yes	36	13.7%
	No	226	86.3%
If No, what are your reasons?	Too costly	-	-
	Weather was hot / discomfort	62	27.4%
	Nothing to hang it in my room	-	-
	I don't know how to hang it	94	41.6%
	I feel caged	28	12.4%
	No reason	20	8.8%
	Other reasons	22	9.7%
How often do you use it?	Always	48	18.3%
	Very often	12	4.6%
	Sometimes	48	18.3%
	Rarely	60	22.9%

	Never	94	35.9%
If ITNs are readily available, would you consider using them daily?	Yes	95	36.3%
	No	48	18.3%
	Sometimes	119	45.4%
How did you place your ITN?	Hanging it over the windows and doors to prevent mosquitoes entering the room	4	4.8%
	Hanging it at one corner of the room	-	-
	Hanging it over the bed, but the net has contact with the skin while sleeping under it	22	26.5%
	Hanging it over the bed and sleeping under it after tucking it under the mattress, preventing contact with the body	57	68.7%
How often do you check for holes in your ITNs?	Always	26	31.3%
	Very often	8	9.6%
	Sometimes	4	4.8%
	Rarely	11	13.3%
	Never	34	41%
Have you been counselled about the use of ITN?	Yes	202	77.1%
	No	60	22.9%
Where did you get information about ITN?	Health centers	119	58.9%
	Church	9	4.5%
	TV/Radio	37	18.3%
	Family/friends	12	5.9%
	Others	25	12.4%

Table 4.4 shows the level of Insecticide Treated Nets Utilisation among pregnant women

Most of the pregnant women from this study, 68.3%, did not own ITN. Although some, 31.7%, reported they had, only 13% had it for days, while only 4.2% have had ITNs for years. The others reported having it for weeks, 13%, and months, 1.5%. Majority of those who owned ITNs reported that their source was from the government, 36.1%, some reported getting it from other sources, 31.3%, while only a few, 4.8%, reported getting it from NGOs.

Although most of the women, 63.7% reported to having ever used ITNs, only a few, 13.7%, were currently sleeping under an ITN. The others who were not currently sleeping under ITNs gave several reasons for that, with majority, 41.6% reporting they did not know how to hang the ITNs while the others reported the weather being hot/discomfort, 27.4%, and I feel caged, 12.4%, as a reason for their lack of usage. Although 9.7% had other reasons, 8.8% had no reason at all for their lack of usage.

Many of the pregnant women in this study who owned ITNs rarely used it, 22.9%, while only 18.3% reported to always using ITNs. However, majority of the women, 45.4% reported that they would sometimes use ITNs were made readily available. Majority of those who Owned and used ITNs, 68.7%, knew the correct way to hang them. As for inspection for holes in the ITNs, only 31.3% reported to always doing so. Majority, 41% never checked their ITNs for holes. A few, 4.8%, sometimes did, but the others 13.3%, rarely did. Majority of the pregnant women in this study, 77.1%, have been counselled about the use of ITN, with most, 58.9%, receiving such counsel from Health Centers.

4.5 BARRIERS TO THE USE OF INSECTICIDE-TREATED NETS

			Frequency (n)	Percentage (%)
1.	**Have you ever used an ITN for malaria prevention during pregnancy?**	Yes	167	63.7%
		No	95	36.3%
2.	**If you have used an ITN during pregnancy, what motivated you to use it?**	Healthcare provider's recommendation	90	34.4%
		Awareness of the benefits	30	11.5%
		Availability of ITNs	100	38.2%
		Fear of malaria	20	7.6%
		Family or community encouragement	32	12.2%
		Other	23	8.8%
3.	**If you have not used an ITN during pregnancy, please select the reasons for not using it.**	Lack of awareness about ITNs	30	11.5%
		Lack of access to ITNs	25	9.5%
		ITNs are uncomfortable to sleep under	60	22.9%
		Concerns about the safety of ITNs during pregnancy	25	9.5%
		The belief that malaria is not a serious threat	2	0.8%
		Other	5	1.9%
4.	**Are ITNs readily available in your area?**	Yes	200	76.3%
		No	62	23.7%

Table 4.5 shows the barriers to the use of Insecticide Treated Nets Utilisation among pregnant women

Many of the pregnant women in this study had used ITNs (63.7%), at one point during their pregnancy while only 36.3% reported not having ever used ITNs. 34.4% of the pregnant women in this study reported that their use of ITNs was a result of their Healthcare provider's recommendation. 11.5% of pregnant women used ITNs because of the awareness of the benefits ITNs provide.

38.2% of the pregnant women, however, reported the availability of ITNs, as a reason for its use. 12.2% and 7.6% of pregnant women however, pointed to encouragement from family members and the fear of malaria respectively as their reason for ITNs use. The remaining 8.8% had other reasons as motivation. . For those who had not used ITNs, Most of them, 22.9%, stated that ITNs were uncomfortable to sleep under, although 76.3% attested to the availability of ITNs in their area.

CHAPTER FIVE

DISCUSSION, SUMMARY AND CONCLUSION

5.1 DISCUSSION

5.1.1 Socio-demographics

In this study, 262 pregnant women with an average age of 25.8±5.9 years were surveyed to assess their knowledge and utilisation of insecticide treated nets. The median age of the pregnant women was 25 years and this falls within sexually active age group. The minimum age of the women was 21 years while the maximum age was 52 years. More than half of the pregnant women (84.7%) were Christians. This distribution is to be expected as majority of Residents are Christians as reported in the 2010 population census (National Bureau of Statistics, 2013). Majority of the pregnant women (95%) reported having attended school before; of which they were of varying educational levels with secondary school being the highest level of education recorded (62.2%). The educational level of respondents plays an important role in health behaviour choices and knowledge on health issues. Having majority of the pregnant women educated will aid in understanding the questionnaire and also provision of appropriate responses. More than half of the pregnant women (60.3%) were married while 20.6% were not married. This distribution agrees with religious and cultural beliefs of the study population. Society

frowns on individuals who become pregnant before getting married. Most people will only get pregnant after marriage. Most of the pregnant women in the study were Business women (40.8%) and traders (27.9%), while 11.8% were Civil Servants. However, 11.5% reported other types of occupations. The distribution of the pregnant women in this study is therefore a reflection of what pertains in the general population.

5.1.2 Level of knowledge of prevention of malaria using ITN among pregnant women attending antenatal care at St. Philomena's Catholic Hospital.

Good knowledge was defined as having 70% and above knowledge on the various aspects of malaria. A correct answer attracted 1 point and a wrong answer attracted 0. In this study, pregnant women showed good knowledge on malaria and its causes. This was supported by 99.65% of them reporting that they have heard of malaria. A look at the educational level of these women seems to be the source of this knowledge. The knowledge of malaria and its preventive measures in pregnancy was 65.8%.

This study further assessed the depth of pregnant women's knowledge on causes of malaria. Majority of the pregnant women correctly knew the causes of malaria. Only a few of the pregnant women did not know the causes of malaria. In spite of the fact that pregnant women mentioned more than one symptom of malaria, the most prevalent symptom of malaria was fever as reported by 40.8% of the respondents after being prompted. However, 3.8% of the pregnant women were unaware of common symptoms of having malaria. The pregnant women also mentioned most of the symptoms of malaria. However, the most predominant symptom was fever as reported by 40.8% of them. Pregnant women mentioned more than one symptom of malaria to emphasize their level

of knowledge on malaria. A small proportion of the pregnant women 3.8% could not mention any symptom of malaria.

According to Awosolu *et al.* (2021), about 165 respondents had good knowledge on malaria, 109 women had heard about intermittent preventive treatment, 7.3% scored very good on knowledge while 53 (48.6%) and 48 (44.1%) scored fair and poor of the 144 (68.9%) respondents who heard about insecticide treated nets 95 (66.0%) scored good on knowledge, while 49 (3 4.0%) scored poor. It was identified that factors that influenced knowledge about malaria were occupation, level of education, months at first appearance at antenatal clinic and transportation cost. Findings from this study also agree with that of Awosolu et al. (2021). The above findings seem to suggest that pregnant women in this study have good knowledge on malaria. This could mean that knowledge on a disease condition may impact the attitude of that person towards any intervention available to control, manage or treat such disease.

Finally, it influences the practice of such interventions by the respondent. In a related study on attitudes to malaria and traditional practices by Kassim (2021), five West African countries were visited to assess the knowledge on the cause of malaria and traditional ways of treating and preventing the infection. Knowledge was low in the five communities: Indigenes considered mosquitoes as a nuisance to it causing malaria. Various herbs were used as mosquito repellents; malaria was also treated by herbal remedies. ITNs were used to a varying extent from 44% in Ghana to 86% in Gambia by residents of each country to protect against mosquitoes' bites. They also used the ITNs

not only to protect them from mosquito bites but for other purposes such as privacy, decoration and protection from debris from the roof dropping on the bed.

5.1.3 Extent of the utilisation of ITN in the prevention of malaria among pregnant women attending antenatal care at St. Philomena's Catholic Hospital.

Majority of the pregnant women 68.3% do not own a mosquito net that can be used and only a few of them 55.7% have owned it for more than 3 months. Sharing of insecticide treated nets by government is common nationwide. The low proportion recorded here may be as a result of the fact that the study was carried out in a private health facility. It was therefore not surprising that only a few of the pregnant women 36% reported that they obtained theirs from the government. A few 5.7% and 1.5% obtained it from shops and NGOs. In contrast, Alukwo et al (2021), reports a relatively high ownership of ITNs (70%) of which majority of the women in his study reported to have gotten their ITNs from their Antenatal Care visits to the hospital. Koury & Blanc (2022) reported a high usage of ITN by the pregnant women in their study. However, findings from this study show a poor extent of ITN usage among the pregnant women. Only 13.7% slept under ITN as of the period of study, with not knowing how to hang the ITNs and Weather being hot/discomfort being the most prevalent reasons for lack of usage. However, findings from this study were in line with studies carried out by Iwafuchi, (2022) and Kapulu et al. (2021), who both recorded less frequent usage, inspection and proper placement of ITN by the pregnant women. This study showed that although majority (77.1%) of the women have been counselled about ITN use, most prevalently from Health Centers and

TV/Radio (58.9% and 18.3% respectively), the usage of ITN still remained low showing that the reasons for this poor usage was not for lack of proper information and counselling.

5.1.4 Barriers to the utilization of ITN in the prevention of malaria among pregnant women attending antenatal care at St. Philomena's Catholic Hospital.

The survey reveals that a majority of the respondents (63.7%) have used ITNs during pregnancy at one point or the other, indicating a relatively high level of awareness and adoption of this malaria prevention measure. This is a positive sign, suggesting that many pregnant women recognize the importance of ITNs in safeguarding their health and that of their unborn child. This is in line with a study done by Gikandi *et al.* (2020), who also reported a relatively high (70.5%) awareness level. Although, a survey by Awosan *et al.,* (2023), reports otherwise, where they recorded a low (40%) awareness level. Among those who used ITNs, the most significant motivation was the healthcare provider's recommendations (34.4%). This underscores the vital role of healthcare professionals in promoting ITN use during antenatal care. The availability of ITNs (38.2%) was another significant motivator, highlighting the importance of ensuring easy access to these nets. Family and community encouragement (12.2%) also played a role in motivating ITN use. Studies carried out by Ameh *et al.,* (2019) and Yirsaw *et al.,* (2021), also report similar motivations for the use of ITNs. For the 36.3% of respondents who did not use ITNs during pregnancy, various barriers were identified. Lack of awareness about ITNs (11.5%) remains a concern, indicating a need for improved health education and awareness campaigns. The discomfort associated with sleeping under ITNs (22.9%) emerged as a

substantial barrier, suggesting the importance of comfort in the design and use of ITNs. Concerns about the safety of ITNs during pregnancy (9.5%) should be addressed through clear and accurate information dissemination. It's noteworthy that a very small percentage (0.8%) believed that malaria was not a serious threat, indicating the general awareness of the risks associated with malaria. Tweneboah-Koduah *et al.,* (2022) in their study also reported that lack of awareness and discomfort as the main barriers t ITNs use. A positive aspect of the survey results is that a majority of respondents (76.3%) reported that ITNs are readily available in their area. This is a promising sign, as availability is a crucial factor in promoting ITN use.

5.2 LIMITATION OF THE STUDY

This study was limited by time frame, attitude of respondents towards filling the questionnaire and distance barrier.

5.3 IMPLICATION TO NURSING

The implication of this study to nursing are as follows:

- This study helps the nurse to determine the level of knowledge of malaria
- This study will enable nurses to design and implement simple easy to use guideline on how to educate and reform.
- It will also provide a point of discussion where pregnant women attend antenatal care based on malaria, its causes, control and preventive measures.

5.4 SUMMARY

The burden of malaria is a major health problem especially in sub-Saharan Africa, with Nigeria bears a major share of Africa's malaria burden. Pregnant women, their developing foetus, and new babies are all at increased risk of malaria infection, which is a serious public health issue. Sleeping under insecticide-treated nets (ITN) remains an important strategy for protecting pregnant women and their infants from malaria-carrying mosquitoes. This study assessed the knowledge and utilisation of insecticide treated nets among pregnant women attending antenatal care services at St. Philomena's Catholic Hospital, Benin City; while also assessing the level of knowledge of malaria, utilisation of ITNs and barriers to the use of ITNs. This study would significantly be useful to researchers, health evaluators, government and other stakeholders. The scope of the study was limited to St. Philomena's Catholic hospital and the pregnant women attending antenatal care. This study was based on Health Belief Model theory, Ecological model theory, Health care utilisation model theory. The study was set at St. Philomena's Catholic Hospital, Benin City, a privately-run hospital. A descriptive survey design was adopted in this study with a population size of 262 pregnant women. A self-structured questionnaire was used to get data from the respondents, after a test-retest method was used to ascertain validity. Thical considerations were put in mind and adequately adhered to. Descriptive statistics (frequency and percentage) were used to analyse the data obtained. The study showed that majority of the women were Christians, married and between the ages of 18 and 28 years of age. Majority of the women had at least a secondary school education, and were business women. There was moderate level of knowledge of malaria and ITN among the pregnant women. However, there was poor utilisation of ITNs in the prevention against malaria among the pregnant women.

5.5 CONCLUSION

This study sought to assess the level of knowledge and utilisation of insecticide treated nets among pregnant women. Pregnant women in this study were quite knowledgeable about malaria and its causes, prevention, and control. Pregnant women in the study could identify some symptoms and causes of malaria. Only a considerable number of pregnant women in the study were having the insecticide-treated net while only a minimal number were making use of it. The primary source of insecticide treated net was from the government, with the study being carried out at a privately-owned hospital being a potential reason for the rather low ownership of ITNs by the pregnant women. The major barriers to the use of ITNs are a lack of awareness and insecticide-treated nets being uncomfortable to sleep under.

5.6 RECOMMENDATIONS

- Pregnant women must be encouraged to attend Antenatal Care regularly and participate fully in its activities. This can be done through community engagement and educational talks. This will provide them with adequate information on various aspects of birth preparedness, safe delivery and knowledge on danger signs.
- Pregnant women must be encouraged to access insecticide treated nets and use them regularly to prevent malaria. Public health nurses can be asked to identify pregnant women in their communities and educate them on the benefits of ITNs.

- Educational talks at OPDs of ANC clinics must be intensified to help provide the needed information to expectant mothers. Such useful information helps expectant mothers to make informed decisions.
- The distribution of treated mosquito nets must be intensified and government must subsidize its cost or make it freely available to ensure that expectant mothers are not excluded based on cost.
- The use of mass media must be encouraged and widened so that those who do not come for ANC visits are covered and provided with the necessary information to help them make informed decisions.
- In view of the findings of this study educational talks should be organized at these centres.

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APPENDIX I

Questionnaire on the Knowledge and utilization of insecticide-treated net in the prevention of malaria among pregnant women attending Antenatal Care at St. Philomena's Catholic Hospital, Benin City.

Dear Respondent,

This Questionnaire is designed to assess the knowledge an d utilization of insecticide-treated net in the prevention of malaria among pregnant women attending antenatal care at St. Philomena's Catholic Hospital, Benin City. This is a research work, therefore your responses will not in any way influence how you are treated as an individual. I implore you to be honest in your responses because your confidentiality is guaranteed.

SOCIO-DEMOGRAPHICS

Age	18-28 ( ) 29-39 ( ) 40-50 ( ) 51 and above ( )
Marital status	Not Married ( ) Married ( ) Widow ( ) Divorced/Separated ( )
Highest Level of Education	Primary ( ) Secondary ( ) Tertiary ( ) None ( )
Religion	Christianity ( ) Islam ( ) Traditional ( ) Others ( )
Occupation	Trader ( ) House Wife ( ) Civil Servant ( ) Business ( ) Others ( )

KNOWLEDGE ON MALARIA

1.	**Do you know what malaria is?**	Yes	
		No	
2.	**How did you come to know about malaria?**	Home/Neighbours	
		Radio/TV/Newspapers	
		Hospital	
		Health workers [nurse, doctor, others]	
		I suffered from malaria	
3.	**Do you know the causes of malaria?**	Yes	
		No	
4.	**What do you think causes malaria?**	Cold	
		Virus	
		Bacteria	
		Protozoa/plasmodium	

		Witchcraft	
		Others	
		Don`t know	
5.	**How is malaria transmitted?**	By mosquito bite	
		By air	
		By dirt water	
		Others	
		Don't know	
6.	**Do you know the signs and symptoms of malaria infection?**	Yes	
		No	
7.	**What are the common symptoms of malaria?**	Fever	
		Painful joints	
		Sweating at night	
		Vomiting	
		Stomach ache	
		All the above	
		Don`t know	
8.	**Can malaria be prevented?**	Yes	
		No	
9.	**Do you know ways to prevent and control malaria?**	Yes	
		No	
10.	**The best way to protect against malaria?**	Keep house clean	
		Insecticide-treated nets	
		Drink clean water	
		Avoid drinking dirty water	
		Spray insecticide	
		Take medicine	
		Avoid exposure to the sun	

KNOWLEDGE ON ITNS

1.	**Do you know about ITNs?**	Yes	
		No	
2.	**How did you get to know about ITNs?**	Antenatal care centres	
		Health education	
		Mass media (radio/tv/newspapers)	
		Friends, colleagues and neighbours	
		Family	
3.	**Why do you think ITNs are important during pregnancy?**	They reduce the contact between the pregnant woman and mosquitoes.	
		They provide a house for the mosquitoes to stay in	
		They drive away mosquitoes from the room	
		It is an instruction from the antenatal clinic that must	

		be followed	
4.	**How long does ITN effectiveness last?**	< 6 months	
		6 – 12 months	
		More than a year	
		3 years	
		< 5 years	
5.	**What is done before first usage of an ITN?**	Dry it in the shade	
		Dry it in the sun	
		Wash it	
6.	**Can ITNs be retreated?**	Yes	
		No	
7.	**When do you retreat the ITNs?**	After washing once	
		After you have a mosquito bite despite sleeping in an ITN	
		After 3 to 5 years of usage	
		After washing 3 times	
		When it is dirty	

UTILISATION OF INSECTICIDE TREATED NETS

1.	**Do you own an ITN?**	Yes
		No
2.	**If yes, for how long have you had bed nets?**	Days
		Weeks
		Months
		Years
3.	**What was the source of the ITN?**	Hospital
		Purchased from shops
		Free community distribution by Government
		Free community distribution by NGO
		Others
4.	**Have you ever used an ITN?**	Yes
		No
5.	**Do you currently sleep under an ITN?**	Yes
		No
6.	**If No, what are your reasons?**	Too costly
		Weather was hot / discomfort
		Nothing to hang it in my room
		I don't know how to hang it
		I feel caged
		No reason
7.	**How often do you use it?**	Always
		Very often

		Sometimes
		Rarely
		Never
8.	**If ITNs are readily available, would you consider using them daily?**	Yes
		No
		Sometimes
9.	**How did you place your ITN?**	Hanging it over the windows and doors to prevent mosquitoes entering the room
		Hanging it at one corner of the room
		Hanging it over the bed, but the net has contact with the skin while sleeping under it
		Hanging it over the bed and sleeping under it after tucking it under the mattress, preventing contact with the body
10.	**How often do you check for holes in your ITNs?**	Always
		Very often
		Sometimes
		Rarely
		Never
11.	**Have you been counselled about the use of ITN?**	Yes
		No
12.	**Where did you get information about ITN?**	Health centers
		Church
		TV/Radio
		Family/friends

BARRIERS TO THE USE OF INSECTICIDE TREATED NETS

1.	**Have you ever used an ITN for malaria prevention during pregnancy?**	Yes	
		No	
		Don't Remember	
2.	**If you have used an ITN during pregnancy, what motivated you to use it?**	Healthcare provider's recommendation	
		Awareness of the benefits	
		Availability of ITNs	
		Fear of malaria	
		Family or community encouragement	
		Other	
3.	**If you have not used**	Lack of awareness about ITNs	

	an ITN during pregnancy, please select the reasons for not using it.	Lack of access to ITNs	
		ITNs are uncomfortable to sleep under	
		Concerns about the safety of ITNs during pregnancy	
		The belief that malaria is not a serious threat	
		Other	
4.	**Are ITNs readily available in your area?**	Yes	
		No	

Thank you for your time