ASSESSMENT OF KNOWLEDGE, ATTITUDE AND PRACTICE OF MALARIA PREVENTION STRATEGIES AMONG MOTHERS OF UNDER-FIVE CHILDREN IN NORTH CENTRAL ZONE, NIGERIA

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ZARIA, NIGERIA

MARCH, 2021

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P16EDPE9004 (BSc. M.Ed ABU)

A THESIS SUBMITTED TO THE SCHOOL OF POSTGRADUATE STUDIES

AHMADU BELLO UNIVERSITY IN PARTIAL FULFILLMENT OF THE

REQUIREMENTS FOR THE AWARD OF DOCTOR OF PHILOSOPHY IN

HEALTH EDUCATION

DEPARTMENT OF HUMAN KINETICS AND HEALTH EDUCATION,

FACULTY OF EDUCATION ,

AHMADU BELLO UNIVERSITY,

ZARIA, NIGERIA

MARCH, 2021

DECLARATION

I declare that the work in the thesis entitled, "**Assessment of the Knowledge, Attitude and Practice of Malaria Prevention Strategies among Mothers of Under-Five Children in North Central Zone, Nigeria**" has been carried out in the Department of Human Kinetics and Health Education under the supervision of Prof. U. Musa, Dr. B.M. Tukur and Prof. V. Dashe. All sources of information have been appropriately acknowledged in the text and written in the list of references. No part of this thesis was previously presented for another Degree at any University.

_____ _____

MUSA PAUL HANNATU **Date**

CERTIFICATION

This thesis entitled "**Assessment of the Knowledge, Attitude and Practice of Malaria Prevention Strategies among Mothers of Under-Five Children in North Central Zone, Nigeria**" meets the regulations governing the award of Ph.D degree in Health Education in Ahmadu Bello University, Zaria and is approved for its contribution to knowledge and literary presentation.

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DEDICATION

This research is dedicated to my Late father Mr. Musa Hai and my beloved mother Mrs. Hauwa Musa.

ACKNOWLEDGEMENTS

All thanks, praises and glory are due to the Almighty God, the omnipotent, omniscience, the Prince of Peace, to Him be all the glory. When it appeared all ways were blocked and the light of hope dwindled, then You proved Yourself again that You are her Father and there can never be anyone like You. All praises and thanksgiving be ascribed to You, for Your love, protection, provision, guidance and strength.

The researcher is grateful to her Supervisors; Prof. U. Musa, Dr. B.M. Tukur and Prof. V. Dashe for their guidance on the selection of the topic in line with the researcher's interest, their contributions to the research work, their encouragement gave a boost to the completion of this research. Her special thanks goes to Prof. C.E. Dikki, Dr. S.N. Akorede and Prof. M.A. Suleiman for ensuring that the research work is of quality. The researcher is particularly indebted to the Head of Department, Prof. (Mrs.) M.A. Suleiman and other lecturers in the Department Prof. (Mrs.) F.B. Adeyanju, Prof. J.A. Gwani, Prof. E.A. Gunen, Prof. C.E. Dikki, Prof. S.A. Shehu, Prof. T.N. Ogwu, Dr. A.A. Biu, Dr. B. W. Zamani, Dr .Y. Abdullahi, Dr. Bichi, Dr. S. Omeiza, Dr. H.A. Abdulfatah, Mallam S. Shuaibu and all other members of staff in the Department for their encouragement and contributions to the success of this research work.

The researcher, hereby, acknowledges the efforts of her research assistant Mr H. Longji and Dr. O. D. Nofiu for the much assistance during the course of the research work. Her appreciation also goes to her, friends, course mates, family members, siblings, quoted authors and others that she did not mention. The researcher appreciates you all and prays that the Almighty God will bless you and take control in your time of need, Amen. To God be the glory for the great things He has done.

ABSTRACT

This study was conducted to assess the knowledge, attitude and practice of malaria prevention strategies among mothers of under-five children in North Central Zone, Nigeria. To achieve this purpose, ex-post facto research design was used. A total sample of 768 mothers of under-five children in North-central zone, Nigeria from a population of 3,641,445 were selected through multi-stage sampling procedures of simple random sampling and proportionate sampling. The instrument used for the study was researcher's structured questionnaire which was pilot tested using Cronbach Alpha reliability test which was 0.833. Out of the 768 copies of questionnaire distributed, 765(99.6%) were valid for analyses. Inferential statistics of one sample t-test and Pearson Products Moment Correlation Coefficients were used to test the formulated hypotheses at 0.05 level of significance. The results revealed that Knowledge of malaria prevention strategies among mothers of under-five children in north-central zone, Nigeria was significant ($p = 0.001$), attitude towards malaria prevention strategies among mothers of under-five children in north-central zone, Nigeria was significant ($p = 0.000$), practice of malaria prevention strategies among mothers of under-five children in north-central zone, Nigeria was not significant ($p = 0.7$). Based on the results, the following conclusions were drawn, that mothers of under-five children have the knowledge of malaria prevention strategies. Also mothers of under-five children have positive attitude towards malaria prevention strategies in North-central zone of Nigeria. Mothers of under-five children do not practice of malaria prevention strategies in North-central zone Nigeria. Based on the conclusions, it was recommended that health educators should carry out awareness campaigns through rendering health talks which would help to further sustain the already existing knowledge of malaria prevention strategies among the mothers of under-five children in North-Central Zone, Nigeria. Health educators in collaboration with other non-governmental and governmental agencies should conduct sensitization campaigns (through mass media or community-based outreach) that would help to further sustain the existing attitudes of mothers of under-five children in North-Central, Nigeria. Health educators should conduct periodic symposia and conferences for mothers of under-five children and women of child-bearing age so as to educate the mothers which would help them to understand the need to apply their knowledge into healthful practices of malaria prevention.

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ABBREVIATIONS

ACT	-	Artemisinin-Based Combination Therapy
DDT	-	Dichlorodiphenyltrichloroethane
FBO	-	Faith-Based Organisations
FGN	-	Federal Government of Nigeria
HBM	-	Health Belief Model
HSR	-	Health Sector Reform
IPT	-	Intermittent Prevention Treatment
IRS	-	Indoor Residual Spraying
ITN	-	Insecticide-Treated Net
ITNs	-	Insecticide-treated mosquito
FMOH	-	Federal Ministry of Health
KAP	-	Knowledge, Attitude and Practice
LLIN	-	Long-Lasting Insecticide Nets
MDGs	-	Millennium Development Goals
MKAP	-	Malaria related Knowledge, attitude and practice
NDHS	-	Nigeria Demographic Health Survey
NGO	-	Non Governmental Organization
NMCP	-	National Malaria Control Programme
NMSP	-	National Malaria Strategic Plan
NNMCP	-	Nigerian National Malaria Control Programme
NPC	-	National Population Commission
RDT	-	Rapid Diagnostic Tests

RBM	-	Roll Back Malaria
SPSS	-	Statistical Package for Social Sciences
SSA	-	Sub-Saharan Africa
SCMs	-	Social Cognition Models
UN	-	United Nations
UNDP	-	United Nations Development Programme
UNICEF	-	United Nations Children's Fund
WHO	-	World Health Organization

OPERATIONAL DEFINITION OF TERMS

Knowledge: this is the general understanding mothers of under-five children who are respondents in this study have about malaria prevention strategies.

Knowledge of malaria prevention strategies: these are facts or experiences known by mothers of under-five children on the awareness, consciousness, or familiarity gained by experience about malaria prevention strategies.

Attitude towards malaria prevention strategies: is the feeling and opinion of mothers of under-five children towards malaria prevention strategies.

Practice: this is what mothers of under-five children do regularly to prevent their children being exposed to malaria fever.

Practice of malaria prevention strategies: is an action towards malaria prevention.

Malaria: is a disease that is transmitted by female anopheles mosquito bite.

Malaria Prevention strategies: activities and steps engages in by mothers of under-five children used in this study to prevent their children and themselves from contracting malaria fever.

Under-five children: children aged 0 - 59 months whose mothers served as respondents in this study.

Mothers of under-five children: nursing mothers of children aged 0 – 59 months who are participants in this study.

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Malaria has continued to be a leading cause of mortality particularly among under-five year's children and pregnant women in tropical African countries. The estimate showed that 3.3 billion people were at risk of contracting the disease worldwide (World Health Organization, WHO, 2010; Ahmed, Haque, Haque, & Hoissan, 2009). In Africa, malaria is known to be a disease of the poor and severe cause of poverty (Roscoe, 2012). This was revealed in a recent economic analysis of 150 countries where 44 countries with intensive malaria transmission grew 1.3 per cent less per year than countries without high levels of malaria. The study further revealed that a 10 per cent reduction in malaria was associated with 0.3 per cent higher economic growth. Thus, malaria reduces a country's productivity through loss of investment and reduced income from tourism (Gallup & Sachs, 2011; Guyatt & Snow, 2004).

In Nigeria, malaria is responsible for around 60% of the out-patient visits to health facilities, 30% of childhood death, 25% of death in children under one year and 11% of maternal deaths (Noland et al., 2014). Similarly, about 70% of pregnant women suffered from malaria, which contributes to maternal anaemia, low birth weight, stillbirths, abortions and other pregnancy-related complications (Federal Ministry of Health Abuja, 2015). The financial loss due to malaria is estimated to be about 132 billion Naira annually in form of treatment costs, prevention costs and loss of man-hours (World Health Organization, 2012).

Malaria, a debilitating febrile and life-threatening illness, is caused by a parasite called Plasmodium. Its route of transmission still remains as bites from infected female anopheles mosquitoes. Environmental factors and behavioural patterns of vectors and

human populations combine to provide favourable conditions for malaria transmission (Boutin, 2015). Proven effective options to reduce morbidity and mortality include early diagnosis, combined with prompt effective therapy and malaria prevention through reduction of human-vector contact, especially with the use of Insecticide Treated Nets (ITNs) (World Health Organization, 2007). Perceptions about malaria illness, particularly households' perceived susceptibility and beliefs about the seriousness of the disease, are important preceding factors for decision-making concerning prevention and curative actions (Radey, 2011). The understanding of the possible causes, modes of transmission, and individual preference and decision-making about the adoption of prevention and control measures vary from community to community and among individual households. There have been a considerable number of reports about knowledge, attitude, and practice relating to malaria and its control from different parts of Africa. These reports concluded that misconceptions concerning malaria still exist and that practice for the control of malaria has been unsatisfactory (Laver, Wetzels & Behrens, 2011; Obol, Lagoro & Christopher, 2011).

According to WHO (2014), there are four types of malaria parasites: falciparum, vivax, malariae and ovale. Plasmodium falciparum is responsible for most malaria deaths, especially in Africa. The infection can develop suddenly and produce several life-threatening complications, Plasmodium vivax is the most geographically widespread of the species, and produces less severe symptoms. Plasmodium malariae infections not only produce typical malaria symptoms but also can persist in the blood for very long periods, possibly decades without ever producing symptoms. A person with asymptomatic (no symptoms) P. malariae, however, can infect others, either through blood donation or mosquito bites. Relapses**,** however, can occur for up to 3 years, and chronic disease is debilitating and Plasmodium ovale is rare, can cause relapses, and

generally occurs in West Africa (WHO, 2015). Distinction on the basis of clinical symptoms is difficult without laboratory examination. Falciparum parasite produces the most fatal form of malaria (WHO, 2014).

Malaria is a major cause of child mortality in Nigeria with approximately 100 million episodes in children under-five years of age every year (Federal Ministry of Health (FMOH), 2008). The mortality rate among children under-five years is 143 per 1,000 live births in the country (World Health Organisation, 2012) and deaths among this category of children often occur within two days of developing symptoms of malaria (Diallo, De Serres, Beayogui, Lapointe & Viens, 2011; Federal Ministry of Health, 2008). Malaria increases susceptibility to other infections and retards growth and development in children. It is associated with considerable economic burden including direct loss to government productivity. Malaria kills Nigerian children every 30 seconds, hence, pregnant women and their unborn children are also vulnerable to malaria which serves as a major cause of maternal anaemia and prenatal death (Davidson, 2010). Attempts at different periods by governments and concerned organizations in these regions aimed at control and eradication have not been satisfactory. This perhaps informed the shifts in campaign from eradication to control. Findings have shown that good knowledge, attitude and practice of any public health disease by individuals and communities seems necessary if effective prevention measures are to be realistic (Ahmed, Haque, Haque and Hoissan, 2009; Iwueze, Ezugbo-Nwobi, Umeanaeto, Egbuche and Anaso, 2013).

Knowledge is the ability to recall or recognize something such as a fact concept, principle or custom (Kalua, 2011). It is further stated that knowledge can be acquired through formal or informal settings either by the help of someone or alone. Ashikeni, Envuladu and Zoakah (2013) stated that the mothers of children less than five years in

Kuje had poor knowledge of the cause of malaria, its prevention and possible complications, good knowledge of the prevention of malaria among mothers such as the use of ITNs, insecticide sprays, nets on windows and doors or protective clothing, was found to be 5.4% at baseline in the intervention group but this increased to 25% at post-intervention. It showed that adequate and proper health education to women especially in the language they understood increased their knowledge and improved their practice of the treatment of malaria in children.

Mothers attitude towards disease are challenging and economically, as well as scientifically, important. It is further stated that people define their personal needs rather than good health. Houmsou, Amuta, Wama, Bingbeng and Hile, (2014) stated that with regards to the attitude of mothers regarding malaria, 73.20% of the mothers always referred their children to hospital with 54.72% of them having post-secondary education and it was also reviewed that mothers prefer the use of one prevention strategy than the other especially the use of insecticide-treated mosquito net. This simply shows that malaria is easily perceived among mothers that have higher educational level. A positive association between level of education and improved perceptions of malaria was also reported in Southeast Nigeria. Oyewole and Ibidapo (2007) in a study of mothers attitude to malaria prevention, treatment and management strategies associated with the prevalence of malaria in a Nigerian urban centre, reported that prevention measures adopted against mosquito bite include sleeping under net (treated and untreated), door and window screening, cover cloth, mosquito repellent/insecticides spray, environmental hygiene, herbal decoction and chemoprophylaxis.

Practice is an action or behaviour that an individual engages in and is normally induced by attitude either consciously or unconsciously. It can also be referred to as behaviour, specifically referring to a behaviour that a person engages in (Williams,

2015). Despite the urgent need for the eradication of malaria, the practice of its prevention measures remains a major challenge in Nigeria especially with respect to the three-pronged prevention measures recommended by Roll Back Malaria (RBM) for under-five children. The practice of prevention of malaria has been globally accepted as a significant aspect of malaria control but majority of mothers of under-five often do not learn the tenets of prevention (Falade, Ogundiran & Bolaji,2016; Obrist, Mayumana, & Kessy, 2010). Falade et al., (2016) found out in their study that many of the mothers do not even believe malaria can be prevented because of series of myths and misconceptions they associated with fever in children, that practice of prevention measures like screening of windows and doors with nets, spraying the house with insecticides aerosol, application of insecticide repellant cream, wearing of long-sleeved clothes and destruction of mosquito breeding sites are not common.

The importance of information on KAPs in designing and improving malaria control activities has been emphasised. An understanding of mothers perceptions and practice on malaria is crucial for policymakers to incorporate disease preventions into the socio-cultural dimensions of the affected communities (Afolabi, 1996; Obi, Nwanebu, Okangba & Nwanebu, 2012). KAP studies are also essential in establishing epidemiological and behavioural baselines and may be used to identify indicators for monitoring malaria control programmes.

Achieving sustainable control of the disease depend on extensive public health promotion programmes which focus on current and proven methods of malaria prevention and management. While much is known about vector biology and behaviour and the malaria parasites, the importance of human behaviour in malaria transmission has not been critically evaluated. Studies focusing on the current practice of malaria

prevention and treatment options in the population are sparse. Thus, it is expedient to evaluate current knowledge of malaria prevention practice and management options as well as the uptake of the management options. In most high-burden countries (including Nigeria), ITN coverage is still below agreed targets (Minja & Obrist, 2015). This may be related to the perception of its use among the community members. The knowledge about prevention measures of malaria is an important preceding factor for the acceptance and use of ITN for malaria control by the community members (Minja, 2011). Therefore, it becomes necessary to assess knowledge, attitude and practice of malaria prevention strategies among mothers of under-five children in North-central zone, Nigeria.

1.2 Statement of the Problem

Malaria presently remains one of the worst menaces of tropical countries of the world. It is a killer and debilitating disease that affects the physical and economic well-being of people living in endemic areas of Africa. The high intensity of the spread of malaria makes it an enormous public health problem. African countries are most hard hit by the disease, where it ravages communities. In most parts of Nigeria, malaria remains endemic, even though it is a preventable and curable disease.

The researcher observed that there is an increase in the number of malaria cases in North Central zone. Most of the clinically diagnosed malaria cases were children under five years. This growing number of cases suggested that malaria preventive strategies are either not known or practiced by the mothers of these children. The researcher also observed that there is an increase in the number of infant mortality due to malaria-related cases, 157 deaths per 1,000 live births which translates to one in every six children born in Nigeria dying before their fifth birthday (National Population Commission and Macro, 2010). This high numbers continues to be an issue of great concern to public health practitioners. The ultimate goal of the Roll Back Malaria

programme is to see that disease transmission and burden is reduced drastically across the country, however, despite the effort put in place by the Government and Non-governmental organizations,the disease continues to be endemic in the country today.

The researcher also observed that mothers of under-five children in North-Central zone may not be knowledgeable on the various malaria prevention strategies, for example the use of insecticide treated nets and mosquito repellent among others.Therefore, this prompted the researcher to assess knowledge, attitude and practice of malaria prevention strategies among mothers of under-five children in north-central zone, Nigeria.

1.3 Purpose of the Study

The main purpose of this study was to assess knowledge, attitude and practice of malaria prevention strategies among mothers of under-five children in North central zone, Nigeria. The specific purposes are to assess;

1. the knowledge of malaria prevention strategies among mothers of under-five children in the north-central zone, Nigeria.
2. the attitude towards malaria prevention strategies among mothers of under-five children in north-central zone, Nigeria.
3. the practice of malaria prevention strategies among mothers of under-five children in north-central zone, Nigeria.
4. the influence of knowledge on attitude towards malaria prevention strategies among mothers of under-five children in north-central zone, Nigeria.
5. the influence of knowledge on the practice of malaria prevention strategies among mothers of under-five children in north-central zone, Nigeria.

6. the influence of demographic variables (age, level of education, number of children and occupation) on knowledge of malaria prevention strategies among mothers of under five children in north central zone, Nigeria.
7. the influence of demographic variables (age, level of education, number of children and occupation) on attitude towards malaria prevention strategies among mothers of under five children in north central zone, Nigeria.
8. the influence of demographic variables (age, level of education, number of children and occupation) on practice of malaria prevention strategies among mothers of under five children in north central zone, Nigeria.

1.4 Research Questions

On the basis of the purposes of the study, the following research questions are raised;

1. Do mothers of under-five children have the knowledge of malaria prevention strategies in north-central zone, Nigeria?
2. What is the attitude of mothers of under-five children on malaria prevention strategies in north-central zone, Nigeria?
3. What is the practice of malaria prevention strategies among mothers of under-five children in north-central zone, Nigeria?
4. What is the influence of knowledge on attitude towards malaria prevention strategies among mothers of under-five children in north-central zone, Nigeria?
5. What is the influence of knowledge on the practice of malaria prevention strategies among mothers of under-five children in north-central zone, Nigeria?
6. What is the influence of demographic variables (age, level of education, number of children and occupation) on knowledge of malaria prevention strategies among mothers of under five children in north central zone, Nigeria?

7. What is the influence of demographic variables (age, level of education, number of children and occupation) on attitude towards malaria prevention strategies among mothers of under five children in north central zone, Nigeria?
8. What is the influence of demographic variables (age, level of education, number of children and occupation) on practice of malaria prevention strategies among mothers of under five children in north central zone, Nigeria?

1.5 Basic Assumptions

On the basis of the research evidence, the following basic assumptions are made;

1. Mothers of under-five children may not have adequate knowledge of malaria prevention strategies in north-central zone, Nigeria.
2. Mothers of under-five children would not have a positive attitude towards malaria prevention strategies in north-central zone, Nigeria.
3. Mothers of under-five children might have a good practice of malaria prevention strategies in north-central zone, Nigeria.
4. Knowledge is not related to attitude towards malaria prevention strategies among mothers of under-five children in north-central zone, Nigeria.
5. Knowledge is not related to the practice of malaria prevention strategies among mothers of under-five children in north-central zone, Nigeria.

1.6 Hypotheses

Based on the research questions, the following hypotheses are formulated

1. Knowledge of malaria prevention strategies among mothers of under-five children in north-central zone, Nigeria is not significant.

2. Attitude towards malaria prevention strategies among mothers of under-five children in north-central zone, Nigeria is not significant.
3. The practice of malaria prevention strategies among mothers of under-five children in north-central zone, Nigeria is not significant.
4. There is no significant influence of knowledge on attitude towards malaria prevention strategies among mothers of under-five children in north-central zone, Nigeria.
5. There is no significant influence of knowledge on the practice of malaria prevention strategies among mothers of under-five children in north-central zone, Nigeria.
6. There is no significant influence of demographic variables (age, level of education, number of children and occupation) on knowledge of malaria prevention strategies among mothers of under five children in north central zone, Nigeria.
7. There is no significant influence of demographic variables (age, level of education, number of children and occupation) on attitude towards malaria prevention strategies among mothers of under five children in north central zone, Nigeria.
8. There is no significant influence of demographic variables (age, level of education, number of children and occupation) on practice of malaria prevention strategies among mothers of under five children in north central zone, Nigeria.

1.7 Significance of the Study

The findings of this study would be significant to mothers of under-five, government and non-governmental organization, health educators and future researchers.

The findings of this research would be significant to the mothers of under-five children. Publications from the study would provide them with information on malaria prevention strategies and also help to improve their knowledge, correct attitudes and encourage the right practices towards malaria prevention strategies among mothers of under-five children.

The findings of the study would benefit government and non-governmental organizations (NGO) by providing them with information's on the level of knowledge, attitude and practice of malaria prevention strategies among mothers of under-five children through publishing articles from the study. This would help to encourage them to place more emphasis on providing awareness on malaria prevention strategies to mothers of under-five children by organizing seminars, workshop, posting of health issues on billboard and conducting mass media campaigns that would enlighten mothers of under-five on malaria prevention strategies.

This study would be relevant to health educators by providing them with information on the knowledge, attitude and practice of malaria prevention strategies among mothers of under-five children. This would help them in creating awareness through health campaign/ rally, one on one persuading, house to house visitation and community discussions so as to enlighten them more on how to prevent malaria and how to improve their knowledge, attitude and practice of malaria prevention strategies.

This study would be of paramount importance to other researchers, by providing them with additional information on knowledge, attitude and practice of malaria prevention strategies through publications that would be made, which could be of relevance to future researchers in the field of health education who may desire to conduct similar studies.

1.8 Delimitations of the Study

This study was delimited to:

1. knowledge of malaria prevention strategies among mothers of under-five children in north-central zone, Nigeria
2. attitude towards malaria prevention strategies among mothers of under-five children in north-central zone, Nigeria
3. the practice of malaria prevention strategies among mothers of under-five children in north central zone, Nigeria
4. influence of knowledge on attitude towards malaria prevention strategies among mothers of under-five children in north-central zone, Nigeria
5. influence of knowledge on the practice of malaria prevention strategies among mothers of under-five children in north-central zone, Nigeria.
6. All mothers of under-five children living in north-central zone of Nigeria.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1 Introduction

The purpose of this study was to assess the knowledge, attitude and practice of malaria prevention strategies among mothers of under-five children in north-central zone, Nigeria. To achieve this purpose, relevant available literature related to the study were reviewed under the following sub-headings:

2.1 Introduction

2.2 Conceptual Framework

2.2.1 Concept of Malaria

2.3 Theoretical Framework

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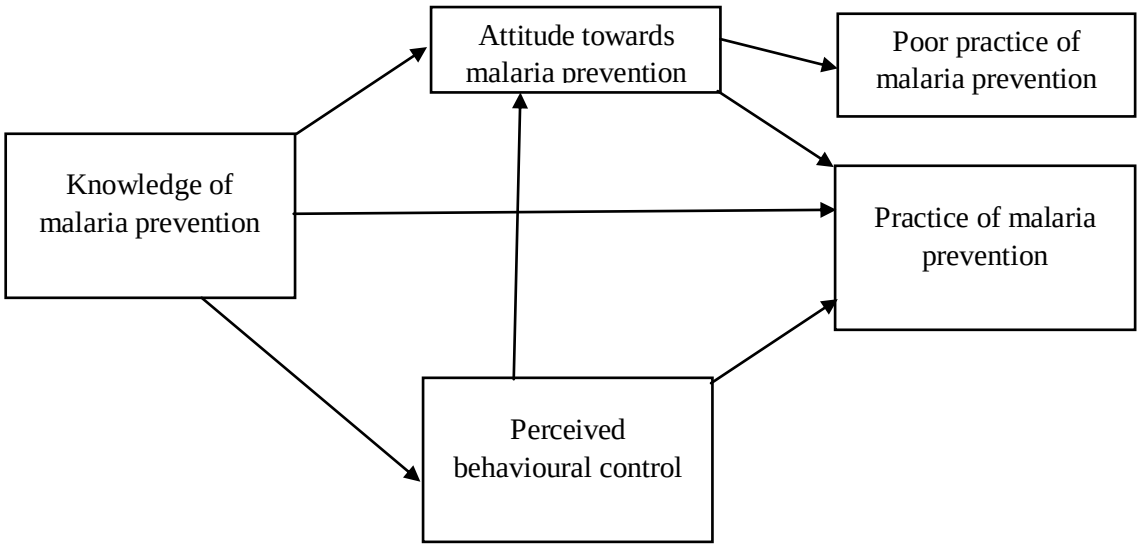
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(Researcher, 2019)

The conceptual framework developed by the researcher points to the impact of knowledge of malaria prevention strategies on perceived behavioural control and attitudes towards malaria prevention. The impact of knowledge is evident in the adoption of healthy practice of malaria prevention. While those with poor attitudes towards malaria prevention are likely to ignore practice of malaria prevention. An individual must perceive such knowledge gained to be important before they can make informed choices.

2.2.1 Concept of Malaria

The term malaria originates from medieval Italian: mala aria meaning “bad air.” The disease was formerly called “ague” or “marsh fever” due to its association with swamps and marshland (Reiter, 2010). Malaria is a disease caused by a parasite that lives

part of its life in humans and part in mosquitoes. Malaria remains one of the major killers of humans worldwide, threatening the lives of more than one-third of the world's population. It thrives in the tropical areas of Asia, Africa, and Central and South America, where it strikes millions of people. Each year 350 to 500 million cases of malaria occur worldwide. Sadly, more than 1 million of its victims, mostly young children, die yearly. Although malaria has been virtually eradicated in the United States and other regions with temperate climates, it continues to affect hundreds of people in this country every year (Guyatt and Snow, 2004).

Malaria has been around since ancient times. The early Egyptians wrote about it on papyrus, and the famous Greek physician Hippocrates described it in detail. It devastated invaders of the Roman Empire. In ancient Rome, as in other temperate climates, malaria lurked in marshes and swamps. People blamed the un-healthiness in these areas on rot and decay that wafted out on the foul air. Hence, the name is derived from the Italian, "*mal aria*," or bad air. In 1880, the French scientist Alphonse Laveran discovered the real cause of malaria, the single-celled *Plasmodium*parasite. Almost 20 years later, scientists working in India and Italy discovered that *Anopheles* mosquitoes are responsible for transmitting malaria (Udonwa, Gyuse and Etokidem, 2010).

Historically, the United States is no stranger to the tragedy of malaria. This disease, then commonly known as "fever and ague," took a toll on early settlers. Historians believe that the incidence of malaria in this country peaked around 1875, but they estimate that by 1914 more than 600,000 new cases still occurred every year. Malaria has been a significant factor in virtually all of the military campaigns involving the United States. In World War II and the Vietnam War, more personnel time was lost due to malaria than to bullets.

The discovery that malaria was transmitted by mosquitoes unleashed a flurry of ambitious public health measures designed to stamp out malaria. These measures were targeted at both the larval stages (which thrive in still waters, such as swamps) and adult stages of the insect. In some areas, such as the southern United States, draining swamps and changing the way land was used was somewhat successful in eliminating mosquitoes. The pace of the battle accelerated rapidly when the insecticide DDT and the drug chloroquine were introduced during World War II. DDT was remarkably effective and could be sprayed on the walls of houses where adult *Anopheles* mosquitoes rested after feeding. Chloroquine has been a highly effective medicine for preventing and treating malaria. In the mid-1950s, the World Health Organization (WHO) launched a massive worldwide campaign to eliminate malaria. In the beginning, the WHO programme, which combined insecticide spraying and drug treatment, had many successes, some spectacular. In some areas, malaria was conquered completely, benefiting more than 600 million people, and was sharply curbed in the homelands of 300 million others.

Malaria is one of the most important causes of morbidity in the world. It is a vector-borne infectious disease caused by a eukaryotic protista of the genus *Plasmodium*. The disease is transmitted by female *Anopheles* mosquitoes which carry infective sporozoite stage of *Plasmodium* parasite in their salivary glands (Akinleye, 2009). It is transmitted from person to person through the bite of a female *Anopheles* mosquito that is infected with one of the four species of *Plasmodium*: *Plasmodium ovale, Plasmodium falciparum, Plasmodium vivax and Plasmodium malariae.* Children under five years and pregnant women are particularly vulnerable to the disease due to their weaker immune systems (WHO, 2010). Malaria is an acute and chronic disease caused by obligate intracellular protozoa of the genus *Plasmodium*. The zoological family Plasmodidae

contains protozoan parasites found in the blood of birds, reptiles and mammals (Akinleye, 2009**).** *P. falciparum* is found throughout tropical Africa, Asia and Latin America. *P vivax* is worldwide in tropical and some temperate zones. *P. ovale* is mainly in West Africa, while *P. malariae* is worldwide but very patchy in distribution (TDR, 2010). *P. falciparum* is responsible for about 80% of malaria infection in man and *P. vivax* is not seen among Africans especially West Africans due to the absence of the Duffy blood group (Afolabi Lesi and Adenuga, 2011).

Malaria is a disease that is associated with poverty due to poor sanitary and environmental conditions. The rich and powerful live in sanitary surroundings with easy access to medical facilities, while the poor live in crowded urban slums and remote rural areas which favour transmission. In 2016, the World Health Organization (WHO) estimated that 3.3 billion persons were at risk of acquiring malaria. Of these, 247 million were infected (86% in Africa) and nearly 1 million (mostly African children) die of the infection. In 2014, malaria was still endemic in 109 countries worldwide, 45 of them in Africa. WHO estimated that approximately 1.1 million persons were still dying of malaria (WHO, 2014). Some 11 percent of all child deaths worldwide are estimated to occur in Nigeria. Malaria is the leading cause of child death in the country and around 250,000 Nigerian children die every year from the disease. While children under the age of five and pregnant women are particularly vulnerable, almost the entire population of Nigeria is at risk of contracting malaria (RBM, 2015). The problem of malaria was brought to the limelight at the ministerial conference on malaria held in Amsterdam on October 1992. The new global control strategy was formulated and emphasis was laid on the patient and only on prevention where it is cost-effective and sustainable. Four elements were identified including disease management, vector control, epidemic control and malaria situation analysis (TDR, 1994). Then, as a follow up to the global malaria

control, a plan for the control of malaria in Africa was drawn up in Brazzaville, Congo. According to the plan, by 1992, 16 out of 20 African countries proved to have malaria epidemic should have started implementing plans to prevent and control the scourge (TDR, 1994). Also by 2007, there should be a fall of 20% in the incidence of severe malaria and mortality in at least 32 of 42 countries with endemic malaria.

To meet up with the above plan a new global initiative for the control of malaria was launched in 2007 by WHO and is known as "Roll Back Malaria". WHO in outlining the challenges of Roll Back Malaria (RBM) acknowledged the fact that one fifth (1/5th) of the world's population is at risk of malaria and that the proportion increases yearly as a result of climate change, environmental damage, breakdown in health care and war (WHO, 1999). As a result of the world's renewed struggle against malaria, the African Union (AU) launched its own African for malaria control in the 21st Century, which became "Roll Back Malaria in Africa". Then, in her 25th April 2010 summit in Abuja, Nigeria, the African Head of States acknowledged the fact that malaria accounts for about one million deaths annually in Africa south of Sahara and that nine out of ten cases of malaria worldwide occur in Africa south of Sahara. They, therefore, resolved to make sure that:

i. At least 60% of those suffering from malaria have prompt access to and are able to use correct affordable and appropriate malaria drug within 24 hours of the onset of symptoms.

ii. At least 60% of those at risk of malaria, particularly woman and children under five years of age, benefit from the most suitable combination of personal and community protective measures such as insecticide-treated mosquito nets and other materials to prevent infection and suffering (WHO, 2011).

Nigeria has been active in RBM movement since 1998 when she participated in pre-testing situation analysis instruments. Measures have been undertaken in the country to develop a dynamic national RBM movement. Among the five strategic approaches of RBM in Nigeria are;

i. Multiple Diseases Prevention (ITN's, prophylaxis, environmental management and personal protection) and
ii. Information, Education, Communication (IEC) and Social Mobilization.

To achieve the above-mentioned goals RBM in Nigeria decided to:

i. Recognize the home as the first point of treatment and strengthen home care with training and information packages for easy use of the anti-malaria drug.
ii. Integrate micronutrient supplementation in malaria case management in collaboration with reproductive health and others.

Also mothers and caregivers of children less than 5 years will be encouraged to use maternal and child health services and take prompt appropriate actions during illness (WHO, 2011). It was expected that the major outcome after the full implication of all the strategies will be that; 80% of the most vulnerable groups (pregnant women and children under 5 years) will use ITNs and other effective methods of prevention by 2015. 80% of community members will be able to correctly identify the causes, prevention and management of both simple and severe malaria by 2015. 80% of caretakers will be able to recognize the symptoms of malaria and provide correct treatment by 2015.

In this context, pregnant women and children under 5 years were identified as the most vulnerable group because of the immune suppression associated with pregnancy and state of the immune system of the children. In non-immune children, the primary attack can vary widely. Common symptoms are drowsiness, refusal of food, thirst, headache, nausea, vomiting and frequent loose stool. There may be no rigour, but the

temperature can be greater than 400C. (1040F). Physical findings often include pallor, cyanosis and later hepatosplenomegaly (Okeke, 2008). Convulsions are frequent, and cerebral malaria is the major complication. Anaemia can be a major clinical problem in children with repeated malaria infections. The mortality rate is high in infants and children with complicated *P. falciparum* infection (Strickland, 1988).

A. Causes of Malaria

Malaria is caused by a single-celled parasite from the genus *Plasmodium*. More than 100 different species of *Plasmodium* exist. Four species of *Plasmodium* commonly infect humans. Each one has a distinctive appearance under the microscope, and each one produces a somewhat different pattern of symptoms (WHO, 2015). Two or more species can live in the same area and infect a single person at the same time.

I. ***Plasmodium falciparum:*** *Plasmodium falciparum* is a protozoan parasite that causes an infectious disease known as malaria. *P. falciparum* is the most severe strain of the malaria species correlated with almost every malarial death. The other 3 species that cause malaria include *P. vivax*, *P. ovale*, and *P. malariae*. Humans become infected by a female Anopheles mosquito which, transfers a parasitic vector through its saliva into the bloodstream. The parasite then infects the liver and undergoes asexual reproduction followed by insertion into red blood cells where an additional round of replication takes place. *P. falciparum* changes the surface of an infected red blood cell causing it to adhere to blood vessels, cytoadherence, as well as to other red blood cells. In severe cases this leads to obstructions of microcirculation resulting in dysfunction of many organs. Symptoms depend on severity of infection and can present a range of signs such

as flulike symptoms, vomiting diarrhoea, shock, kidney failure, coma, and death. *Plasmodium falciparum* mostly infects students. Transmission of *P. falciparum* occurs between humans and Anopheles mosquitoes. Mosquito vectors pass malaria from host to host. The parasite can infect the mosquitoes through the intake of human blood or a human may be infected by the mosquito's injection of saliva. Once the mosquito becomes infected with *Plasmodium falciparum* it transfers the disease to each new host it penetrates. Humans can rarely transfer the parasite between each other. There have been rare cases of contaminated transfused blood infecting the recipient, but seldom does this occur because of screening that takes place pre-blood donation. Students can also pass *P. falciparum* to their friends, this is also a seldom occurrence (Wikipedia, 2011).

a. Symptoms of Malaria typically begin 8-25 days following infection however, in a few cases it can take up to a year. The late onset of incubation is due to taking an inadequate amount of anti-malaria medication. The infectious dose is not precisely known, but it is understood to be a very low number. Malaria can be observed months to years after the first set of symptoms are observed. This is due to the parasites ability to lie dormant in liver cells until the environment is right for a relapse. This is mainly seen in *P.vivax* and *P. ovale*, rather than *P. falciparum*. The parasite colonizes in the liver and is then released into the bloodstream and enters erythrocytes. The key to Malaria-endemic is Anopheles the mosquito's ability to live in a certain area. Temperature is also important having to stay above 20 degrees Celsius. The main areas of *P. falciparum* are South America, Africa, India, and few parts of Indonesia. The ideal location for transmission is along the equator in a warmer region. Transmission will not occur in high altitudes, colder seasons, and deserts. Malaria is considered to have arisen

since the beginning of mankind but was first discovered in blood in 1880 and found to be transmitted by mosquitoes in 1889. There are four common species of Malaria of which P. falciparum is the most severe. *Plasmodium falciparum* continues to increase in drug-resistant populations and insecticide-resistant mosquitoes leading to the prediction that the disease will only worsen over time. Rapid and accurate diagnosis using microscopic examination of blood smears is the most precise way to determine *Plasmodium falciparum* as the disease. CDC provides various references for microscope diagnosis along with serology, PCR, and drug resistance testing. Each species of P. falciparum has distinctive characteristics that can be seen under a microscope. In only early form, trophozoites and gametocytes of *P.falciparum*are seen in the blood as ring form inside the erythrocyte. There are normally multiple parasites in one erythrocyte appearing as several dots

II. ***Plasmodium vivax:*** *Plasmodiumvivax* is a protozoalparasite and a human pathogen. The most frequent and widely distributed cause of recurring (Benign tertian) malaria, *P. vivax* is one of the five species of malaria parasites that commonly infect humans.[2] It is less virulent than *Plasmodium falciparum*, the deadliest of the five, but vivax malaria can lead to severe disease and death due to splenomegaly (a pathologically enlarged spleen). *P. vivax* is carried by the female *Anopheles* mosquito since it is only the female of the species that bite. *P. vivax* was found mainly in the United States, Latin America, and in some parts of Africa. More recently it became a plague of low- and middle-income countries, except those in sub-Saharan Africa, where the P. vivax map has a conspicuous hole. Overall it accounts for 65% of malaria cases in Asia and South America. It

is the logic that Plasmodium vivax is found there where humans and mosquito are rich. It never is found where temperature is low.

a. As overall malaria rates fall in a region, its proportion of cases increases. It has been estimated that 2.5 billion people are at risk of infection with this organism. Although the Americas contribute 22% of the global area at risk, high endemic areas are generally sparsely populated and the region contributes only 6% to the total population at risk. In Africa, the widespread lack of the Duffy antigen in the population has ensured that stable transmission is constrained to Madagascar and parts of the Horn of Africa. It contributes 3.5% of the global population at risk. Central Asia is responsible for 82% of global population at risk with high endemic areas coinciding with dense populations particularly in India and Myanmar. South-East Asia has areas of high endemicity in Indonesia and Papua New Guinea and overall contributes 9% of global population at risk. P. vivax is carried by at least 71 mosquito species. Many vivax vectors live happily in temperate climates as far north as Finland. Some prefer to bite outdoors or during the daytime, hampering the effectiveness of indoor insecticide and bed nets. Several key vector species have yet to be grown in the lab for closer study, and insecticide resistance is unquantified.

III. ***Plasmodium malariae:*** *Plasmodium malariae*infections not only produce typical malaria symptoms but also can persist in the blood for very long periods, possibly decades, without ever producing symptoms. A person with asymptomatic (no symptoms) *P. malariae*, however, can infect others, either through blood donation or mosquito bites. *P. malariae* has been wiped out from temperate climates, but it persists in Africa. *Plasmodium malariae* is a

malaria-causing parasite that colonizes the blood of a human host. Malaria is a disease that is both preventable and curable but still continues to cause hundreds of thousands of deaths annually. A recent inquiry conducted by the World Health Organization (WHO) showed that in 2014, 781,000 deaths could be attributed to malaria. This is one of the reasons that studying the species of the genus *Plasmodium* is so important. Although *Plasmodium malariae* is one of the less virulent strains of the genus, it is still one of the few species that use a human as a host. It is the study of the group of organisms that infect humans that could lead to new drugs that may be more readily available, easier to produce, cheaper, or that can combat drug-resistant strains (WHO, 2013).

IV. ***Plasmodium ovale:*** *Plasmodium ovale* is a species of parasiticprotozoa that causes tertian malaria in humans. It is one of several species of *Plasmodium* parasites that infect humans including *Plasmodium falciparum* and *Plasmodium vivax* which are responsible for most malarial infection. It is rare compared to these two parasites, and substantially less dangerous than *P. falciparum*.

Recognizable descriptions of malaria were recorded in Chinese, Indian, Egyptian and Mesopotamian texts as early as 5,000 years ago. Evidence from human DNA sequences shows the effects of malaria to be far older still, influencing human evolution across tens of thousands of years. It is no exaggeration to say that malaria has played a crucial role in human history, determining the fates of armies and empires. Malaria brought down Alexander the Great and saved Rome from Attila's hordes. Dubbed the 'King of Diseases' in the Vedas, its modern name comes from the Italian peninsula, where *mal'aria*or 'bad air' was thought to cause the debilitating paroxysmal tertian or quartan (three- or four-day) fevers and febrile deaths that ravaged the populace

every year for millennia. Approximately 22,000 people per year suffer from *vivax* malaria in regions where the disease is non-endemic (rare). This is about twice the number suffering from non-endemic *falciparum* malaria. Such infections are 'imported', that is, they stem from travel to regions where *vivax* malaria is endemic, or from an encounter with a stray *vivax*-infected mosquito far from its home. *Vivax* malaria was formerly endemic in many regions where today it is rare, such as Western Europe. It has been estimated (Hay et al., 2014) that in 1900, before worldwide intervention efforts against the disease began, the probable maximum distribution of malaria spanned 64° north to 32° south latitudes, limits corresponding to the northern and southern 15°C (59°F) summer isotherms supporting *P. vivax* transmission. Thus malaria, and *vivax* malaria in particular, formerly prevailed northward into subarctic Siberia and Canada and southward to the upper third of Australia, regions where today it is all but unheard of.

B. Signs and Symptoms of Malaria

Symptoms of malaria include fever, shivering, arthralgia (joint pain), vomiting, anaemia (caused by hemolysis), hemoglobinuria, and convulsions. There may be the feeling of tingling in the skin, particularly with malaria caused by Plasmodium falciparum. The classical symptom of malaria is the cyclical occurrence of sudden coldness followed by rigour and then fever and sweating lasting four to six hours, occurring every two days in Plasmodium vivax and plasmodium ovale infections, while every three days for plasmodium malariae. Plasmodium falciparum can have recurrent fever every 36 – 48 hours or less pronounced and almost continues fever. For reasons that are poorly understood, but which may be related to high intracranial pressure, children with malaria frequently exhibit abnormal posturing, a sign indicating severe

brain damage. Malaria has been found to cause cognitive impairments. It causes widespread anaemia during a period of rapid brain development and also direct brain damage (Idro, Otieno, White, Kahindi, Fegan, Ogutu, ... & Newton, 2005).

Severe malaria is almost exclusively caused by Plasmodium falciparum infection and usually arises 6 – 14 days after infection. Consequences of severe malaria include coma and death if untreated, young children and pregnant women are especially vulnerable to splenomegaly (enlarged spleen), severe headache, cerebral ischemia, hepatomegaly (enlarged liver), hypoglycaemia, and hemoglobinuria with renal failure may occur. Renal failure may cause morbidity and mortality cause black water fever, where haemoglobin from lysed red blood cells leaks into the urine. Severe malaria can progress extremely rapidly and cause death within hours or days. In the most severe cases of the disease fatality rates can exceed 20%, even with intensive care and treatment. In endemic areas, treatment is often less satisfactory and the overall fatality rate for all cases of malaria can be as high as one in ten. Over the longer term, developmental impairments have been documented in children who have suffered episodes of severe malaria (Idro et al., 2005; Okekeand Okafor, 2013).

C. Life Cycle of Malaria Parasite

The life cycle of the malaria parasite is complex and differs in certain aspect according to the plasmodia species involved. Generally, the life cycle of *Plasmodium* can be divided into three phases; the exoerythrocytic or pre-erythrocytic phase which occurs in the liver, the erythrocytic phase which occurs in the erythrocyte and the sexual phase which occurs in the mosquito (Ekpenyong and Eyo, 2016). The exoerythrocytic phase of the malaria parasite is triggered off by inoculation through the bite of infected blood-feeding female mosquito of the genus *Anopheles*, which transfer parasite from human to human. The infective stages of plasmodia, called sporozoites are injected from the

salivary gland of the infected mosquito into the bloodstream through subcutaneous capillaries. After 30 minutes the sporozoites disappear from the bloodstream, some are destroyed by phagocytes while many will enter the parenchyma cells of the liver (hepatocytes), where they multiply asexually in a process known exoerythrocytic schizogony. According to Afolabi (2011) the nucleus of the parasite undergoes repeated division, resulting in the formation of thousands of uninucleated merozoites, each measuring 0.7 to 1.8μm in diameter. The nucleus of the liver cell will be displaced in about 6 to 16 days from the time of infection, hepatic cell containing the tissue schizonts ruptures and the merozoites enter the circulation.

In infection due to *P. falciparum* and *P. malariae*, the tissue schizonts rupture at about the same time and none persists in the liver, therefore, relapses do not occur in infections with these species. In contrast, *P. vivax* and *P. ovale* have two types of exoerythrocytic forms. A primary type which develops and ruptures within 6 to 9 days, and a secondary type, the hypnozoite, that may remain dormant in the liver for weeks, months or up to 5 years before developing, therefore, result in relapses of erythrocytic infection. In the second phase which is known as erythrocytic phase, merozoites released from tissue schizonts invade erythrocytes. According to Strickland (1988) invasion depends on the interaction of a specific receptor on the red blood cells, glycophorin, and the merozoites. The anterior end of the merozoite attachés to the erythrocytic membrane. The merozoite membrane thickens and joins with the membrane of the erythrocyte and then invaginates, forming a vacuole within which the parasite lies. As the merozoite enters, it is surface coat appears to be pinched off. At this point, the merozoite assumes the appearance of a small chromatin mass situated at the periphery of a larger mass of cytoplasm. Because of its characteristic appearance, early trophozoite stage is referred to as a “signet ring” (Ekpenyong and Eyo, 2016).

As the trophozoites grow, they become irregular and amoeboid in appearance. During development, the parasite utilizes haemoglobin leaving as the product of digestion an iron-containing pigment, haematin or hemozoin, which can be seen in the cytoplasm of the parasite as dark granules. After a period of growth in the red blood cell, the parasite undergoes nuclear division to form merozoite. The infected erythrocyte ruptures, liberating merozoites which must invade new red blood cells (Quinin and Strickland, 1986). The schizonts also release pigments and waste product which along with the merozoites are responsible for the feverish condition depicted by high temperature. Also merozoites of some *Plasmodium* species show a distinct preference for erythrocyte of certain age (Ekpenyong and Eyo, 2016). According to Aikawa (1980) merozoites of *P. vivax* attack young immature red blood corpuscles, those of *P. malariae* attack the older erythrocytes, while those of *P. falciparum* indiscriminately enter into any available erythrocyte. From 3 to 15 days after the onset of symptoms of malaria, some merozoites differentiate into sexual forms, gametocytes i.e. female macro gametocytes and male micro gametocytes. The duration of gametocytogony is 4 days in *P. vivax* infection and 10 days or more days in *P. falciparum* infection (Strickland, 1988).

The sexual phase of the lifecycle of *Plasmodium* begins with the mosquito ingesting the gametocytes with a blood meal, which undergoes further development in the stomach of the mosquito. The microgamete moves actively forward through small projection that forms on the female parasite. After fertilization, the zygote, within 18 to 24 hours elongates to between and 24 μm and become motile ookinetes. The ookinetes force its way between the epithelial cells of the outer surface of the stomach, forming oocyst. The oocyst enlarges progressively up to 500 μm in diameter, as the nucleus divides repeatedly, giving rise to numerous sporozoites. On rupture of the mature sporocyst, the sporozoites are released into the body cavity where they make their way to

the salivary gland. On feeding, the sporozoites are injected into the tissue or directly into the bloodstream of the new host (man) to initiate a new schizogonic cycle (Ekpenyong and Eyo, 2016).

D. Epidemiology of Malaria

Malaria killed 437,000 children before their fifth birthday in 2013, the majority in sub-Saharan Africa (WHO, 2014). It is a mosquito-borne infection that killed an estimated 1.1 million people in 1998 and with an estimated 300 to 1600 million new cases, but in 2013 the disease caused an estimated 453,000 under – five deaths. According to the latest estimates, malaria mortality rates were reduced by about 47% globally and by 54% in the WHO African Region between 2010 and 2013**.** The incidence rates declined by 30% around the world and by 34% in the African region. These substantial reductions occurred as a result of a major scale-up of vector control interventions, diagnostic testing and treatment with artemisinin-based combination therapies, or ACTs. The absolute numbers of malaria cases and deaths are not going down as fast as they could. The disease still took an estimated 627 000 lives in 2012, mostly those of children under five years of age in Africa. This means 1300 young lives lost to malaria every day – a strong reminder that victory over this ancient foe is still a long way off (WHO, 2013).

Malaria is a major public health problem in Nigeria where it accounts for more cases and deaths than any other country in the world. Malaria is a risk for 97% of Nigeria's population. The remaining 3% of the population live in the malaria-free highlands. There are an estimated 100 million malaria cases with over 300,000 deaths per year in Nigeria. This compares with 215,000 deaths per year in Nigeria from HIV/AIDS **(**United States Embassy in Nigeria, 2011**).** The fact that so many people are dying from mosquito bites is one of the greatest tragedies of the 21st century**.** Like other

diseases once banished to the geopolitical margin, malaria is re-appearing in areas of the world formerly deemed disease-free. In a 1999 report, WHO warned of the serious risk of uncontrolled resurgence of malaria in Europe owing to civil disorder, global warming, increased irrigation (canals are important breeding sites for mosquitoes) and international travel.

In the United Kingdom, 1,000 new cases of malaria were imported each year from malaria-endemic countries. The weakening public infrastructures have triggered large scale epidemics in Central Asian Republics, while in Turkey the numbers of infected individuals have increased tenfold since the diseases were believed to be nearly eradicated in 1989 (WHO, 2010). Also in 2016, WHO estimated that 3.3 billion persons were at risk of acquiring malaria, of these, 247 million were infected (86% in Africa) and nearly 1 million (mostly African children) died of the infection. In 2014, malaria was endemic in 109 countries worldwide, 45 of them in Africa. According to TDR (2007), an African baby dies from malaria every 3 seconds and at the end of the year, 1 million more babies are buried by the families – a scene which TDR is trying to prevent through its research into the innovative concept of home management of malaria (HMM). According to United States Embassy in Nigeria report 2011 there were 216 million cases of malaria and an estimated 655,000 deaths in 2011. Most deaths occur among children living in Africa where a child dies every minute and the disease accounting for approximately 27% of all childhood deaths (WHO, 2011). In Nigeria, it has been well known that the bulk of the burden of disease due to malaria is borne by children under the age of five years (Sodeinde, 2007). Malaria contributes greatly to the increase in hospital attendance across the six zones of Nigeria. World malaria report indicated that Nigeria accounted for a quarter of all malaria cases in the 45 malaria-endemic countries in Africa, showing clearly the challenges of malaria in Nigeria (WHO, 2014).

Malaria does not only affect the health of the child but, it also causes a great drain on the national economy. The cost of daily labour coupled with cost of treatment and high mortality associated with the disease make malaria one of the main diseases retarding development in Africa (Ekpenyong and Eyo, 2014). Since many malaria endemic countries are already classified among the poor nations, the disease maintains a vicious cycle of disease and poverty. Early studies on malaria had focused on vector control and chemoprophylaxis and were done without reference to the behaviour and belief system of the affected population. A different approach was taken in the 1970s with the malaria scourge being tackled through socio-cultural and behavioural research (Jones and Williams, 2014). The early 1990s saw an increase in the number of malaria studies that focused on local terms, perceptions of disease causation, treatment-seeking behaviour, prescriber behaviour and prevention measures such as the use of bed nets (Agyepong, 1992; Aikins, Pickering, & Greenwood, 2011; Mwenesi *et al*., 1995; Binka and Adongo, 2007; Muela *et al*., 1998).

Studies on treatment-seeking behaviour have shown that most malaria episodes are first treated at home because there are no nearby health care workers or facilities in many rural areas. Facilities are so far that families have to walk many miles and hours, and even then with no promise of care at the end of their trip. So people often do not even attempt to seek out care, instead they use local remedies or just wait it out (TDR, 2007). As a result of this TDR in 1998 supported research in the training of local mothers and other communities members to recognize fever, provide prepackaged medication, and keep the medicines properly stored and recorded, and this was tagged “Home Management of Malaria (HMM)”. Therefore, studies in HMM has become a cornerstone in malarial case-management and more generally, of malaria control in sub-Saharan Africa (Gypapong and Garshong, 2007).

E. Prevalence of malaria and its transmission indices

The prevalence of malaria in an area is governed by the density of mosquito population, presence of an environment that supports mosquito breeding, presence of people especially children having gametocytes within their red blood cells, effectiveness of anti-mosquito measures and the use of suppressive drugs (WHO, 1985). Other factors that affect the prevalence of malaria in an area are parasite species and strains, human population dynamics, economic conditions, climate and land use. These factors also determine the levels of malaria endemicity and development of immunity. All those persons who become exposed to the malaria parasite either by visiting or living in malaria-endemic areas but are not immunized to the disease are at risk, as well as those who are not immune to malaria and are living in endemic areas. Studies have shown that it is the under privilege in these areas who are more at risk (Munguti, 1998).

Greenwood (1999) reported that a visit to the paediatric ward or to the general out-patient department of most hospitals in tropical Africa is all that is needed to convince a visitor that malaria remains a major cause of mortality and morbidity in African children. According to him, a conversation with the families of the children in the ward would quickly agree to the same message. Malaria is accepted as a major killer of African children. It occurs most frequently in the rainy season. This can be seen in the report of Imboua-Bogui and Diawara (1986) in Mbengue in Cote d'Ivoire. According to them, 45 percent of children in the forest zone had malaria parasites in the rainy season as compared with 12 percent during dry season. In another report, out of 101 children aged 0 - 4 years who had fever, 42 children were found to have malaria parasite with levels greater than 1000 *Plasmodium* parasites per cubic millimetre of blood (Eneanya,1998).

In Humera, North Western Ethiopia, malaria is also a threat to the lives of children of school age. In children aged 0 - 9 years *P. falciparum* was present in 12% of the 616 randomly selected slides of the out-patient population, *P. vivax* was present in 5% of the children, 3% had mixed infections with *P. falciparum* and *P. vivax*, while *P. malariae* was uncommon (1%) (Seboxa and Snow, 2007). They also noted that of the 705 paediatric admissions to Humera district hospital of children aged one month to ten years, 458 (68%) were clinically diagnosed with malaria. The case fatality rate among paediatric malaria admissions was also high. Velema *et al*. (1991) reported that in Benin republic, the average number of fever episode per child per year was 2.4 and 33% of these were estimated to be caused by malaria. Malaria is also one of the major health problems in Ghana accounting for 7 - 8% of all certified deaths and ranks fifth as the commonest cause of death in children less than five years. Amofah and Adjei-Aequah (2011) confirmed this when they carried out a study on 1508 school children aged 1- 3 years in the Kumasi Metropolis to determine the prevalence of malaria parasitaemia in them. They reported that 295 of children showed positive blood film for malaria parasites giving a prevalence of 19.6%. They also noted that none of the children has any signs or symptoms of malaria. The parasite density rate of nearly 20% is quite high which indicated high degree of malaria parasitaemia in Kumasi. The predominant malaria parasite species discovered in their study was *Plasmodium falciparum*.

Malaria is holoendemic in all parts of Nigeria. It accounts for up to 30% of children's mortality (Afolabi *et al*., 2007). It has also been established from hospital records in Nigeria that 8 - 9% of hospital attendance was due to malaria. In a study by Salako *et al*. (1990) at University Teaching Hospital Ibadan, a total of 6,132 children aged 6 months to 12 years who presented with pyrexia illness, diagnosed clinically as malaria, were screened for parasitaemia. According to their report, 2930 (47.8%) of them

were positive for the asexual forms of the malaria parasite. *P. falciparum* was 97% of the cases, 3% for mixed infection of *P. falciparum* and *P. ovale* while less than 1% was *P. malaria*e alone. Malaria continues to be a serious health problem among children of school age in our society as can be seen in the survey in Jos University Teaching Hospital (JUTH) by Angyo *et al.* (2011). The ages of the children ranged from one month to fourteen years. Out of 2014 children admitted in the emergency paediatric Unit at JUTH, 501 (25%) were admitted with diagnosis of acute malaria. Three hundred and fifty-three (353) of the children were aged five years and below, and the majority of the admissions 396 (79%) were between the months of April and October coinciding with the rainy season in the environment. Sixteen (16) out of the 501 children died, giving a mortality rate of 3.2% and 11 (68.8%) of all the deaths occurred in children between 1 and 5 years of age.

F. Pathology of malaria

As the malaria parasites enter the bloodstream they infect and destroy red blood cells. Destruction of these essential cells leads to fever and flu-like symptoms such as chills, headache, muscle aches, tiredness, nausea, vomiting and diarrhoea (Strickland, 1988). The symptoms of uncomplicated malaria are non-specific and include fever. Malaria is considered uncomplicated when symptoms are present but there are no clinical or laboratory signs to indicate severity or vital organ dysfunction. Severe malaria is caused mostly by *P. falciparum* and if not promptly treated can present with the following symptoms: coma, severe breathing difficulties, low blood sugar and low blood haemoglobin (severe anaemia). Children are particularly vulnerable since they have little or no immunity to the parasite (WHO, 2010).

However; children who have malaria display some early symptoms of infection such as drowsiness, irritability, loss of appetite and difficulty in sleeping. These are

generally considered to be the initial warning signs that a child has malaria. This is followed by chills which often develop into fever characterized by extremely fast breathing. When the fever subsides, the temperature of the body very rapidly returns to normal and the child experiences an extreme period of sweating (Davis, 2011). There has been wide variation in symptoms and presentation of cases of malaria, depending on immune status and age group (Jayant and Mani, 2010). Deaths from malaria in Africa are higher among children under the age of 5 years from the severe and complicated form of the disease. However, children under 6 months of age are believed to be relatively immune to the disease. In malaria-endemic regions of Africa, life, threatening malaria due principally to *P. falciparum* occurs mostly during the latter part of life when the disease usually presents as severe anaemia, congenital malaria is infrequent and very young infants are reported to suffer only mild symptoms when they are infected (Afolabi *et al*., 2007). Clinical attacks are said to be rare in the first months of life and severe attacks are believed to more likely develop between the ages of 6 months and 2 years. According to Sodeinde (2007) it is so in this age group because the parasite counts are generally low and high antibody titres that have crossed the placenta from the mother clear the parasites usually within one week. Foetal haemoglobin in baby's red blood cells and the malaria antibodies from the mother together protect the young infant from malaria during the first 6 months of life, the frequency of parasitaemia nevertheless increases with age (Afolabi Lesi and Adenuga, 2011).

In the latter age group, various manifestations of paediatric malaria are known as prodromal symptoms. In non-immune children, the primary attack can vary widely. Also Jayant and Mani (2010) reported that the prodromal symptoms in Indian children include non-specific conditions like generalized weakness, headache, fatigue, abdominal discomfort and muscle ache, loss of appetite, nausea, vomiting followed by fever. Infants

in endemic areas have some immunity to malaria, some symptoms of malaria are often more insidious and they include anaemia, restlessness, loss of appetite, easy fatigue, sweating and intermittent fever (Strickland, 1988).

The classical presentation of malaria consists of paroxysms of chills and rigour (15 min – 1hr) followed by hot state (1 – 8hr) and then there is sweating stage (fever comes down with profuse sweating) (Jayant and Mani, 2010). An irregular fever with respiratory or gastrointestinal symptoms may mark the presence of malaria. Rougemont *et al.* (2015) confirmed that during the rainy, high transmission season in Republic of Niger, there was high significant relation ($p<0.0001$) between the likelihood of fever and the parasite count. In Nigeria, Afolabi Lesi and Adenuga (2011) reported that the diagnoses of malaria in most cases is made on clinical grounds based on the presence of fever without localizing signs which can be confirmed by finding asexual forms of the malaria parasite in the peripheral thin and thick blood films. Symptoms associated with febrile paroxysm include rigour, sweating and headache as well as myalgia, backache, abdominal pain, nausea, vomiting, diarrhoea and pallor. On examination, hepatosplenomegaly was also found. However, malaria may involve every organ hence symptoms can vary accordingly (Strickland, 1988; Jayant and Mani, 2010).

2.3 Theoretical Framework

2.3.1 Knowledge Attitude and Practice (KAP) Theory

The **Critical Knowledge Theory** approaches knowledge as an ongoing dialogue. This theory suggests that an individual is ignorant or holds a belief about a health matter, the educator attempts to change or ascertain the individual's level of knowledge towards the health or concept through questioning the respondent. As the person answer the health question the person's knowledge and belief will begin to change, the new question arises and the respondent asks the educator some questions, the educator responds to

these question (Dignam, 2012). This theory posits that people know about things and events around them through their senses and that knowledge can mean any of the following, too:

1. Be aware of something,
2. Be certain about it,
3. Have understanding or grasp of the object of knowledge,
4. Be familiar with something
5. Be able to recognize or identify something
6. Ability to distinguish between things,
7. Have enough experience and training and to be intimate with something (Dignam, 2012)

Attitude Theory of Cognitive Dissonance posited that attitudes predict behaviour and that where attitude and behaviour are not related to cognitive dissonance results. Cognitive dissonance refers to an individual's motivation to reduce the discomfort (dissonance) caused by two inconsistent thoughts. The attitude theory is based principally on observational learning. The theory explains how people acquire and maintain certain behavioural patterns.

Grizzel, (2013) stated that behaviour is affected by environmental influences, personal factors and attributes of the behaviour itself. The central tenet of the theory being the concept of self-efficacy. This is to say that one must believe in his ability to perform behaviour, and he must see an incentive to doing so.

Practice Theory of Self-efficacy mentioned that the belief that one has is able to control one's practice of a particular behaviour. Self-efficacy refers to one's belief that one can successfully execute a particular action. People are more likely to engage in certain practice when they believe that they are capable of executing those practice successfully.

This means that they will have high self-confidence towards action. In layman's terms, self-efficacy could be looked at as self-confidence towards action, in analysing this, individuals tend to choose activities they will be successful in doing and they tend to put more effort to activity and behaviour they consider they could achieve success. Self-efficacy is so effective because of its influence on certain effective behaviour control (Bandura, 1982).

2.3.2 Health Belief Model

The Health Belief Model (HBM) originated from psychosocial theory, designed by Lewin, which is based on a phenomenological orientation to positive and negative influences in the individual's subjective world as they affect behaviour. The model is a value expectancy model that examines an individual's behaviour, values, and judgment of how an action will provide a positive outcome. The HBM is generalizable in numerous settings, it is cost-conscious, and prompts hypotheses for testing, not to mention it is a proficient predictor of participation in prevention screening programmes (Poss, 2010). The examination of the components associated with the HBM model will further justify its worthiness. A perceived benefit is the individual believes that a specific action will be beneficial in reducing the health threat. The lack of uniformity in testing the model, especially in the way variables is operationalized that the measures and components used in the HBM have not been refined or standardized (Poss, 2011).

HBM examined the effects of health beliefs and decision methods in making behavioural changes. This model is appropriate for this study because it examines the psycho-social factors associated with compliance with malaria prevention. Severity is a person's perception of the symptoms from contracting the illness. HBM examines difficulties in performing the specific behaviours of interest and the negative things that could happen from performing those behaviours, cues to action such as environmental

events, bodily events, or stories in the media that trigger perceptions of susceptibility (Daddario, 2011).

Mcgriff (2010), opined that HBM posits that illness knowledge factors, perceived susceptibility to disease and perceived severity of the disease influence preventative health behaviours. The effects of these factors are influenced by the benefits and efficacy of prevention action and perceived barriers to prevention activities. HBM focuses on the attitudes and beliefs of individuals. The HBM is based on individual participation in health-related action if that individual: (1) feels that a negative health condition can be avoided; (2) has a positive expectation that he/she will avoid a negative health condition by participation in prevention measures; and (3) believes that he/she can successfully participate in the health-related action.

Health Belief Model attempts to reduce the health epidemic by incorporating prevention components susceptibility, severity, benefits, barriers, actions, and self-efficacy. Health Belief Model examines dependably related variables for preventative health behaviour outcomes. Severity has been deemed as the least reliable among HBM variables. Action is the link between intention and implementation execution of the preventative measure. Self-efficacy is an individual's belief that they have the power to implement an action to prevent malaria. The model reviews demographics and socio-psychological factors that are related to healthcare behaviour. Self-report that has commonly been used in empirical studies on the HBM conveys concern about the recall or other biases associated with this reporting style. The HBM does not apply numeric coefficients to the concepts of susceptibility, severity, benefits, and barriers, nor does it delineate the specific nature of the relationships among the variables. Some researchers add variables and others delete variables from the original model. The HBM includes normative or cultural factors that may influence health-seeking behaviours (Poss, 2010).

Application of the theory

The HBM examines individual's perception about illness and disease. A perceived benefit is the individual believes that a specific action will be beneficial in reducing the health threat. HBM is applicable to this study because the health-related behaviours of individuals with regards to malaria prevention relies on the knowledge the individual has of the prevention strategies and the attitude of the individual regarding the prevention strategies. The theory seeks an understanding of an individual's motivation to engage or not to engage in certain prevention strategies and or preventive health practices. Developed in the 1950s, the Health Belief Model (HBM) was designed to explain the failure of people to engage in preventative health behaviours. Health Belief Model attempts to reduce the health epidemic by incorporating prevention components susceptibility, severity, benefits, barriers, actions, and self-efficacy. Health Belief Model examines dependably related variables for preventative health behaviour outcomes. Severity has been deemed as the least reliable among HBM variables. Action is the link between intention and implementation execution of the preventative measure. Self-efficacy is an individual's belief that they have the power to implement an action to malaria prevention.

2.4 Knowledge, Attitude and Practice of Malaria Prevention Strategies among Mothers of under five Children

Review of literatures on the knowledge, attitude and practice of Malaria Prevention Strategies among Mothers of under five Children are presented under this section.

2.4.1 Knowledge of Malaria Prevention Strategies among Mothers of under five Children

Knowledge is the ability to recall or recognize something such as a fact concept, principle or custom (Kalua, 2011). It is further stated that knowledge can be acquired through formal or informal settings either by the help of someone or alone. Knowledge is said to be a source of power necessary for everyone to make informed decisions about one's health and participate actively in promoting the health of the community (Kalua, 2011). Mothers play very important role in the prevention of any childhood disease. In malaria-endemic areas, majority of mothers can identify the disease with fever (Ahorlu, Dunyo, Afari, Koram, & Nkrumah, 1997). Understanding people's perceptions of malaria and the factors which influence this perception must be a central part of mounting successful interventions to the control of malaria throughout the world (Ahorlu, et al, 1997). Within Nigeria, surveys of residents of the Atlantic coast revealed a lack of knowledge and many misconceptions about the transmission and treatment of malaria, which could adversely affect malaria control measures and antimalarial therapy (Afolabi, 2011).

Ashikeni, Envuladu and Zoakah (2013) stated that the mothers of children less than five years in Kuje had poor knowledge of the cause of malaria, its prevention and possible complications, good knowledge of the prevention of malaria among mothers such as the use of ITNs, insecticide sprays, nets on windows and doors or protective clothing, was found to be 5.4% at baseline in the intervention group but this increased to 25% at post-intervention. This was statistically significant (p= 0.0002). In the control group, good knowledge of prevention of malaria increased marginally from 7.7% to9.7% but this was not statistically significant (p= 0.369). Its showed that adequate and proper health education to women especially in the language they understood increased their knowledge and improved their practice of the treatment of malaria in children.

Prevention of malaria has been globally accepted as a significant aspect of malaria control but a majority of mothers of under-five often do not learn the tenets of prevention (Falade, Ogundiran and Bolaji, 2016; Obrist*et al* 2010). Falade, *et al (*2016) found out in their study that many of the mothers do not even believe malaria can be prevented because of series of myths and misconceptions they associate with fever in children. Obrist *et al* 2010 observed that information on utilization of prevention measures like screening of windows and doors with nets, spraying the house with insecticides aerosol, application of insecticide repellent cream, wearing of long-sleeved clothes and destruction of mosquito breeding sites are not common. A large proportion of the mothers accepted that malaria can be prevented, yet none of the prevention measures was utilized by up to50% of the mothers. Personal protection like wearing long sleeved cloth and trouser and environmental management were not well known and practised by the mothers. As found by Amodu, Olumese, Gbadegesin, Ayoola, and Adeyemo,(2006) in their study, the commonly used individual prevention measures among mothers of under-five children were window and door nets, spraying of house with insecticide aerosol and mosquito coil. While the common environmental management measures among them include cutting of grasses around the houses and destroying of the mosquito breeding sites.

2.4.2 Attitude towards Malaria Prevention Strategies among Mothers of under five Children

In the health belief model, individuals perceive themselves to be at risk of the health threat before they will take actions to reduce risk behaviour or engage in healthy alternative behaviours. This may explain why people take their health for granted because they view themselves as not at risk or threatened by potential water-borne diseases. People attitude towards, diseases are challenging and economically, as well as

scientifically, important. It is further stated that people define their personal needs rather than good health.

Houmsou, et al, (2014) stated that with regards to the attitudes of the children's mothers regarding malaria, 73.20% of the children's mothers always referred their children to hospital with 54.72% of them having post-secondary education and it was also reviewed that mothers prefer the use of one prevention strategies than the other especially the use of Insecticide Treated mosquito net. This simply shows that malaria is easily perceived among mothers that have higher educational level. The positive association between level of education and improved perceptions of malaria was also reported in Southeast Nigeria and Zambia. Crombie (2012) where infected persons attributed their preference of patent medicine stores to hospitals, arose from undue delay, unending protocols and bottleneck in hospitals before seeing the doctor. And since they were always in a hurry, would prefer the quickest and easiest way which they say was quite effective and reliable, thus only a few visited the hospital (5.98%). The study revealed that 37.85 % of the respondents used herbs which they referred to as 'Ogwuigbo' as a treatment regimen.

Oyewole and Ibidapo, (2007) in a study of attitudes to malaria prevention, treatment and management strategies associated with the prevalence of malaria in a Nigerian urban centre, reported that prevention measures adopted against mosquito bite include sleeping under net (treated and untreated) 17(4.2%), door and window screening 37(9.2%),cover cloth 55(13.8%), mosquito repellent/insecticides spray 39(9.8%), environmental hygiene 26(6.5%), herbal decoction 26(6.5%), and chemoprophylaxis 45(11.3%). Also in the study, self-treatment (medication) accounted for 267(66.8%) as against hospital treatment 93(23.3%). Attapeu provincial Health service (2003) in a survey of knowledge, attitude and practice (KAP) in Lao PDR reported that 48.5%

responded that they visit a doctor for treatment in hospital, 17.8% said they go to a health centre, 51.8% goes to buy and take medicine, by themselves and 9.5% undergoes traditional healing practice. The prevention strategies adopted include: sleeping under mosquito nets (91.3%), drinking boiled water (15.5%), keeping the house and surrounding clean (54.8%) and wearing long sleeves shirts (23%).

In a study by Oyedeji, Yussuf, Abdul Wasiu-Idowu, and Oyedeji, (2009) on the use of ITNs among children aged 3months to 13 years in south-western Nigeria. The prevalence of the use of ITNs was1%. The major reasons why ITNs were not used was because of ignorance, unavailability, use of alternative barrier methods and financial constraints. The alternatives were insect sprays, mosquito repellent coils, screened doors and windows and topical cream agents. Mothers also complained of lack of freedom of access and exit thus making the tool a cumbersome daily exercise and fear of their child developing allergy. The poor prevention practice could be a reflection of this poor association. These inadequacies might have been the reasons for poor practice of home management and prevention of malaria among the mothers. These conform to findings of previous studies conducted among rural dwellers in Nigeria and Sub-Sahara Africa (Faladee*t al.,* 2016; Oyedeji *et al.,* 2009; Noor, Omumbo, Amin, Zurovac, & Snow, 2006; Ebuehi & Adebajo, 2010).

There is a definite need for further research and more recent research, especially now that so many plans to fight malaria have been implemented. People's attitudes toward this disease as well as its treatments and preventions greatly influence their compliance; knowing these attitudes and ideas will help educators and health care providers modify their plans for decreasing the spread of malaria. Understanding people of western and northern Africa's current ideas toward malaria will help in the construction of plans to provide better, more adequate care (Oyedeji*et al.,* 2009).

2.4.3 Practice of Malaria Prevention Strategies among Mothers of under five Children

Practice is an action or behaviour that individual engages in and is normally induced by attitude either consciously or unconsciously. It can also be referred to as behaviours, specifically referring to a behaviour that a person engages in (Williams, 2015). The terms, practice and behaviours, are used synonymously in this study. Research suggests that prevention practice are crucial elements in any effort targeted towards the reduction of disease burden such as malaria (Minnesota Health Improvement Partnership Social Conditions and Health Action Team, 2010). Tyagi, Roy, and Malhotra (2015) reported that the failure to establish practice of community members regarding malaria was responsible for the inability of intervention programmes to achieve sustainable control. It has also been observed that community participation which is paramount in the control of malaria depends, among others, basically on the people's prevention practice (Sharma, Bhasin and Chaturvedi, 2007). Some socio-demographic factors are known to influence the understanding as well as demonstration of prevention practice regarding communicable diseases, including malaria, in under-five children.

Furthermore, some cultural beliefs and myths about illness perception prevalent in many rural settings are likely to influence malaria prevention practice among rural dwellers. Since women population in Ebonyi state comprises different educational levels, it is vital to establish whether the level of education will influence practice of actions that could prevent malaria among expectant mothers in the state. Further comparison between urban and rural women in the state will offer valuable facts in years to come for planning, designing and execution of programmes aimed at malaria prevention in the state.

Despite the urgent need for the eradication of malaria, the practice of its prevention measures remains a major challenge in Nigeria especially with respect to the three-prong preventions measures recommended by RBM for under-five children. These measures as earlier stated include the use of ITN, uptake of IPT and Prompt treatment and early diagnosis. World Health Organization (2015) revealed that although many health facilities in many endemic countries including Nigeria have begun the implementation of IPT and prompt case management, only 5% under-five children receive good prevention regimen with the situation being more severe among under-five children residing within local settings. Research report (Sheeran, and Abraham, 2011) on some countries in African revealed that under-five children who make use of prevention regimens in line with the prescribed standards of WHO are only about twenty percent.

The practice of prevention of malaria has been globally accepted as a significant aspect of malaria control but majority of mothers of under-five often do not learn the tenets of prevention (Falade *et al* 2016, Obrist *et al* 2010). Falade, *et al., (*2016) found out in their study that many of the mothers do not even believe malaria can be prevented because of series of myths and misconceptions they associate with fever in children, that practice of prevention measures like screening of windows and doors with nets, spraying the house with insecticides aerosol, application of insecticide repellent cream, wearing of long-sleeved clothes and destruction of mosquito breeding sites are not common.

The use of ITNs to protect children from malaria parasite transmission is one of the main strategies recommended by the Roll Back Malaria (RBM) partnership. A major objective of the (RBM) campaign is to have 80% of under-five children and children aged under-five sleep under ITNs by 2010 (WHO, 2015). In the year 2010, the African summit on RBM considered the removal of taxes and tariffs on ITNs as one of the

important arsenals for fighting malaria. However, as of year 2007, more than half, 24 of the 39 Abuja signatories continue to impose taxes and tariffs on this life-saving tool. Taxes and tariffs considerably increase the price of ITN, reduce affordability, and discourage the commercial sector from importing ITNs (Alilio et al., 2007). The government of Ghana through its Ministry of Health has been at the forefront of malaria control and actively involved in the global effort against malaria under the RBM initiative. The commitment of the government of Ghana in the fight against the menace could be seen in the tax waiver on the importation of nets since 2010. This is to help render the price of ITNs affordable across income groups. A study by Simons et al. (2012) has shown that a reform of the tariff and tax policies on insecticides could significantly influence bed net use.

2.5 Prevention Strategies of Malaria among mothers of under-five children

The method used to prevent the spread of disease, or to protect individuals in areas where malaria is endemic, include prophylactic drugs, mosquito eradication, and the prevention bites (Oreagba, Onajole, Olayemi, & Mabadeje, 2014). The continued existence of malaria in an area results from a combination of high human population density, high rate of transmission from human to mosquitoes and from mosquito to humans. If any of these is lowered sufficiently, the parasite will sooner or later disappear from that area, as happened in North-America, Europe. However, unless the parasites are eliminated from the whole world, it could become re-established if conditions revert to a combination that favours the parasite's reproductions (RBM, 2015).

According to Afolabi (2016), levels of malaria prevention was classified into 4 ways. They are;

a) Preventing infection by avoiding bites by parasite-carrying mosquitoes.

b) Preventing disease by using anti-malaria drugs prophylactically. The drugs do not prevent initial infection through a mosquito bite, but they prevent the development of malaria parasites in the blood which are the forms that cause disease. This type of prevention is also called suppression.

c) Prevention and Control in Endemic Areas. Prevention is an important component of malaria control in endemic areas. It is achieved through;

   i) Vector control

   ii) Personal protection measures such as insecticide-treated bed nets and mosquito repellent creams.

d) Prevention treatment with anti-malaria drugs of vulnerable groups such as under-five children who receive intermittent treatment.

Patel, Gupta, and Oswal (2012) and Okwa (2013) reviewed current trends in the battle against malaria by use of Insecticide-treated nets (ITNs), vector control, Indoor residual spraying (IRS), use of mosquito repellent, electric mosquito zapper and health education on knowledge, attitude and practice.

I. **Insecticide-treated nets:** One of the highly recommended strategies of "Roll Back Malaria" was the utilization of ITNs as personal protective devices or tools to kill or repel mosquitoes (WHO, 2012). These nets were used in order to orchestrate a barrier between mosquitoes and humans especially the vulnerable. There are two types of nets used:

   Insecticide-treated nets (ITNs), which require re-treatment every 6 to 12 months and insecticide can be permethrin or deltamethrin. *"*Deltamethrin is effective for a year; thus, re-treatment is annual. Permethrin lasts for six months; thus, two treatments per year are assumed if the transmission season is longer than six months*″* (Jamison, 2016).

Long-lasting insecticidal nets (LLINs) are also manufactured with insecticide-impregnated to last for 4-5 years (Guillet, 2011).

Although untreated bed nets have been used for mosquitoes nuisance as well as malaria control, ITNs are far more effective than untreated nets in reducing malaria, especially in children less than 5 years of age. Pyrethroids are the insecticides of choice for treatment due to their low mammalian toxicity. They are extremely safe for household use and even if an infant chews a relatively large area of the treated netting, it would not exceed the maximum daily intake level. To be of maximum effectiveness, bed nets should be used properly and at the right time and place. In doing so, bed nets should be tucked in under the mattress, vulnerable groups especially children should be under the bed nets early in the night and care must be taken to avoid contact of bare arms and legs to the nets as mosquitoes can blood feed from them against the nets.

In Africa, malaria-carrying mosquitoes typically bite between dusk and dawn. A net hung over the sleeping area prevents mosquitoes from biting. When that net is treated with insecticide, it provides greater protection by repelling mosquitoes and killing those that land on it. It thus provides a physical and chemical barrier to the mosquitoes. The insecticides used to treat the nets have been approved for safety and efficacy by the WHO. In Nigeria insecticides approved by WHO Pesticide Evaluation Scheme (WHOPES) and National agency for food, drug administration and control (NAFDAC) are used for ITNs in Nigeria. ITNs have been shown to reduce all-cause mortality in children under-five by about 20 percent and malarial illnesses among children under-five and pregnant women by up to 50 percent. Until a few years ago, ITNs required re-treatment with insecticide about every six months to maintain their effectiveness.

The use of ITNs has been known to reduce childhood mortality by 18% in sub-Saharan Africa (WHO, 2007). Newer, long-lasting ITNs have the insecticide bound to the netting material during production, which enables them to maintain their full protective effect through at least 20 washes, which is estimated to be about three years of regular use. (www.pmi.gov). Two such nets that have passed WHO approval and in the market are the Olyset net with permethrin insecticide and Permanet with deltamethrin insecticide. Nigeria demonstrated its commitment in rolling back malaria by hosting the Roll Back Malaria Africa summit in Abuja, Nigeria in April, 25 2015. They also declared that 60% of children and pregnant women should sleep under nets by 2015. ITNs are now distributed freely to vulnerable groups in Nigeria. However, it has its limitations in its usage in Nigeria.

In a study by Ordinioha (2012) in Rivers State, south – south Nigeria, net ownership does not always translate to use; with factors such as low mosquito activity and high nighttime temperature capable of reducing use to as low as 20%. Low mosquito activity has particularly been noted to be a very important deterrent to ITNs use in several communities in Nigeria, where the net is predominantly used for mosquito nuisance control and not malaria control. The study also showed that a large number of the nets were not hanged, improperly deployed and unoccupied. Reasons given were torn nets, forgetfulness and tiredness. Although, this is consistent with the findings in several other communities in Nigeria. In a study by Oyedeji et al (2009) on the use of ITNs among children aged 3months to 13 years in south-western Nigeria. The prevalence of the use of ITNs was 1%. The major reasons why ITNs were not used was because of ignorance, unavailability, use of alternative barrier methods

and financial constraints. The alternatives were insect sprays, mosquito repellent coils, screened doors and windows and topical cream agents. Mothers also complained of lack of freedom of access and exit thus making the tool a cumbersome daily exercise and fear of their child developing allergy.

II. **Vector control**: Prevention and control mechanisms with respect to addressing the vector population largely depends on combining different methods such as environmental management by educating the population on the need for environmental and personal hygiene especially in keeping the immediate surrounding clean with proper drainage system, and above all instigating a change in behaviour of the population at risk (Jamison, 2016). According to Erhun, Agbani and Adesanya, (2005), malaria was successfully eradicated or controlled in several tropical areas by removing or poisoning the breeding grounds of the mosquitoes or the aquatic habitats of the larva stages, by filling or applying oil to places with stagnant water. These methods have seen little application in Africa for more than half a century. Efforts to eradicate malaria by eliminating mosquitoes have been successful in some areas. Malaria was once common in the United States and Southern Europe, but the draining of wetlands breeding grounds and better sanitation, in conjunction with the monitoring and treatment of infected humans eliminated it from affluent regions. Malaria was eliminated from the Northern parts of the USA in the early twentieth century, and use of the pesticide DDT eliminated it from the South by 1951. In the 1959s and 1990s, there was a major public health effort to eradicate malaria worldwide by selectively targeting mosquitoes in areas where malaria was rampant. However, these efforts have so far failed to eradicate malaria in many parts of the developing world- the problem is most prevalent in Africa (RBM, 2015).

III. **Indoor residual spraying (IRS):** IRS is defined as the application of stable formulations of insecticides on the inside of houses to kill mosquitoes that come in contact with. Application of non-residual formulations like aerosols in houses especially children's bedrooms before retiring at night is also recommended for temporary malaria control. It is recommended to apply the spray well before the children are put in the room to sleep to reduce the risk even further. It involves applying lethal doses of insecticide for at least 6 months on the wall of buildings, thus, repelling the mosquito vector from entering houses, and eventually prevents transmission of malaria (Jamison, 2016). Amongst the widely used insecticides, are: organophosphates, carbamates, and pyrethroids, generally accepted because of their property of rapid degradation in the soil. Other types of insecticide (dichlorodiphenyl-trichloroethane, or DDT) belonging to the organochlorines group, have widely been rejected and banned in many developed nations given their persistence in the environment and adverse effects on the health of humans and wildlife, though some countries still rely on them (Robert, 2016). However, the consistent use of IRS would not be cost-effective in the endemic areas where transmission is year-round due to lack of affordability, acceptance and other political constraints. IRS is a highly effective method of malaria control recommended by the World Health Organization. Unfortunately it remains underutilized in sub-Saharan Africa (WHO Global Malaria programme (2010). IRS, a proven and highly effective malaria control measure, involves the coordinated, timely spraying of the interior walls of homes with insecticides. Mosquitoes are killed when they rest on those walls. Sprayed houses are protected for about 4 to 10 months, depending on the insecticide used and the housing construction. While previously the WHO had recommended IRS only in

areas of sporadic malaria transmission, in 2016 it began recommending IRS in areas of endemic, stable transmission as well. IRS is considered as one of the major vector control interventions used in Nigeria today. Pilot trials have been carried out in 2016 in Epe Local Government Area in Lagos State, Barkin-Ladi in Plateau State and Damboa in Borno State using three different insecticides namely Lambda-cyhalothrin, Alpha Cypermethrin and Bifenthrin all of which are synthetic pyrethroids. The evaluation report of the IRS pilot trial by a WHO external consultant recommended that the intervention be scaled up in the country. Further IRS pilot trial using two insecticides namely Deltamethrin and Bendiocarb were carried out in Remo North LGA in North-central zone, Barkin-Ladi in Plateau State and Madagali LGA in Adamawa State. In a study in Iba Local Council Development Area, Lagos, 86% of residents believed IRS was effective and 87% claimed they rarely had malaria again after the intervention (Ajose, 2012).The country has now poised to scale up IRS intervention throughout the ecological zones. WHO has approved 12 insecticides it considers effective and safe for use in IRS, including DDT. The choice of insecticide depends on its registration status in-country, the housing construction (e.g., mud, brick, or wood), the duration of the malaria transmission season, and susceptibility of local *Anopheles* mosquitoes to the insecticide.

IV. **Mosquito repellent**: A mosquito repellent is a substance applied to skin, clothing or other surfaces which discourages insects (and arthropods in general) from landing or climbing on that surface. There are also mosquito repellent products available based on sound production, particularly ultrasound (inaudibly high-frequency sounds) involves the use of mosquito repellent which is generally composed of chemical substances, in order to prevent the bites of mosquitoes.

These may include: toxic plant derivatives (pyrethroids), or the use of rudimentary methods of burning herd or plants to produce smoke, thus repelling mosquitoes (Jamison, 2016). Even though several methods have been used to repel mosquito, (Charlwood & Jolly, 1984) in a study at Papua New Guinea showed that the use of ITNs produced more effective results with minimum health implications. Different chemicals such as Diethyl-meta-toluamide (DEET) in formulations like spray, cream, lotion and fumigants are commercially available to be used personally to keep the mosquitoes away. Application of every 3-4 hours of any formulation of DEET less than 40% to exposed areas of skin except eyes and mouth is recommended. In infants, hands are frequently put in mouth, so they are not to be treated.

V. **Electric mosquito zapper and mosquito magnet:** An electric zapper works by using ultraviolet light to lure in bugs and then kills them upon contact with its lethal dose of electrical charge. The Mosquito Magnet mimics mammals by giving off carbon dioxide, heat and moisture. Once the mosquito gets too close to the magnet, it is sucked in and eventually dies of dehydration these are combined with an attractant called octanol which is a natural plant pheromone. As an advantage, the Mosquito Magnet not only captures mosquitoes, but will also kill biting midges, black flies, and sand flies. It vacuums the insects into a net where they dehydrate and die. The mosquito magnet works by releasing a carbon dioxide spray, heat and moisture. Insect repellents help prevent and control the outbreak of insect-borne diseases such as malaria, Lyme disease, Dengue fever, bubonic plague, and West Nile fever. Pest animals commonly serving as vectors for disease include the insect's flea, fly, and mosquito; and the arachnid tick.

Health education on Knowledge, Attitudes and Practice (KAP): Health education is the profession of educating people about health. It can be defined as the principle by which individuals and groups of people learn to behave in a manner conducive to the promotion, maintenance, or restoration of health. The environment will best reduce mosquitoes. Health Education involves the provision of knowledge acquired as information through various media while Health Counselling requires interaction between individual with the ability to acquire skills. Given the importance of this component, it was imperative that households should acquire information on ways to prevent malaria especially for populations in endemic communities. In which case, these should include the importance of the population to seek prompt treatment at accessible health facilities with support and in full compliance with the overall health system (Jamison et al., 2016). Usually local affiliated NGOs alongside community's leaders and volunteers play a very active role in disseminating information to the local population. According to Gilles (2012) individuals involved in such activities are an extension of the health system and they work alongside competent health professionals or health nongovernmental organizations in accordance with standards established by different governments. The Joint Committee on Health Education and Promotion Terminology of 2011 defined Health Education as "any combination of planned learning experiences based on sound theories that provide individuals, groups, and communities the opportunity to acquire information and the skills needed to make quality health decisions. WHO (2014) defined Health Education as "comprising of consciously constructed opportunities for learning involving some form of communication designed to improve health literacy, including improving knowledge and developing life skills which are conducive to individual and community health. Education for health begins with people. It hopes to motivate them with whatever interests they may have in

improving their living conditions. Its aim is to develop in them a sense of responsibility for health conditions for themselves as individuals, as members of families, and as communities. In communicable disease control, health education commonly includes an appraisal of what is known by a population about a disease, an assessment of habits and attitudes of the people as they relate to spreading and frequency of the disease, and the presentation of specific means to remedy observed deficiencies. Health education is also an effective tool that helps improve health in developing nations. It not only teaches prevention and basic health knowledge but also conditions ideas that re-shape everyday habits of people with unhealthy lifestyles in developing countries. This type of conditioning not only affects the immediate recipients of such education but also future generations will benefit from improved and properly cultivated ideas about health that will eventually be ingrained. KAP studies measure the knowledge, attitude and practice of a community. It is the educational diagnosis of a community which eventually is essential for control programmes. The knowledge of malaria is the understanding, which affects the attitude which is the preconceived ideas and feelings which culminates in practice, the way they demonstrate this knowledge and attitude by their actions. KAP is simply then awareness tailored to the need of a community. KAP on malaria studies have being carried out in various communities in Nigeria focusing on different age groups i.e. School children and students (Okwa, Bello, & Olundegun, 2011), adolescents (Okwa and Ibidapo, 2010), Occupation i.e. artisans and Traders (Okwa et al., 2011) educated i.e. academic staff (Okwa, Soremekun, Adeseko, & Raheem, 2012).

2.5.1 Effects of Malaria Infection on Biological Profile of the Infected Child

Effects on Haematology

(a). Central nervous system (CNS) manifestation: CNS manifestations which are common in children can be due to the following causes:

(i) Severe infection and cerebral malaria

(ii) Severe infection and hypoglycaemia

(iii) Hypoglycaemia induced by quinine

(IV) Severe anaemia

(v) High-grade fever

(vi) Drug-induced behavioural changes (Strickland, 1988).

However, CNS dysfunction may not always, indicate cerebral malaria and it is very important to differentiate between the various causes. Despite prompt treatment with an effective antimalarial drug, cerebral malaria still has a mortality of 20 – 30% (Shabbar *et al.,* 2007). The mortality and morbidity among patients with cerebral malaria still remain unacceptably high and this has been further compounded by the emergence and rapid spread of drug-resistant *P. falciparum* (Olumese *et al.*, 2007). The earliest symptoms of cerebral malaria in children include high-grade fever (37.5 – 410C) and failure to eat and drink, vomiting and cough are common. *P. falciparum* can present as frank cerebral malaria in which there is repeated convulsion (>3 convulsions in 24 hours despite cooling) or unrousable coma not attributed to any other cause. Neurological sequelae occur in more than 10% of the children. Abnormality of brain stem reflexes (e.g. ocular vestibular and ocular cervical) may also be found (Jayant and Mani, 2010).

Shabbar *et al*. (2007) reported that out of the 624 children with defined cerebral malaria, 124 (21.5%) died in Nigeria. Three-quarters of the deaths occurred within 24 hours of admission and multiple logistic regression analysis showed that a cold periphery (odds ratio = 2.7) a deep comma (OR = 2.0) and hypoglycaemia (OR = 4.1) were the

clinical signs and laboratory parameter that predicted death most strongly. They, therefore, concluded that combination of clinical and laboratory manifestations can identify a group of children with cerebral malaria who are most at risk of dying and requires intensive care.

Also in Nigeria Olumese *et al.* (2007) reported that the time interval between the last seizure episode and presentation to the hospital, malnutrition, abnormal posture (decerebrate or decorticate), absence of corneal reflex, increasing depth and duration of coma, respiratory distress and retinal haemorrhage were all independently associated with high mortality. They equally reported that haemoglobin AS individual with cerebral malaria did not exhibit major differences in clinical and laboratory characteristics when compared with their haemoglobin AA counterpart. There were no deaths among the Hb AS children compared with 18% mortality in Hb AA group. They, therefore, concluded that the clinical manifestations of cerebral malaria are similar in children with haemoglobin AS and AA but the former has higher transfusion needs and are less likely to die. Afolabi and Adenuga (2011) reported that cerebral malaria in children is characterized by unrousable coma longer than one hour or altered consciousness in a child with asexual forms of malaria parasitaemia in the blood. It is due to the sequestration and blocking of cerebral capillaries by parasitized and non-parasitized red blood cells.

Some children may have noisy and laboured breathing. Deep breathing due to acidosis may be seen in some cold, clammy skin with a core-to-skin temperature difference of >100C. While some children may have associated shock, with the systolic pressure below 50 mmHg. Some children may present with extreme episthotones (‘bent-like-a bow) posture mimicking either tetanus or meningitis (Davis, 2011). Severe cerebral malaria is characterized by clogging of the postcapillary venules by *P.*

falciparum parasites. Mature, knobs appear on the surface of the parasitized red cells that facilitates cytoadherence of *P. falciparum*-infected red cells, to endothelial cells in capillaries and postcapillary venules of the brain, kidneys and other affected organs (Pavithran, 2015). The malaria parasite uses blood group antigen A present on the surface of uninfected red cells for rosette formation (Pogo and Chaudhurie, 2010), resulting in occlusion of cerebral vessels. Cyto-adherence is followed by sequestration of parasitized red cells to endothelial cells leading to endothelial cell damage, leakage of plasma and occlusion of micro-circulation.

(b). Anaemia

Most of the systematic complications from malaria results from hyper-parasitaemia and is often associated with high mortality (10 – 30% in complicated *P. falciparum infection*).haematological changes, which are the most common complications play a major role in these fatal complications (Pavithran, 2015). They include anaemia, cytoadherence of infected red cells, leukocyte change followed by induction of cytokines, thrombocytopenia and coagulopathy, particularly disseminated intravascular coagulation (DIC) (Strickland, 1988; Pavithran, 2015). Severe anaemia is defined as a haematocrit <20%. It is due to the presence of haemolysis and dyserythropoiesis in children with malaria. Certain factors have been shown to increase the risk of developing severe anaemia in children with malaria. These are; the age of the child (4 years), fever lasting longer than four days, hepatosplenomegaly and the presence of coma (Afolabi and Adenuga, 2011). The incidence of anaemia in malaria was reported to be as high as 74% in India (Jooter *et al.*, 1995). Severe anaemia was observed predominantly in *P. falciparum* infection with hyperparasitaemia and systemic complications, such as disseminated intravascular coagulation (DIC) (Afolabi and Adenuga, 2011).

Anaemia in malaria is caused by:

(a) Bone Marrow Suppression: This is evidenced by suppression of CFU – E and BFU – E in the bone and decreased erythropoietin levels (Burgmann *et al.*, 2011; Abdulla *et al.*, 1980).

(b) Ineffective erythropoiesis: This is most often seen in chronic malaria and is due to dyserythropoiesis in vitro defective heme synthesis and premature death of normoblasts. Certain factors have been shown to increase the risk of developing severe anaemia in children with malaria. These are the age of the child (4 year –0) fever lasting for more than 4 days, hepatosplenomegaly and the presence of coma (Afolabi and Adenuga, 2011).

Anaemia has been reported as a clinical feature of *falciparum* malaria. It was found out that there was a significant increase in the prevalence of anaemia PCV>25% with an increase in parasite density. After the age of 7 months, infants with low parasite density tend to recover, probably as a result of developing immunity, therefore, the maintenance of low parasite density appear crucial to the survival of infants in malaria-endemic areas (Kitua *et al.*, 2007). In line with the above observation, Gregory *et al.* (1985) and Achidi *et al.* (2011) also reported that malaria parasitaemia significantly lowered the PCV levels of infants only at four ($p<0.0001$), six ($p<0.025$), eight ($p<0.001$) and 10 ($p<0.01$) months of age. However, there was no difference in the frequency of haemolysis or dyserythropoiesis in the children with malaria anaemia and those with anaemia from other causes, such as iron deficiency or sickle cell disease (Newton *et al*., 2007).

The rate of development and degree of anaemia depend on the severity and duration of parasitaemia. In some children, repeated untreated episodes of malaria can result in normocytic anaemia. In these cases, bone marrow shows changes of

dyserythropoiesis and peripheral blood shows low-grade parasitaemia. In patients with high parasitaemia anaemia may develop rapidly due to haemolysis of the parasitized red cells and this may worsen even after completion of anti-malaria therapy. Also children with severe anaemia may present with symptoms and signs of cardiac failure, dyspnoea, tachycardia, gallop rhythm, basal crackles, hepatomegaly, raised jugular pressure, confusion, restlessness and retinal haemorrhages (Davis, 2011). In Papua, New Guinea the most common severe manifestations of malaria were severe anaemia (22%) and coma (16%). Children with severe anaemia were younger than those with coma (median age 2.2 Vs 3.7 year) and had been ill for longer days before admission (median 7 vs. 4 days respectively). Jayant and Mani (2010) reported that in India mild anaemia is very common. The anaemia may be very severe (presenting with Hb<5g/dl or Hct<15% in the presence of parasite count >10,000/mcl) or even fatal, particularly when it is chronic and recurrent. In Nigeria, anaemia is characterized by pallor, easy fatigability, tachycardia and restlessness. However, differentials to be considered include sickle cell anaemia, malnutrition, septicaemia and leukaemia. Afolabi and Adenuga (2011) confirmed that malaria is a potent cause of severe anaemia in children (6 months to 3 years) in endemic areas and it may be sufficiently acute and severe to cause death. They reported an anaemic heart failure that accounted for 18.4% deaths amongst children. Non-severe malaria anaemia can be reduced by treatment to eradicate malaria infection combined with specific therapy and health education to address any other causes (Bates, 2014). Studies in Tanzania demonstrated that weekly pyrimethamine-dapsone between the ages of 2 – 11 months reduced episode of malaria by 60% and episodes of anaemia by 57% during the first year of life, therefore, WHO have approved intermittent treatment (MIT) i.e. a full treatment – dose of anti-malaria drug given at specific time during the first year

of life. Also iron supplement has been shown to be safe and effective when given orally and daily during the infants first year of life (Menendez, 1977).

(c). Hypoglycaemia: It is less common in children compared to adult. It occurs in some patients with severe *falciparum* malaria and markedly increases both morbidity and mortality. Most patients had hypoglycaemia before treatment, which was associated with elevated plasma concentrations of lactate, alanine, and 5-nucleotidase. It is also associated with cerebral malaria and is more common in young children and pregnant women (Strickland, 1988). It may present with convulsions or impairment in the level of consciousness. In India, blood glucose concentration <40mg/dl, hepatic dysfunction – hepatomelogy with or without jaundice (visible jaundice or S. Bilirubin >2.5mg/dl) may be seen in severe malaria which mimics viral hepatitis (Jayant and Mani, 2010). Also high level of plasma lactate (> 5mmol/L) was common (20%) and was the major predictor of death in Papua, New Guinea.

(d). Fluid electrolyte and acid-base imbalance: These are manifested in the form of dehydration, dyselectrolytemia and academia/acidosis (Arterial ph<7.25 or plasma HC03 <15.m mol/L (Jayant and Mani, 2010). Raised plasma creatinine and decreased plasma bicarbonate were observed and this suggested that an investigation of the causes of acidosis in children with malaria should be high research priorities.

(e). Renal failure: Renal failure is uncommon in children, however, mild renal abnormalities including slightly elevated urea, nitrogen and creatinine levels, proteinuria and abnormal urine sediment, are common in malaria. Acute renal insufficiency is common in severe *falciparum* malaria with high parasitaemia and marked intravascular haemolysis (Strickland, 1988). Oke (2011) reported Oliguria with preceding anuria which can occur with associated uraemia in chronic *Plasmodium* malaria infection. Jayant and Mani (2010), observed that in rare conditions, there is renal failure

(presenting with urine output <12ml/kg /24hrs in children failing to improve after re-hydration, creatinine level is >3mg/dl). Urine volume usually resume in median 4 days and creatinine level come down to normal in a mean of 17 days.

(f). Bleeding: Bleeding tendency with prolonged clotting time, thrombocytopenia and decreased coagulation factors may occur in *falciparum* malaria. Spontaneous bleeding from various sites' including the upper GI tract may occur (Olumese *et al.,* 2007; and Davis, 2011).

(g). Pulmonary oedema: Children with cerebral malaria, severe anaemia and high parastaemia, may develop acute pulmonary oedema. Acute pulmonary oedema can develop rapidly and has been associated with excessive intravenous fluid administration and is often fatal (Strickland, 1988). This result in respiratory distress (tachypnea, deep breathing / nasal flaring / intercostals in-drawing) and / radiological evidence of pulmonary oedema (Oke, 2011; Strickland, 1988; Jayant and Mani, 2010).

(h). Low blood pressure: In these patients, the blood pressure is low i.e. 80 to 90mmHg/40 to 50mmHg and there is actual vascular collapse, resembling acute adrenal insufficiency. These patients have pale, cold and clammy skin with shallow breathing (Quinn and Strickland, 1986). In India, Jayant and Mani (2010) reported that there was circulatory collapse (systolic BP <70mmHg in older children, <50mmHg in 1 – 5 years with cold extremities, temperature difference >100c in case of severe *P. falciparum* infection.

(i). Spleen rupture: Malaria is an important cause of spontaneous rupture of spleen. It is more common in *vivax* malaria than *falciparum* malaria and tends to occur in up to 0.7% of the patient (Wareell *et al.,* 1990; Jayant and Mani, 2010). The spleen is enlarged and tense, and the cut surface is slate gray with prominent Malpighian corpuscles. The blood vessels, Billroth Cords, and Sinusoids are enlarged with parasitized erythrocytes. The

organ is often friable, it occasionally rupture, causing death (Strickland, 1988; Oke 2011).

(j). Haemolysis in malaria: Haemolysis that is out of proportion results into anaemia. During the acute phase of malaria, the survival of Cr-tagged erythrocytes is reduced in both infected and non-infected erythrocytes. Sequestration and destruction of erythrocytes occur in the spleen. The extents of sequestration correlate with splenic size and not with the presence of the anti-malaria antibodies. In some patient, haemolysis is out of proportion to the parasitaemia suggesting an autoimmune component to the anaemia (Marsh, 1999).

Haemolysis is common with *P. falciparum* infection. It is predominantly extravascular but could be intravascular also (Pavithran, 2015). In extravascular haemolysis, both parasitized and not parasitized red cells are destroyed as they pass through the spleen by the process of "pitting" (Perrin *et al.*, 1982). Following the pitting of parasites, the red cells lose their membrane deformability and are further destroyed in the spleen. The non-parasitized erythrocytes were destroyed by:

(i) Increase activity of macrophages in the spleen

(ii) Non-immune mechanism. This is the changes of the red cell membrane-like increased membrane peroxidation, change of membrane lipid and ATP, and alteration of Intra erythrocyte content of Na, K and Ca.

(iii) Immune destruction – By IgM and 1gG antibody: In intravascular haemolysis, the mechanisms involved in the pathogenesis are the use of antimalarial drugs like quinine, G6PD deficiency and malaria fever (Rocket *et al.*, 1994). Quinine is also known to induce immuno–haemolytic anaemia (Pavithran, 2015). Studies on the losses of blood Hb, increase in Plasma Hb and appearance of Hb in the urine indicated that extravascular

clearance of red cells was the predominant mode of erythrocytes clearance; however, some subjects showed minor signs of intravascular haemolysis (Ekvall *et al.*, 2011).

(k). Changes in leukocytes: Changes in leukocyte proliferation and function are seen with severe *P. falciparum* infection. Leukocyte proliferation is associated with the release of cytokines like TNF, S/L-1, S/L-2, S/L-6 and S/FN. They are involved in cytoadherence, thrombocytopenia, disseminated intravascular coagulation, hypoglycaemia and lactic acidosis (Sharma *et al.*, 1992; Krishna *et al.*, 1994). Hypoglycaemia has also been shown to be a consequence of parenteral Quinine therapy (i.e. as a result of quinine induced hyperinsulinaemia). In another study Ladhani *et al.*, (2012) reported that children with malaria had a higher white cell count and that leucocytosis was strongly associated with younger age, deep breathing, severe anaemia, thrombocytopenia and death.

(l). Changes in platelets/thrombocytopenia: Thrombocytopenia and platelet dysfunction is the most important changes seen in malaria infection (Pavithran, 2015). It was seen in 40% of patients infected with *P. falciparum* infection in India (Burgamann *et al.*, 2011). Maximum thrombocytopenia in malaria is due to peripheral destruction and consumption by disseminated intravascular coagulation (Looareesuwan *et al.*, 1993). About 70% of malaria hospitalized patient had thrombocytopenia, 95% with thrombocytopenia were suffering from *falciparum* malaria and 5% had *vivax* malaria, this should alert the severity of childhood *falciparum* malaria (Abdul Rauf and Afsar, 2016).

In platelet dysfunction, two types of changes are seen. Initially, there is platelet hyperactivity; this is followed by platelet hypoactivity. Hyperactivity results from various aggregating agents like immune complexes, surface contact of platelets membrane to malaria red cells and damage to endothelial cells. The injured platelet

undergoes lyses intravascularly. The release of platelet content can active the coagulation cascade and contributes, to DIC. Transient platelet hypoactivity is seen following this phase and returns to normal in 1 to 2 weeks (Srichaikul *et al.,* 1988). Laura *et al.* (2014) reported that persons with platelet count <150,000 / μL were 12-15 times more likely to have malaria than persons with platelet count >150,000 / μL. Also a platelet count of less than 150 109/L was found in 56.7% of children with malaria and was associated with age, prostration and parasite density, but not with bleeding problems or mortality. The mean platelet volume was also higher in children with malaria compared with other medical conditions (Ladhani *et al.*, 2012).

(m). Disseminated intravascular coagulation. The incidence of DIC is reported to be 4 –13% and it usually occurs in patients with *P. falciparum* infection and hyperparasitemia (Murthy et *al.*, 2010; Pavithran, 2015). In severe complicated malaria, there is activation of coagulation cascade by the release of various procoagulants. Procoagulants are derived from various sources – lyses of platelets and red cells, release of tissue factors from monocytes and damaged endothelial cells, cytokines and microcirculatory stasis (Pavithran, 2015). *P. falciparum* infection was associated with increasing plasma levels of plasminogen activator inhibitor, factor VIIIR: Ag and reduced levels of protein C, protein S and antithrombin III. The monocyte procoagulant activity was also found to be high in *P. falciparum* infection. All these contribute towards a hypercoagulable state in *P. falciparum* infection (Pukrittayakama *et al.*, 1989; Mohanty *et al.*, 1985; Mohanty *et al.*, 2007).

Despite all the haematological change observed in complicated and non-complicated malaria infection in children, WHO trials showed that malaria chemoprophylaxis improves mean haemoglobin levels and reduces severe anaemia, clinical malaria attacks, parasite and spleen rates. Significant reductions in outpatient

attendance and hospital admissions have been achieved (WHO, 2011). Therefore, intermittent routine combination therapy early in childhood may be appropriate for those living under holoendemic condition.

2.6 Malaria in Africa

Despite a great diversity of geographical, economic, cultural and political landscapes, countries in Africa share the common challenges of a high disease burden and relatively weak health systems (Malaria Consortium, 2016). The Sub-Saharan Africa region has the greatest number of people exposed to malaria transmission and the highest malaria morbidity and mortality rates in the world (WHO, 2015). About 91% of all malaria deaths occur in Africa (WHO, 2011). Malaria accounts for 25 to 45% of all outpatient clinic attendances, between 20 and 45% of all hospital admissions and cause 17% of under-five mortality in the African region (WHO, 2011). It is widely appreciated that there may be considered seasonal and between year variations in all malaria-metric indices such that assessments undertaken in a population in different seasons or years may produce dramatically different results (Kalua, 2011). The epidemiology of malaria and the ecological and social linked distribution of malaria vectors are complicated by both seasonal and periodic variation (Jamison, 2016). About 90% of all malaria deaths in the world today occur in Africa south of the Sahara. This is because the majority of infections in Africa are caused by Plasmodium falciparum, the most dangerous of the four human malaria parasites (Dick, 2015).

Malaria affects the lives of almost all people living in the area of Africa defined by the southern fringes of the Sahara Desert in the north, and latitude of about 28° in the south. Most people at risk of the disease live in areas of relatively stable malaria transmission – infection is common and occurs with sufficient frequency that some level of immunity develops. A smaller proportion of people live in areas where the risk of

malaria is more seasonal and less predictable, because of either altitude or rainfall patterns. People living in the peripheral areas north or south of the main endemic area or bordering highland areas are vulnerable to highly seasonal transmission and to malaria epidemics. In areas of stable malaria transmission, very young students and pregnant women are the population groups at highest risk for malaria morbidity and mortality (Ukaga, Nwoke & Onyeka, 2013).

Most students experience their first malaria infections during the first year or two of life when they have not yet acquired adequate clinical immunity – which makes these early years particularly dangerous. Ninety percent of all malaria deaths in Africa occur in young students. Adult women in areas of stable transmission have a high level of immunity, but this is impaired especially in the first pregnancy, with the result that risk of infection increases (Taylor & Mutambu, 1986). Malaria has been well controlled or eliminated in the five northernmost African countries, Algeria, Egypt, Libyan Arab Jamahiriya, Morocco, and Tunisia. In these countries, the disease was caused predominantly by Plasmodium vivax and transmitted by mosquitoes that were much easier to control than those in Africa south of the Sahara. Surveillance efforts continue in most of these countries in order to prevent both a reintroduction of malaria parasites to local mosquito populations and the introduction of other mosquito species that could transmit malaria more efficiently (a particular risk in southern Egypt). The malaria situation in these countries is not considered further in this report. Malaria is endemic in some of the offshore islands to the west of mainland Africa – Sao Tome and Principe and São Tiago Island of Cape Verde. In the east, malaria is endemic in Madagascar, in the Comoro islands (both the Islamic Federal Republic of Comoros and the French Territorial Collectivity of Mayotte) (Ukaga, Nwoke & Onyeka, 2013).

2.6.1 Economic Burden of Malaria

Malaria attack results in morbidity, disability and mortality (Hussain, et al, 2014). Therefore, the two major costs of malaria disease are morbidity and mortality costs. Malaria morbidity affects household welfare as a result of an increase in the cost of treatment and prevention of the disease and a decline in productivity through lost time. In the case of mortality, losses to households include lost of future incomes and cumulative investment on the dead due to malaria (Alaba and Alaba, 2013). Beside mortality "malaria causes morbidity through fever, weakness, malnutrition, anaemia, spleen disorders and vulnerability to other diseases. Malicious patients also experience asymptomatic parasitemia, acute febrile, chronic debilitation, and pregnancy complications" (Bremen, 2011).

Morbidity costs due to illness can be higher in areas of unstable transmission than elsewhere. For example, the economic burden may be lower in settings where malaria is concentrated among young students than in settings where both adults and students are equally vulnerable to malaria. Household expenditure on treatment is usually highly regressive and consuming a larger proportion of income in the poor households to the extent that slow economic growth limits malaria control funds (Chima, et. al., 2013). There is a vicious cycle of poverty and malaria that diminishes economic opportunities for a huge number of people. Malaria is estimated to decrease annual per capita GNP growth by 0.25 to 1.30 percent in tropical countries, after accounting for initial endowments, overall life expectancy, and geographic location (Sachs and Malaney, 2012).

Malaria manifests itself through cycles of fever that occur every two to four days. Severe cases can affect the brain and the kidneys. Progression from initial symptoms to death can take as little as 24 hours (Malaria Foundation International, 2014). Malaria, therefore, affects the quality of labour, it can also lead to absenteeism, and even though

an acute malaria attack might not prevent people from working, it may only reduce the quality or productivity or output (Goodman, et. al., 2010). Absenteeism from work can lead to income losses, particularly in the informal sector, where income is largely dependent on the number of productive hours. Students living in areas of low transmission report more malaria than those in higher transmission settings (Clarke, et. al, 2014).

2.6.2 Risk Factors of Malaria among Mothers of under five Children

Cultural beliefs about malaria

Despite the growing global concern about malaria and its devastating effects on the health outcomes of poor people in developing countries, the level of knowledge and general awareness about malaria remains low in the most affected societies. In most Nigerian communities, especially the very rural ones, knowledge about causes of malaria, transmission modes and/or severity of the disease is still abysmally low country (Adefemi, Awolaran, and Caleb, 2015). Most communities still refer to malaria as 'ordinary fever'; some people still do not associate malaria with mosquito bites and worst still, most parents still do not take their children to health facilities as first line of action when they notice 'fever'. Disturbingly, the trend is similar across the length and breadth of the country (Adefemi, Awolaran, and Caleb, 2015).

In the Yoruba population of a South-West state of Nigeria for example, less than 10% of a surveyed population associated mosquito bites with malaria. Instead, 'too much work' (17.7%), 'staying for too long in the sun' (12.6%), 'drinking bad/dirty water' (5.3%) were most often believed to be the cause of malaria. In addition, convulsion and anaemia were not seen as complications of malaria and most infant mortality are not

linked to malaria, whatsoever. Most cases of malaria are treated at home or with traditional healers as the first line of action. While this study may be biased as almost 50% of the sample had no formal education, it still does, perhaps, fairly represent the level of knowledge about malaria, its prevention and treatment in most rural communities of Nigeria.

Also, within the Ibo population of South-East Nigeria, Dike found that just about half of the population associated mosquito bites with malaria. Again, malaria was generally characterised as 'ordinary fever'. However, a larger proportion of this sample could accurately identify the signs of malaria, even though seeking medical treatment for their kids with 'fever' was not the most popular first line of action. In the northern city of Maiduguri, while almost 90% of a surveyed population was aware of the existence of malaria, 83% of the sample did not consider malaria a serious health issue, nor did they associate mosquito bite with malaria country (Adefemi, Awolaran, and Caleb, 2015).

Such a low level of accurate knowledge about the mode of transmission and signs of malaria across the population could only result from a combination of poor access to information and wrong cultural/social beliefs about malaria. This perhaps explains why interventions built around distribution of free insecticide-treated nets (ITNs) or drugs have not really achieved the desired results. Until malaria is seen, by all concerned, as a serious disease caused by mosquito bites, the motivation to protect children from mosquito or take immediate actions to treat malaria in children would remain poor. The consequence is the high and increasing incidence and prevalence of malaria in children country (Adefemi, Awolaran, and Caleb, 2015).

Hierarchy and Social Stratification

Another risk factor of malaria in children under five is the hierarchical structure of most Nigerian communities. Children under five are more vulnerable to malaria because their level of built immunity is still very low. This combination of low immunity in the face of a reservoir of plasmodium parasites housed by parents and older siblings create a 'malaria-endemic zone' for children in most homes. To strengthen their immune systems, children need regular and nutritiously balanced meals. However, the social structure in most communities deprives children access to such meals. Fathers hold the right to the best part of a meal, and children are left, most times, with meals far below their biological requirements for proper development. Inadequate nutrition due to cultural structures, thus further aggravate children's vulnerability to malaria.

Environmental risks factors

WHO (2007) argues that more than a quarter of the global disease burden and at least 42% of global malaria incidence are due to modifiable environmental factors. The environment plays a defining role in the health outcomes of any society. Unfortunately, for most developing countries, the environment constitutes a particularly negative influence on health. This is especially true in Nigeria, where until very recently, the environment was one of the most de-emphasised health issues, nationally and locally. Environmental factors that contribute to malaria risks include the large rural population, poor waste disposal, water and sanitation infrastructures and habits country (Adefemi, Awolaran, and Caleb, 2015).

The vast populations of Nigerians live in rural communities, with less than 25% living in urban communities. Both categories of communities present some level of malaria risk, however, rural dwellers are far more exposed to malaria. In most rural communities, the primary occupation is farming (or fishing in coastal areas). The vast area of open fields, stagnant pools of water and green vegetation in these communities,

create the perfect breeding environment for mosquitoes, especially during wet seasons. Children have to accompany parents to the farm and as such are exposed, for most parts of the day, to mosquito bites country (Adefemi, Awolaran, and Caleb, 2015). Moreover, formal education is lowest in rural communities, thus the awareness about malaria; malaria control efforts and/or seeking medical treatment for malaria early are quite minimal. Thus, rural communities suffer a dynamic interplay of higher malaria vector density, sparse human population and limited access to health information and facility country (Adefemi, Awolaran, and Caleb, 2015).

While rural dwellers are exposed to mosquitoes due to vast expanse of natural vegetation and water bodies, urban residents often create their own mosquito-breeding sites through improper disposal of waste, allowing water to accumulate in crevices and containers around the home and sometimes uncleared bushes around residential areas. In most cities, wastes are often deposited indiscriminately on open grounds, in city centres, uncompleted buildings and sometimes around the homes, creating man-made mosquito breeding sites. In rural communities, sanitation levels can be very poor, and access to water-limited country (Adefemi, Awolaran, and Caleb, 2015).

2.6.3 Roll Back Malaria (RBM): A Prevention Programme

Roll Back Malaria (RBM) programme was initiated in 1998 by the World Health Organisation (WHO) to make available a number of key evidence-based and cost-effective malaria preventions that include Home Management of Malaria (HMM) with emphasis on early and appropriate treatment of malaria particularly for children under five years old (World Health Organisation, 2011). The RBM target through HMM was to ensure at least 60% and 80% of mothers of children under five years have access to information on HMM and affordable antimalarials for effective malaria treatment by 2015 and 2010 respectively in order to achieve the goal to halve malaria morbidity and

mortality worldwide by 2010 and further reduce the burden by 50% in 2015 (Dossou-Yov, Amalaman, & Carnevale, 2011). This is expected to contribute to attaining the Millennium Development Goal (MDG) of halting malaria and beginning to reverse the incidence of malaria and other major diseases by the target date of 2015 (United Nations, 2010; Teklehaimanot, Singer and Spielman, 2015).

In 2011, Nigeria launched a five-year strategic plan focusing on these RBM targets (NDHS, 2011) under the policy stewardship of the Federal National Malaria Control Programme and with the aim of reducing the malaria burden by 25% by 2015. An ITN strategy was developed to ensure 60% coverage among students by 2015 and promoted the creation of an enabling private sector market combined with social marketing initiatives. Those partners engaged with the Federal Ministry of Health (FMoH) at State levels for ITN distribution included UNICEF (Ogun, Bauchi, Enugu and FCT-Abuja); the Futures Group/DFID (Ekiti, Jigawa, Benue and Enugu); USAID/BASICS (Lagos, Kano and Abia); and USAID/NetMark (Edo, Rivers, Lagos, Kano, FCT and Abia). Despite these initiatives, by 2015 ITN use by students aged less than five years was only 1.7% (NDHS, 2015; Oresanya et al., 2016). During much of the 2011-2015 national policy, CQ and SP were the recommended 1st and 2nd line anti-malarial regimens, respectively. However, sensitivity tests undertaken across the country in 2012 revealed unacceptably high CQ treatment failures (circa 39%) and SP (circa 43%) (NDHS, 2011). In 2014, the efficacy of two candidate artemisinin-based combinations (ACTs) was evaluated and using these results artemether-lumefantrine (AL) was selected as first-line treatment in 2015 (NDHS, 2013). The second, post-Abuja strategic plan was launched in 2014, revising targets to 80% coverage of key interventions, re-invigorating the role of selected IRS and environmental management (NDHS, 2013) with a combined aim to reduce the malaria mortality and morbidity

burden by 50% by 2010. In 2014, the optimistic vision of a "Malaria free Nigeria" was first declared.

However, coverage of ITN across the country by 2016 was extremely poor, only 5.5% of students below the age of five years were sleeping under a treated net 18 (NPC, 2013). Of all unprotected students in sub-Saharan Africa not sleeping under a net in 2007, 25% were Nigerian (Noor et al., 2009]. Between 2014 and 2014, ODA for malaria control was between US$ 15 and 23 million per year. Between 2007 and 2010, US$ 117 million was disbursed by the World Bank to support the delivery of interventions in seven states (Akwa Ibom, Anambra, Bauchi, Gombe, Jigawa, Kano, and Rivers). Nigeria made successful applications to the Global Fund during Round 2 (US$ 20 million), Round 4 (US$ 64 million), and Round 8 (US$ 220 million); Round 8 funding was largely used for mass LLIN campaigns in seven additional states, not covered by the World Bank Booster program (Adamawa, Ekiti, Kaduna, Kebbi, Niger, Ogun, and Sokoto). Since 2007 other donors have included USAID, DFID-UK, UNICEF, US President's Malaria Initiative and JICA. It is estimated that between 2016 and 2010, US$ 3.5 million was spent on malaria control out of the Government of Nigeria budget and US$ 78 million was disbursed through the Debt Relief Millennium Development Goals Achievement Fund (MDG-F) (RBM, 2012). Nearly US$ 600 million of external funds was provided for Nigeria’s national malaria control efforts between 2014 and 2010. In 2009, donor disbursements reached a peak of around US$ 325 million, a staggering amount of ODA but nevertheless this remains less than US$ 2 per person at risk for malaria less than the minimum recommended requirement (Sherman, 2012).

The most recent National Malaria Strategic Plan covers the period 2009-2013, the Road Map for Malaria Control in Nigeria (NDHS, 2009) and highlights its ambitious goals for the rapid national scale-up of a package of core interventions to achieve impact

as a pathway toward a malaria-free Nigeria. As one of its primary objectives it aims to reduce malaria mortality and morbidity by 50% by 2013 and minimize the social impact of the disease. Consequently, the current strategic plan aims for universal ITN coverage, combined ITN and IRS approaches in areas intractable to reductions in transmission with ITN alone and a more prominent coordinated role of integrated vector management (IVM) that considers larval control following pilot studies using Bacillus thurigiensisvarisraelensis (BTI) and Bacillus sphaericus (BS). In 2009 and 2012 mass ITN distribution campaigns were launched and 50 million long-lasting insecticide treated nets (LLIN) had been distributed by April 2012. The impact on coverage of these campaigns was reflected in the national household survey data in 2010 which showed an improvement in coverage of under-fives to a national average of 29% sleeping under an ITN the night before the survey (NPC, 2013).

States without LLIN campaigns at the time of the national survey included: Abia, Bayelsa, Benue, Bono, Cross Rivers, Delta, Ebonyi, Edo, Enugu, FCT, Imo, Katsina, Kogi, Kwara, Lagos, Nasarawa, Ondo, Osun, Oyo, Plateau, Taraba, Yobe and Zamfara. The current strategy to distribute LLIN includes continued free distribution of LLINs through routine health services, antenatal clinics, during national campaigns and routine immunization and a smaller role played by the commercial sector. IRS was implemented in three LGAs in 2016 in seven states supported by the World Bank Malaria Booster Programme (Bauchi, Jigawa, Gombe, Kano, Anambra, Akwa-Ibom and River State) and one state supported by the US President's Malaria Initiative (PMI) (Nassarawa) using alphacypermethrin, lambda-cyhalothrin and deltamethrin. Between 2009 and 2011, Lagos State started a campaign of IRS covering 246,803 households (MPR, 2012). 19 Providing prompt efficacious treatment under evolving guidelines related to the WHO recommendations to Test, Treat and Track (WHO, 2012) continue to pose challenges to

the national strategy [MPR, 2012]. From the national malaria indicator survey in 2010, 44% of women reported that malaria in students should be treated with aspirin, panadol or paracetamol, while 37% reported that CQ should be the drug of choice; only 12% were aware that ACTs are the drug of choice (FMoH, 2014). Many Nigerians use the private sector for treatment and strengthening this sector has been a focus of the NDHS through support from the Affordable Medicines for Malaria (AMFm) initiative launched in Nigeria in 2010 (Tougher et al., 2012).

The specific targets for malaria control during the five-year period (2009-2013) are: to reduce malaria-related mortality by 50% by 2013, to reduce malaria parasite prevalence in students under age 5 by 50% by the year 2013, to increase net ownership to at least 80% of households by 2010 and to sustain this level until 2013, to expand and sustain net usage to at least 80% of students under the age of 5 and to pregnant women by 2010 and to sustain the coverage until 2013, to introduce and scale up indoor residual spraying (IRS) to national household coverage of 8% in selected areas by 2010 and to 20% by 2013, to increase diagnostic malaria testing by 2013 to at least 80% of patients age 5 and older who come to health facilities to seek treatment for fever or malaria, to increase appropriate and timely treatment of all patients who seek treatment for fever or malaria in health facilities to at least 80% by 2013, to increase the coverage of pregnant women who receive at least two doses of Intermittent Prevention Treatment (IPT) to 100% of pregnant women attending antenatal care (ANC) by 2013 (Fleck and Moody, 2012).

Consequent to the identified problems and the persistence of malaria as a major public health problem in both rural and urban communities of sub-Saharan Africa including Nigeria (UNICEF, 2014), the Roll Back Malaria (RBM) Programme was initiated in 1998 by the World Health Organization (WHO). RBM was established to

address all the identified issues that have thwarted early attempts at fighting malaria and to make available a number of key evidence-based and cost-effective malaria prevention strategies and control, with the stated goal to decrease malaria morbidity and mortality by 50% worldwide by 2010, and further reduce the burden by another 50% in 2015 (Nabarro and Tayler, 2014).

Additional goals of the RBM movement included: meeting the malaria-related United Nations Millennium Development Goals (MDGs); Abuja Declaration; and the RBM Partnership Global Strategic Plan. The Abuja Declaration plan is where 189 heads of state adopted the Millennium Declaration designed to improve social and economic conditions in the world's poorest countries by 2015 (WHO, 2011). The United Nations MDGs 4, 5, and 6 are directly linked to malaria control, while MDGs 1 and 2 are indirectly related. RBM Partnership Global Strategic Plan is expected to coordinate all efforts at malaria control; it will promote the development and better utilization of all tools for malaria control – old, new and future - as and where appropriate; and it will help strengthen the health sector. It will be driven by the respective individual countries. The RBM thrust, however, conforms with the Health Sector Reform (HSR) initiative in Nigeria where first-phase implementation covered 2014-2007 and sought to ensure the health of citizens in the country are guaranteed (FMOH, 2014). The achievement of the MDGs, therefore, depends on the success of the RBM initiative (FMOH, 2014).

Table 2.1: RBM, MDGs and Abuja Target

RBM	**MDGs**	**Abuja Targets**
Vision: Achieve a malaria-free world (from 2010 levels).		
Objective 1: Reduce global malaria deaths to near zero by the end of 2015. Timeline: 50% by 2010; 50% by	Goal #4: Reduce by two-thirds Child Mortality Target/Time: 1990 - 2015	Reduce deaths to children Target: 60% by 2015; 80% by 2010

2015		
Objective 2: Reduce global malaria cases by 75% by end- 2015 Timeline: 50% by 2010; 50% by 2015	Goals #5: Improve by three-quarters maternal health Target/Time: 1990 - 2015	Improve maternal health Target: 60% by 2015; 80% by 2010
Objective 3: Eliminate malaria by 2015 in 10 new countries and in the WHO European Region.	Goal #6: Combat HIV/AIDS, Malaria and other diseases. Target/Time: Have halted by 2015 the incidence of malaria and other major diseases.	Combat HIV/AIDS, Malaria and other diseases. Target: 60% by 2015; 80% by 2010 Also: 60% of people sleeping under nets by 2015; 80% by 2010.

Source: FMOH, 2014

It was with this in mind that the African Planning and Development Ministers, meeting in the framework of the Roll Back Malaria Programme, adopted an overall framework and a joint approach defining a strategy intended simultaneously to address mosquito control within the region. Specific targets included increased access of pregnant women and children under age five with 60% by 2015, and 80% by 2010 (United Nation 2010; Nabarro and Taylor, 2014). This approach received the support of the General Assembly of the United Nations and the World Health Organization. Referring to the same context, the African Ministers of Health, meeting in Abuja, Nigeria, called for a Decade of Malaria Eradication for Africa on a renewed basis and with intensified efforts, capable of making healthcare into a driving force for growth and a factor of socio-economic transformation.

Within this time frame (2003-2014), two studies were carried out by the Federal Ministry of Health. Results of the 2003 Nigeria Demographic and Health Survey (NDHS) showed that only 2.2% of households had at least one Long Lasting Insecticide

Nets (LLIN) (National Population Commission and Marco, 2014). In contrast, the 2014 NDHS results showed an increase in LLIN ownership to 17.0% (still below targets) of households with at least one LLIN (National Population Commission and ICF Macro, 2010). While the 2003 NDHS study showed that 1.3% of pregnant women who used LLIN prior to the study; the 2014 NDHS showed that 4.8% of this population used LLIN prior to the study. With regard to IPT use during antenatal clinics, 1.0% of pregnant women attending antenatal clinics received IPT according to the 2003 NDHS results (National Population Commission and ORC Marco, 2014). By 2014 the NDHS showed an improvement as 6.5% of pregnant women attending antenatal clinics received IPT.

Determined to accelerate and intensify efforts on malaria control in Nigeria, the Federal Government through the Federal Ministry of Health's National Malaria Control Programme, in partnership with the RBM partners, States' Ministries of Health and their local government areas, and other stakeholders collaborated to enable a national scale-up of key prevention. They designed and developed a five-year National Malaria Strategic Plan (NMSP) on malaria control. By this, the RBM goals and the MDGs were targeted for 2010 and 2015, respectively (Federal Ministry of Health, 2015).

Consequently, the Lagos State government, in taking a cue from the RBM programme, established the Eko Free Malaria Treatment Programme in 1998 for all children under age five at its various health facilities. The State provided LLINs and IPTp to pregnant women during visits to antenatal clinics and LLINs to children under age five on completion of immunization. As of 2012, the State government had distributed about 4.2 million LLINs to the aforementioned groups using hospital-based and house-to-house distribution approaches (Lagos State Ministry of Health, 2012). This is close to the expected target population of about 2.1 and 2.2 million pregnant women and children under age five, respectively, in the State. However, LLIN use in the State is

still low, based on findings of a 2014 and 2013 survey (UNICEF, 2014; Adeneye et al., 2013).

Prevention of malaria in highly endemic countries relies largely on vector control through one of two main methods: Insecticide Treated (mosquito) Nets (ITNs) and indoor residual (house) spraying (IRS). Use of Long Lasting Insecticide Nets (LLINs) and implementation of Indoor Residual Spraying (IRS) prevents mosquitoes transmitting malaria parasites between people and reduces re-infection of people that have been recently cured. In many cases, these methods are used together in the same households, especially to suppress transmission is holoendemic and hyperendemic scenarios.

Free distribution of LLINs and ITNs is currently being conducted through campaigns, public health facilities, Faith-Based Organisations (FBOs) and non-governmental organisations (NGOs) with the goal of achieving universal access for the at-risk population of children under age five and pregnant women (A Road Map for Malaria Control in Nigeria Abuja, 2014). Though widespread, there has been some evidence of low coverage of ITNs use. The effective ways of reducing malaria and saving lives is by correctly diagnosing people infected and then quickly eliminating malaria parasites using anti-malaria drugs. Rapid Diagnostic Tests (RDTs) are now used by Community Health Workers (CHWs) to correctly diagnose malaria. Confirmed cases can then be fully cured by treatment with highly effective Artemisinin Combination Therapy (ACT) drugs, thus reducing malaria and potentially saving thousands of lives. In most endemic countries millions of pregnant women are now also provided with prophylactic anti-malarial drugs as part of the Interruptive Prevention Treatment (IPT), during their second and third trimesters to prevent infections (Adeneye et al., 2013).

2.7 Empirical Studies

Oladimeji, Tsoka-Gwegweni, Ojewole, & Yunga, (2019) conducted a similar study that assessed knowledge of malaria prevention among pregnant women and non-pregnant mothers of children aged under 5 years in Ibadan, South West Nigeria. The cross sectional study collected data on socio-demographic, clinical and knowledge on malaria prevention using interviewer administered questionnaires from consenting study participants attending Adeoyo maternity hospital between May and November 2016. Data was described using percentages and compared across the two maternal groups in the study population. Knowledge scoring from collected data was computed using the variables on causes, symptoms and prevention of malaria and thereafter dichotomised. Multivariate analyses were used to assess the interactive effect of socio demographic and clinical characteristics with malaria knowledge. Level of statistical significance was set at $p < 0.05$. Result of the study revealed that, of the 1373 women in the study, 59.6% (818) were pregnant women while 40.4% (555) were mothers of children aged under 5 years. The respondents mean age was 29 years $\pm$ 5.2. A considerable proportion of both the pregnant women ($n = 494$, 60.4%) and the non-pregnant mothers of children aged under 5 years ($n = 254$, 45.8%) did not have correct knowledge on malaria prevention measures based on our assessment threshold ($p < 0.001$). Having a tertiary level education was associated with better knowledge on malaria (4.20 ± 1.18, $F = 16.80$, $p < 0.001$). Multivariate analyses showed that marital status, educational attainment, gravidity, and HIV status were significantly associated with knowledge of malaria prevention and control. In conclusion, the findings indicate that socio-demographic factors such as marital and educational status greatly influence knowledge on malaria prevention and control measures. Key health stakeholders and authorities need to implement strategies and direct resources to improve the knowledge of mothers on

malaria prevention and control. This would stem the tides of malaria related deaths among pregnant women and children aged under 5 years.

A similar study was conducted by Atulomah, Farotimi, & Atulomah, (2014) which aimed at exploring levels of knowledge, attitudes about malaria and preventive practices among pregnant women attending antenatal clinic at Olabisi Onabanjo University Teaching Hospital (OOUTH), Sagamu, Nigeria and to find out whether age and educational attainment are associated with risk of malaria transmission. This was cross-sectional descriptive study. Data about demographic characteristics, knowledge, attitude and practice of malaria prevention was obtained from 137 participants who consented through a validated 36-item interviewer-administered questionnaire (reliability coefficient of 0.74). Analysis of variance was used to test differences in measures across age and education with a cut-off set at $p \leq 0.05$ level of significance. The results showed that the median age of participants was 20 years and majority (80.3%) had at least secondary school education with 9.5% reporting non-formal education. Results also showed that knowledge and attitude about malaria measured on 15-and 18-point scales respectively reported for the participants mean scores of 10.73 ±1.62 and 9.77±3.64 respectively. When malaria prevention practice was assessed on a 24-point scale, participants scored a mean of 13.69±3.82 which translates to 57.0% of the level of preventive practice expected from the pregnant women. The study also revealed that younger participants and women with non-formal education consistently reported lowest scores for knowledge. Findings suggest moderate knowledge with average attitude and inadequate malaria preventive practices among the pregnant mothers surveyed and recommends that well designed health education programme about malaria and their implications in pregnancy should be incorporated in clinic activities to enhance their preventive practices.

A similar study was conducted by Kio, Agbede, Olayinka, Omeonu, & Yewande, (2016). The study aims at assessing the knowledge, attitude and practices of mothers regarding the prevention of malaria in children between 0-5 years. Convenience sampling method was used to select 160 mothers that attend child survival clinic and children outpatient clinic in olabisi onabanjo university teaching hospital (OOUTH), sagamu, Ogun State. Questionnaire was used to collect data from the respondents, and the data was analysed using statistic package for social sciences (SPSS, version 17). Findings from the study showed that 55% of the respondents had a good knowledge about malaria, 78% of the respondents had a positive attitude regarding malaria prevention, 37% of the respondents practiced malaria prevention. The factors which influenced respondents' practice of prevention were the age of mothers, their income level and the frequency of malaria episode. Despite the fair overall knowledge and good attitudes, practices towards malaria prevention were poor. Therefore interventions aimed at social and behaviour change should primarily target the gaps in practices highlighted by the study.

A study was conducted by Nwaorgu, and Orajaka (2011), on the prevalence of Malaria among children 1 – 10 years old in Communities in Awka North Local Government Area, Anambra State South-East Nigeria. The researchers observed that malaria is a major cause of illness and death, especially among children under five year's old and pregnant women. It was estimated that more than one million children living in Africa especially in remote areas with poor access to health services die annually from direct and indirect effects of malaria. Fatally affected children often die within less than 72h after developing the symptoms. In Nigeria, malaria consistently ranks among the five most common causes of death in children. As a result of increased mortality and morbidity there is need for proper understanding of the epidemiology of the disease

among the most at-risk groups. In the study of 1000 children, 1 -10 years old were randomly selected from 20 primary and 31 nursery schools in the four randomly selected communities in Awka North LGA. Two millilitres venous blood was collected from each of the 1000 pupil (600 primary and 400 nursery) and stored in an anticoagulant specimen bottle. Thick and thin films were prepared, stained and examined for malarial parasite under the microscope using the oil immersion objective. Also both human bait collection and pyrethrum knocked down methods were used for identification of types of mosquitoes found in the study communities.

Malaria infection is most prevalent among 1- 4 years old, highest being among 3 years old (76.4%), followed by 1 and 4 years old with 71.3 and 71.2% respective, and 62.04% for 2 years old. This decreased as the children get older. There was no significant difference in prevalence among the male and female pupils, with 59. 2 and 57.2%, respectively. The most prominent species in the community is Plasmodium falciparum (51.8%). Forty-three percent of the pupil positive for malaria had low parasitic diversity below 1000, 12.4% between 1000 and 10,000, 2.3% between 10,000 and 100,000 and 0.2% above 100,000. Malaria is a problem among pupil 1-10 years old especially from age 2 years when their immunity from mothers starts reducing. There is need to ensure that mothers protect their children from mosquito bite by ensuring that they sleep under ITN. The study clearly showed that malaria is still posing problems in Awka North Local Government Area of Anambra State. The prevalent rate is still high among the younger age group (1 – 5 years). The low haemoglobin and packed cell volume observed in the infected children showed that malaria plays an important role in causing anaemia in children. For these reasons, recommendations were made that public health education campaign for mothers and health caregivers to create awareness that may lead to reduction of vectors of malaria, infection and control of the disease

especially in young children, free or subsidised insecticide-treated bed nets (ITN) should be, made available to mothers so that the infection of malaria could be controlled in children and mothers and other caregivers need to be empowered to treat malaria infection at home.

A similar study was conducted by Houmsou, et al, (2014) that examined the occurrence of malaria in children under five years: knowledge, attitudes and perceptions among mothers in a Nigerian semi-urban area. This study was conducted to determine the occurrence of malaria among children under-five years and to assess the knowledge, attitudes and perceptions of the children's mothers regarding malaria and prevention measures. The study was cross-sectional in design and conducted between May - September 2012. Three hospitals namely: Atuna, NKST and General Hospitals all located within Gboko were visited. Children 54 under-five years that attended these hospitals for malaria diagnosis with their respective mothers were 55 enrolled for the study. Prior to the commencement of the study ethical approval was obtained from the 56 Ministry of Health, Makurdi, Benue State. Permissions were also sought from the various hospital 57 managements at the beginning of the study and mothers of the children were duly briefed and informed on 58 the significance of the study and they also gave their consent before blood sample collection. The study was conducted in Gboko Local Government Area (LGA) of Benue State which is 43 located at the central zone of Nigeria. The area is located at latitude 7º18'N and longitude 8°58'E. Gboko 44 LGA has a landmass of about 2,264 square kilometres with a population of about 360,128 people making 45 it one of the most populous Local Government in Benue State. The Local Government is bounded by Tarka and GumaLGAs to the North, Ushongo LGA to the South, Bukuru LGA to the 46 West and Konshisha 47 LGA to the Southwest. 48 The climate of the area is tropical, sub-humid with daily average temperature of about 28°C

and average 49 annual rainfall of 1000mm. The rainy season starts from April to October while the dry season starts from 50 November to March. Chi-square test was used to compare occurrence of malaria between sexes of the children and socio-demographic data of mothers. Chi-square test was also used to compare the knowledge, attitudes and perceptions of the children's mothers regarding malaria in relation to their educational status Children under-five years that attended three hospitals (Atuna, NKST and General Hospital) for malaria diagnosis with their respective mothers were enrolled for the study. Thick blood films were prepared for parasitological examination. Questionnaires were administered to children's mothers to collect information on socio-demographic data, knowledge, attitudes and perceptions regarding malaria and prevention measures. Of the 220 children examined, 14.50% (32/220) were infected with malaria. Males and females recorded similar infection level (14.50% vs 14.60%) with no significance difference (χ^2 = 0.000, p=.989). With regards to the socio-demographic data of the children's mothers, malaria was reported to be 100.00% (4/4) (χ^2 = 24.40, p=.000) among children whose mothers were within the age group [41-50] years and among children whose mothers are divorced, 45.50% (5/11) (χ^2 = 12.50, p=.006). The occurrence of malaria was high among children whose mothers claimed to have attained post-secondary education, 17.80% (16/90) (χ^2 = 1.37, p=.503) and among children whose mothers are traders, 25.00% (13/52) (χ^2 = 8.27; p=.142), with no significant difference. Children's mothers were observed having good knowledge of: malaria, 99.50% (219/220) (χ^2= 1.45**,** p=.484**)**; its vectors, 79.50% (175/220) (χ^2=14.82, p=.001**)** and aetiological agent, 74.52% (164/220) (χ^2= 63.15, p=.000). Likewise, 90.90% (200/220) of the children's mothers perceived that high temperature was a common malaria symptom (χ^2= 23.66, p=.000) and 70.31% (161/220) of the mothers always referred their children to a hospital for treatment (χ^2=70.81, p=.000). With regards to the mother's attitude towards

prevention, 85.53% (188/220) used Insecticide Treated Nets (ITNs) as prevention methods (χ^2 = 16.38, p=.003). This study is the first baseline survey on childhood malaria in the area and it adds to the data on malaria in Nigeria and sub-Saharan Africa as a whole. Good knowledge of malaria, its aetiological agent and vectors, attitudes, perceptions and use of prevention measures were observed among mothers that attended health facilities with their children in Gboko, Benue State, Nigeria. It is recommended that a more concerted effort should be built between the Government and the private sector to scale-up the distribution of ITNs to households so as to significantly reduce the occurrence of malaria in children under-five years. There is also the need to enhance health education through media, conferences, seminars, workshops using local dialects in semi-urban and rural areas; this will help in raising the knowledge and understanding of less or non-educated mothers on the good use of malaria prevention measures.

A similar study was conducted by Amaechi and Ukpai (2013), that assessed knowledge, attitude and practice about malaria among mothers and care-givers in Aba South Local Government Area, Abia State, Nigeria. The knowledge of the symptoms, treatment-seeking behaviours and management of malaria amongst mothers and care-givers in Aba South LGA in South-Eastern Nigeria was assessed. A total of five hundred and two mothers and caregivers were interviewed using closed-ended pre-tested structured questionnaires, which was administered to community members that fell within the targeted audience. The results of the investigations showed that there was a high level of knowledge of the causal agent of malaria, as 97.01 % attributed it to female anopheles mosquito bites. Radio (56.77%) and the television (20.32 %) was the major sources of information on malaria diagnosis and management strategies amongst the studied population. 54.58 % of the respondents had only secondary level of education. A remarkable mix-up of traditional and orthodox medication in the treatment of malaria

was noticed. 53.19 % visited the patent medicine shop each time they fell ill and 37.85 % used local herbs. Some of the herbs were boiled before drinking, inhaled or used to bathe as the case may be, while 5.98 % visited the hospital. Prevention measures against mosquito bites included the use of insecticide spray (15.25%), use of mosquito coils (44.60%), use of insecticide-treated bed nets (12.88%) and the use of fumes from Ocimumgrattissimum (10.74%) locally called Nchanwu among others. It was discovered that malaria remains the leading cause of death in children under 6 years, the prevalence of malaria in infants and children between 0-6 years is high, which is in agreement with the findings of other workers in malaria-endemic countries. It was observed that new-borns and infants between 0-6 years who are confronted with fever were found to be positive for malaria. The findings of the study indicated that the respondents in Obuda Aba community, Aba South LGA have high knowledge of the causes, symptoms, treatment and management of malaria. The use of insecticide-treated bed nets was not as high as should be expected. It is therefore recommended that government health workers should sensitize the people on appropriate prevention and mosquito control strategies especially on the use of insecticide-treated bed nets in order to mitigate the malaria scourge.

In a study conducted by Ashikeni, Envuladu, and Zoakah (2013) on the perception and practice of malaria prevention and treatment among mothers in Kuje area council of the federal capital territory, Abuja, Nigeria. Malaria remains a huge public health problem in Sub-Saharan African countries and accounts for 10% of its disease burden even though it is both preventable and curable. To assess the knowledge of malaria and practice related to its prevention and treatment among the women of Kuje Area Council in the FCT. The study was a comparative community intervention study conducted among 232 mothers/ caregivers of under-five children selected through a two-

staged sampling technique by balloting in Kuje and Rubochi community in Kuje Area Council of the Federal Capital Territory. Data collected were collated and analysed using SPSS version 17 computer software to produce frequency tables. Qualitative data such as the children's age groups and sex and educational status of the mothers collated and displayed as frequency tables. Data on knowledge of malaria, its prevention, complications and the drugs used by mothers for the treatment of malaria in their children aged below five years at baseline were compared with the data obtained after 5 months of Health Education intervention and differences or changes tested for significance using the chi-square statistical test with the software. Similar data obtained from a control community was also analysed and changes tested using chi-square for significance.

The level of significance was set at 95% ($p \leq 0.05$) for all statistical analysis. At baseline, only 1.8% in the intervention group had good knowledge of the cause of malaria while 90.2% had fair knowledge which improved significantly ($p=0.013$) after the intervention. Good knowledge of the prevention measures was also poor (5.4%) in the intervention group but increased significantly after 5 months of intervention. However, the control group showed no change. Most mothers used Chloroquine to treat malaria in both the intervention and control groups. This however declined from 72.2% to 53.6% in the intervention group. The findings of the study revealed a lack of knowledge and many misconceptions about the transmission and treatment of malaria, which could adversely affect malaria control measures and antimalarial therapy. The researchers concluded that mothers of children under-five in Kuje had poor knowledge of the cause of malaria and its prevention method, and were not using the recommended drug by the Federal Government of Nigeria (ACTs) for the treatment of uncomplicated malaria. However adequate health education to women especially in the language they

understood effectively increased their knowledge and improved the practice of malaria treatment.

Furthermore, Adeyemo, Oluwatosin, Amodu and Taofeeq (2014) conducted a study on home management and prevention of malaria among under-five children: experiences of mothers in a Nigerian local government area. The ravaging effect of malaria on children is of concern due to its high mortality and morbidity rates. This study assessed the practice of mothers of under-five children in home management and prevention of malaria. The study, a cross-sectional adopting explorative survey approach, was carried out in Egbedore local government area (LGA) in Osun State, South-Western Nigeria. The local government area is located at the North West of the state and covers approximately 102 square kilometres of land (Egbedore LGA). The tropical rain coupled with fertile land support farming as the predominant occupation. The local government area is made up of 10 political wards and most of the communities are rural. The population of the LGA according to year 2016 population census is 73,969, consisting of 37,302 males and 36,667 females (Federal Republic of Nigeria, 2015).The inhabitants of Egbedore LGA are predominantly Yorubas of the Oyo extraction and are mainly adherents of Islamic, Christianity and traditional faiths. There are 22 primary health care facilities owned by the LGA and one National Primary Health Care Centre (Egbedore LGA). The target population for this study were mothers of under-five children residing in Egbedore LGA in Osun State South West of Nigeria. Multistage random sampling technique was used for selection of 837 mothers of under-five. The instruments used were focus group discussion and structured questionnaire. Statistical Package for Social Sciences (SPSS) was used for data entry and analysis. Each correct answer on knowledge was assigned a score of one (1), while wrong answer got zero (0). The scores were graded as high (60% to 100%), average (40% to 59%) or low (<40%). The items on

practice were ranked as always (2), occasional (1) and never (0), they were graded as good- 60% to 100%, fair- 40% to 59% and poor- <40%. The level of knowledge of the respondents on causes, transmission and symptoms of malaria was low, as 75% of them scored less than 40%, 45.2% scored less than 40% in knowledge of prevention, 97.7% scored less than 40% in practice of home management and 63.3% scored <40% in prevention practice. The findings of this study justify and support the need for interventional study to improve the mother's experiences in practice of home management and prevention of malaria. In conclusion, mothers of under-five children in this study manifested poor knowledge and practice of home management and prevention of malaria. These findings justify and support the need for intervention that will improve mother's knowledge of transmission, symptoms and management of malaria. Such intervention should be community-based in order to make it effective in the promotion of correct home management and utilization of prevention measures at the household level particularly among mothers of under-five children.

A similar study was conducted by Okoli and Enna (2014) on knowledge of, attitudes towards and practice of malaria prevention and control measures in central Nigeria. The study was conducted at Jos University Teaching Hospital and Bukuru Central, Bukuru Express and Rayfield Primary Healthcare Centers. Jos is the capital city of Plateau State, located between latitude $80^{o}24'$N and longitude $80^{o}32'$ and $100^{o}38'$ east, with a land area of approximately 26 899 km^2. Bukuru lies at latitude 9°54'N and longitude 8°53'E, covers an area of roughly 50 km^2, and is situated less than 300 km from Abuja, the federal capital of Nigeria. Plateau State is characterised by two seasonal variations: the rainy season, which occurs from May to October, and the dry season, from November to April. Children who consented to participate in the study and were not seriously sick were recruited. Some of them came to the hospitals purposely to

participate in it. The study comprised 640 subjects aged 0-18 years, attending Jos University Teaching Hospital, Bukuru Central, Bukuru. Express and Rayfield Primary Healthcare Centres, who met the inclusion criteria, i.e. gave consent, had no known chronic illness, and were aged 0-18 years. Non-consenting subjects, subjects with chronic illness or those older than 18 years were excluded from the study. Hospital workers, in conjunction with the research team, informed respondents of the usefulness and benefits of the study. Participants were provided with information on malaria prevention and control measures after the interview. This was a cross-sectional study, conducted from May to August 2011. A structured standard questionnaire was issued to 640 children and mothers. Mothers responded to the questions in the case of minors. In this study, children aged 0-5 years were considered to be minors. Four hundred and nineteen mothers were interviewed. Information obtained from the subjects using a questionnaire (prepared in English) included the child's environmental or personal hygiene; knowledge of the cause of malaria, the signs and symptoms relating thereto, and conventional antimalarial drugs and malaria prevention or control measures; as well as their attitudes towards, and practice, of different malaria prevention or control measures. There was no previous information on the level of knowledge, attitudes or practice in relation to malaria prevention and control in study areas. However, 63.2% of the population that had heard of ITNs, as reported by Adeneye et al. in a pilot study in the North-Central zone, south-west Nigeria. The required sample size was obtained from the equation using a prevalence of 63.2%, and a precision of 1% at 95% confidence interval. Data analysis was performed using Epi Info statistical software, version 3.3.2. Less than 5% was adopted as a test of significance. Results were expressed in percentages and frequencies. These included the educational levels of the subjects, the socio-economic status of the parents and knowledge, attitudes and practise domains. The results of this

study showed that there were increased ownership and use of ITNs at community level. However, the level of environmental and personal hygiene was low, and presence of mosquito-breeding sources high. Thus, effort needs to be intensified in malaria control strategies to ensure that adequate information is available relating to the importance of environmental and personal hygiene, the elimination of mosquito-breeding sources and the safety of ITNs at community level. This will help to achieve and sustain the RBM Partnership goals, both in Plateau State and in Nigeria in general.

A similar study was conducted by Nwana (2011) that assessed the knowledge and utilization of insecticide-treated nets to prevent malaria in Cameroon. The purpose of this study was to assess and evaluate the Knowledge, attitude and practice (KAP) of households with children under-five in rural communities of Cameroon regarding malaria. The research was aimed at providing pointer information for further studies and also to draw attention to those involved in policymaking, bureaucrats, as a useful advocacy material in better strategizing and strengthening malaria eradication programmes in endemic regions. The study was focused on the Information Education Communication (IEC) package delivery by the National Malaria Control Programme (NMCP); and the communities' perceived Knowledge, attitude and practice to the use of Insecticide Treated Nets (ITNs) were categorized and assessed in terms of QVR (quality, value, regularity) evaluation model, respectively, while the personal and environmental hygiene were observed. Restricted to 2 main ecological zones (a highland area in the Buea district mountain vicinity and a lowland area in the Tiko district) within the Fako division, a sample of 10 communities, 5 from each zone were identified and a multistage cluster sampling technique was employed in an "on location" analysis. Caregivers within households were targeted as primary subjects (n=140) and information was collected using a semi-structured questionnaire in an interview process. The method of cross-

sectional survey including descriptive and analytical statistics was employed for the analysis of the data. The results revealed that despite some variation in the knowledge of caregivers regarding individual malaria components, their general level of knowledge of malaria was dominantly good (n=78). Possession of ITN, perception and value of ITN, levels of knowledge of malaria and the principal sources of information for this knowledge, but not the demographic variables of marital status, educational levels, family size, occupation, income and housing type of the respondents, were significantly associated to the utilization patterns of ITN ($X2=139.0$, $p<0.01$; $X2=61.91$, $p<0.01$; $X2=32.56$, $p<0.01$; $X2=23.80$, $p<0.01$; $X2=3.22$, $P=0.20$; $X2=1.703$, $p=0.94$; $X2=3.54$, $P=0.47$; $X2=4.39$, $P=0.63$; $X2=0.661$, $P=1.00$; $X2=7.42$, $P=0.11$) respectively at 1% alpha rate. Various Attitude and Practice with regards to the possession and patterns of ITN utilization were exhibited. Perceptions of the value of ITN were identified and explicitly manifested through beneficial attributes such as: to prevent malaria, avoid mosquito bites and nuisance. Whereas, regarding the non-beneficial attributes some of which also coincided with barriers associated with the possession and regular use of ITN, subjects often and implicitly perceived ITNs as having toxic effects and associated with illnesses, not cost-effective and inconvenient due to hot weather. According to this study, the determinant factors associated with a high incidence and prevalence of malaria within the studied communities involved a lack of environmental hygiene, and until there is proper understanding of the mode of transmission of the disease and the opportunities to disseminate malaria knowledge are met, widespread adherence to the regular practice of ITN utilization is difficult.

A similar study was conducted by Nofiu, Dashe and Dikki (2017) that assessed the knowledge and practice of Malaria Prevention Strategies among Mothers of under Five in Ogun State, Nigeria. This study employed ex-post facto design in assessing the

knowledge and practice of malaria prevention strategies among mothers of under-five in Ogun State, Nigeria. The population of this study comprised of 641,445 mothers of under-five in Ogun State, Nigeria. A multi-stage sampling approach was used to select the respondents using a stratified random sampling approach, simple random sampling technique and convenient sampling techniques. The instrument used for data collection was a structured questionnaire. Two hundred and sixteen (216) copies of questionnaire were validated and used for the analyses. Data collected were analysed using simple percentage, frequency count, one sample t-test analysis and Pearson Product Moment Correlation coefficient at 0.05 alpha level. The results obtained revealed that mothers of under-five have significant knowledge of malaria prevention strategies, mothers of under-five do not significantly practice malaria prevention strategies and there is a significant relationship between knowledge and practice of malaria prevention strategies among mothers of under-five. Based on the findings, it was concluded that mothers of under-five have adequate knowledge of malaria prevention strategies, practice of mothers of under-five towards malaria prevention strategies are not good and significant relationship exist between attitude and practice of malaria prevention strategies among mothers of under-five in Ogun State. It was recommended that seminars/workshop and community health-related programmes should be organized by government and non – governmental organization for malaria health education intervention which could address and promote a constant practice of malaria prevention strategies among mothers of under-five by government and non-governmental organization through mass media, seminars/ workshop and community health-related programmes.

2.8 Summary

In this chapter, the researcher had taken a look at works conducted by other researches on knowledge, attitude and practice of malaria prevention strategies in a

different part of the world including Nigeria. This chapter was divided into subheadings and they are conceptual framework, theoretical framework and empirical framework. The conceptual framework comprises of concept of knowledge, concept of attitude and practice, concept of malaria, causes of malaria, signs and symptoms of malaria, epidemiology of malaria and malaria parasite and its life cycle while the empirical framework comprises of knowledge, attitude and practice of malaria among mothers of under-five children, Rolling Back Malaria as a prevention strategy and prevention strategies of malaria among mothers of under-five children. Two theory adopted for this study, they were KAP theory and Health Belief Model (HBM). KAP theory comprises of Knowledge, Attitude and Practice theory. Knowledge Theory approaches knowledge as an ongoing dialogue. It suggests that an individual is ignorant or holds a belief about a health matter, the educator attempts to change or ascertain the individual's level of knowledge towards the health or concept through questioning the respondent. Attitude Theory of Cognitive Dissonance posits that attitudes predict behaviour and that where attitude and behaviour are not related cognitive dissonance results. Practice Theory of Self-efficacy holds that the belief that one has is able to control one's practice of a particular behaviour. Self-efficacy refers to one's belief that one can successfully execute a particular action. HBM is generalizable in numerous settings, it is cost-conscious, and prompts hypotheses for testing, not to mention it is a proficient predictor of participation in prevention screening programmes. The attitude theory is based principally on observational learning. The theory explains how people acquire and maintain certain behavioural patterns. Self-efficacy refers to one's belief that one can successfully execute a particular action. People are more likely to engage in certain practice when they believe that they are capable of executing those practice successfully.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

The purpose of this study was to assess knowledge, attitude and practice of malaria prevention strategies among mothers of under-five children in North-Central zone, Nigeria. To achieve this purpose research design, population of the study, sample and sampling techniques, instrument, validity of the instrument, procedures for data collection and data analysis are presented and described in this chapter.

3.2 Research Design

The research design used for this study was ex-post facto research design. Ex post facto design is a non-experimental research design in which pre-existing groups are compared on dependent variables. It does not include any form of manipulation or measurement by the researcher before the facts occurred (Lammers & Badia, 2015). This research design is deemed appropriate as the research requires the researcher to collect personal and general information for the purpose of assessing the opinion related to knowledge, attitude and practice of the respondents. It is a non-experimental design, so experimental and control groups are not involved.

3.3 Population of the Study

The population of this study comprised of Three million, six hundred and forty-one thousand, four hundred and forty-five (3,641,445) mothers of under-five children in North-central zone, Nigeria. (National Population Commission (NPC) and ICF Macro, 2016).

3.4 Sample and Sampling Techniques

The sample size for this study consisted of seven hundred and sixty-eight (768) respondents who are mothers of under-five between the ages of 18 – 49 years. Research Advisor (2016), suggested that in a population of 1,000,000 and above a sample size of 384 can be used in a study. However, the researcher doubled the figure to have a wider coverage of respondents and also to be able to generalize the findings on the target population.

A multi-stage sampling technique which involved simple random sampling, proportionate sampling technique and purposive sampling were used for this study.

The first stage involved the use of simple random sampling technique to select six (6) states in north-central zone (Kogi, Niger, Benue, Kwara, Plateau and Nasarawa) by writing all the states on a rolled piece of paper, placed in a container, shuffled it, and the selection is made. A total of six (6) states is used to collect data.

The second stage involved the use of simple random sampling techniques to select two (2) general hospital from each state by writing all the names of general hospital on a piece of paper, folded and dropped in a container, shuffled it, and the selection is made by one of the research assistants. A total of twelve (12) general hospital are used to collect data.

The third stage employed the use of purposive sampling to select the respondents (mothers of under-five children) attending each general hospital at the paediatric unit and ante/post-natal clinic in each general hospital. The researcher having identified the population of the study as a peculiar subset of the people, and having prior knowledge about the purpose of the research deemed it appropriate to adopt purposive sampling techniques to select eligible participants. The respondents were purposively selected because they fit a particular profile (have children not more than 5 years

old).Alternatively, Dudovskiy (2019) emphasized that purposive sampling method may prove to be effective when only limited numbers of people can serve as primary data sources due to the nature of research design, its aims and objectives.

At the fourth stage, proportionate sampling was used to determine the number of respondents per general hospital. The researcher divided the population of mothers of under-five children at each LGA by the total population from all LGAs selected and multiplied it by the sample size (768).

Proportionate sampling technique $= \frac{n}{N} \times 768$

Where n = population of mothers of under-five in a LGA

N = total population of mothers of under-five children

The fifth stage, the researcher employed a systematic random sampling procedure to select the respondents at the general hospitals. The researcher and her four (4) research assistants selected every second mother of under-five children that visited the hospital as they come. This procedure continued until the total sample size required for the study was gotten.

The sample selection is summarized in table 3.1 as follows:

Table 3.1: Distribution of Sample size

States	General Hospitals	Population	Target population (29.8%)	Sample Size
Kogi State	General Hospital, Okene	217,219	47,680	42
	General Hopital, Ogori	191,480	44,303	39
Niger State	General Hospital, Minna	132,098	203,466	181
	General Hospital, Suleja	209,777	188,293	167
Benue State	General Hospital, Ugba	225,471	37,446	33
	General Hospital, Otukpo	98,707	59,240	53
Kwara State	General Hospital, Ilorin	209,251	38,968	35
	General Hospital, Offa	59,481	86,083	76
Plateau State	General Hospital, Langtang	124,268	18,492	16
	General Hospital, Plateau	300,520	57,022	51
Nasarawa State	General Hospital, Karshi	119,051	24,239	22
	General Hospital, Akwanga	329,922	59,757	53
Total			**864,989**	**768**

3.5 Instrument of the Study

The instrument that was used for the purpose of data collection was a researcher - structured questionnaire. Awotunde and Ugoduhunwa (2014) were of the view that a structured questionnaire is a set of either statements and or items that are related to the purpose of a study to which the respondents are expected to respond to by ticking one of the given options. It is worded unambiguously in order to elicit the correct responses from the participants. Statements in the questionnaire are close-ended in nature.

The questionnaire was divided into four (4) sections (sections A – D) and comprised of thirty-seven (37) items. Section A contained four (4) items which were designed to obtain information on the demographic characteristics of the respondents. Section B contained eleven (11) items on the knowledge of malaria prevention strategies among mothers of under-five children. Section C contained eleven (11) items on attitude

towards malaria prevention strategies among mothers of under-five children. Section D contained eleven (11) items on the practice of malaria prevention strategies among mothers of under-five children in North-central zone, Nigeria. The modified four (4) point Likert scale was used as shown below:

Strongly agree	(SA)	4 points
Agreed	(A)	3 points
Disagreed	(D)	2points
Strongly disagree	(SD)	1 point

Thus, any response that has a mean score of 2.5 and above was accepted as positive and any response that has a mean score of less than 2.5 was negative or not accepted.

3.6 Validity of the Instrument

In order to establish the face and content validity of the instrument, the questionnaire was vetted by five (5) experts in the Department of Human Kinetics and Health Education, Nursing Sciences and Community Medicine, Ahmadu Bello University, Zaria for comment, observations, corrections and suggestions. After incorporating all the suggestions made by the experts, the final copy of the questionnaire was pilot tested to further validate the instrument.

3.6.1 Pilot Study

To test the reliability of the instrument, a pilot study was conducted using Bwari general hospital, F.C.T Abuja. A total of fifty (50) copies of the questionnaire were distributed in the general hospital using simple random sampling technique. The researcher employed the dip hand method to select the respondents at the health facility. Yes and No was written on pieces of paper folded and dropped in a container, the

researcher shooked the container and gave it to the mothers of under-five children who were present. Those who picked Yes were administered copies of the questionnaire. The copies of the questionnaire distributed were then retrieved on the spot after being completed. To determine the level of reliability of the instrument, the Cronbach Alpha reliability test was used.

The results revealed that the Cronbach Alpha reliability test was 0.833. This was a confirmation of test of reliability which according to Spiegel (1992), an instrument is considered reliable if it's reliability coefficient lies between zero (0) and one (1) and that the closer the calculated reliability coefficient is to zero, the less reliable is the instrument, and the closer the calculated reliability co-efficient is to one (1), the more reliable is the instrument. This, therefore, showed that the instrument used for this study was reliable.

3.7 Procedure for Data Collection

The instrument of this study was administered to participants at the selected general hospitals in the north-central zone of Nigeria. Four (4) research assistants were used for the purpose of distributing and collecting of the research instrument in this study. The researcher collected letter of introduction from the Department of Human Kinetics and Health Education, Faculty of Education, Ahmadu Bello University, Zaria and issued it to the Chief Medical Director (CMD) of the General hospitals selected for this study for permission to collect data. The researcher instructed four (4) research assists ants on how to administer and retrieve copies of the questionnaire. In the general hospitals the researcher and her four (4) research assistants systematically selected the respondents as they come to the hospital. The researcher selected every mother of under-five children as they come by systematic random sampling technique. The researcher and her research assistants used even number (2, 4, 6, 8). This procedure was used until the

total sample size required for the study was obtained. The researcher and her research assistants then administered the copies of the questionnaire to the respondents for filling and retrieved them immediately after they have been filled. These process of data collection lasted for four (4) weeks.

3.8 Procedure for Data Analysis

1. Descriptive statistics of frequencies count and percentages, means and standard deviations were used to describe the demographic characteristics of the respondents, and to answer the structured research questions respectively. Hence, any mean score of any response was considered positive, if it was 2.5 and above and any mean score of any response less than 2.5 was regarded as negative.
2. Inferential statistics of one sample t-test was used to test the formulated hypotheses 1 to 3 on knowledge, attitude and practice at 0.05 alpha level of significance.
3. Pearson Product Moment Correlation Coefficients (PPMC) was used to test hypotheses 4 and 5 at 0.05 alpha level of significance.
4. Multiple regression analysis was used to test hypotheses 6, 7 and 8.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Introduction

The purpose of this study was to assess the knowledge, attitude and practice of malaria prevention strategies among mothers of under-five children in North Central Zone, Nigeria. To achieve this purpose, seven hundred and sixty-eight (768) copies of questionnaire were systematically distributed using even numbers to the respondents. Out of which 765 (99.6%) copies of questionnaire were adequately filled and returned. The data collected were analysed and presented according to the order in which they were arranged in the questionnaire. The various responses were, therefore, grouped and tabulated towards ensuring an objective analysis and interpretation of the findings. Simple percentage was used to describe the demographic characteristics of the respondents, descriptive statistics which comprised of mean and standard deviation were used to answer the research questions. One-sample t-test was used to test hypotheses 1-3, Pearson Product Moment Correlation was used to test the hypotheses 4 and 5, while multiple regression analysis was used to test hypotheses 6-8 respectively.

4.2 Results

Table 4.1: Demographic Characteristics of the Respondents

S/N	Variable	Option	Frequency	Percentage (%)
1.	**Age Range of mothers of under-five children**	15 – 24 years	114	14.9
		25 – 34 years	311	40.7
		35 – 44 years	253	33.1
		45 years and above	87	11.4
		Total	**765**	**100.0**
2.	**Level of Education**	No formal Education	134	17.5
		Primary Education	265	34.6
		Secondary Education	299	39.1
		Tertiary Education	67	8.8
		Total	**765**	**100.0**
3.	**Number of Children per Family**	1 – 3 children	414	54.1
		4 – 6 children	285	37.3
		7 children and above	66	8.6
		Total	**765**	**100.0**
4.	**Occupation**	Civil Servant	238	31.1
		Self – Employed	185	24.2
		Full – time housewife	342	44.7
		Total	**765**	**100.0**

Table 4.1 shows that many 311 (40.7%) of the respondents are between the ages 25-34 years, 253 (33.1%) of the respondents are between the ages of 35 – 44 years, 114 (14.9%) are between the ages 15-24 years, while 87 (11.4%) of the respondents were between the age of 45 years and above. Furthermore, Table 4.1 reveals that 114 (17.5%) of the respondents have no formal education, 265 (34.6%) of the respondents have a primary school education, 299 (39.1%) of the respondents have secondary education

while 67 (8.8%) of the respondents have tertiary education. Majority 414 (54.1%) of the respondents have 1 – 3 children, 285 (37.3%) of the respondents have 4 – 6 children while 66 (8.6%) of the respondents have 7 children and above. 238 (31.1%) of the respondents were civil servant, 185 (24.2%) of the respondents were self – employed while 342 (44.7%) of the respondents were full – time housewives.

Research Question One: Domothers of under-five children have the knowledge of malaria prevention strategies in North Central Zone, Nigeria?

Table 4.2:Mean scores of responses on the knowledge of malaria prevention strategies among mothers of under-five children in North Central Zone, Nigeria

Item	Mean	Std. Dev.
Mosquito coil can prevent mosquito from biting my child	3.55	1.59
Insect repellent use can prevent mosquito from biting my child	3.61	0.10
Mosquito net when used can help to prevent mosquitoes from biting my child	3.28	0.59
Window net when fixed properly can help to prevent mosquitoes from biting my child	3.44	1.40
Door nets when fixed can help to prevent mosquitoes from biting my child	3.22	0.98
Cutting bushes around the house can help to prevent mosquitoes breeding	3.37	1.40
I know that disposing of empty containers harboring water can help to prevent breading of mosquitoes	3.35	1.50
Use of electric mosquito zapper can help to prevent mosquitoes from biting my child	2.81	0.95
Dressing the children in protective cloths such as long sleeve shirts can help prevent them from mosquito bites	3.44	1.43
Indoor residual spraying of insecticide can completely prevent mosquitoes from staying in dark corners of the rooms	3.42	0.95
Sleeping inside insecticide treated mosquitoes net prevent mosquitoes from biting my child	2.71	1.01
Aggregate Mean	**3.29**	**1.08**

Table 4.2 reveals the mean score of the responses on the knowledge of malaria prevention strategies among mothers of under-five children. The result shows that mothers of under-five children have the knowledge of malaria prevention strategies. The respondents knew that mosquito coil can prevent mosquito from biting my child (3.55; SD=1.59), insect repellent use can prevent mosquito from biting my child (3.61; SD=0.10), mosquito net when used can help to prevent mosquitoes from biting my child (3.28; SD=0.59), window net when fixed properly can help to prevent mosquitoes from biting my child (3.44; SD=1.40), door nets when fixed can help to prevent mosquitoes from biting my child (3.22; SD=0.98), cutting bushes around the house can help to prevent mosquitoes breeding (3.37; SD=1.40), know that disposing of empty containers harbouring water can help to prevent breading of mosquitoes (3.35; SD=1.50), use of electric mosquito zapper can help to prevent mosquitoes from biting my child (2.81; SD=0.95), dressing the children in protective cloths such as long sleeve shirts can help prevent them from mosquito bites (3.44; SD=1.43), indoor residual spraying of insecticide can completely prevent mosquitoes from staying in dark corners of the rooms (3.42; SD=0.95) and sleeping inside insecticide treated mosquitoes net prevent mosquitoes from biting my child (2.71; SD=1.01). The aggregate mean score of the items is 3.29 which was found to be greater than they know about mosquito coil which can prevent mosquito bites (3.55). This implies that mothers of under-five children have knowledge of malaria prevention strategies in North Central zone, Nigeria.

Research Question Two: What is the attitude of mothers of under-five children on malaria prevention strategies in North Central Zone, Nigeria?

Table 4.3: **Mean scores of responses on the attitude towards malaria prevention strategies among mothers of under-five children in North Central Zone, Nigeria**

Item	Mean	Std. Dev.
I feel it will be comfortable sleeping under mosquito net	2.52	1.10
I like repellent on my child	3.39	0.91
I like mosquito coil in my room	2.62	1.10
I often like cleaning my surroundings to prevent breeding environment for mosquitoes	2.69	0.91
I like electric mosquito zapper to prevent mosquito bites	2.62	1.16
I prefer door net rather than the use of the other prevention methods	2.51	1.06
I prefer indoor residual spraying of insecticide to prevent mosquito bites	2.70	0.83
I prefer mosquito coil to prevent mosquito bites	2.64	1.02
I prefer wearing protective cloths for my child to prevent mosquitoes bite	2.66	0.83
I prefer insect repellent for the family to prevent mosquitoes bite.	2.52	0.72
I prefer insecticide treated mosquitoes net for the prevention of mosquitoes bite.	2.67	1.12
Aggregate mean	**2.69**	**1.00**

Table 4.3 shows the mean score of the responses on the attitude of mothers of under-five children towards malaria prevention strategies in the north-central zone, Nigeria. 3.39 (0.91) like repellent on my child, 2.70 (SD=0.83) prefer indoor residual spraying of insecticide to prevent mosquito bites, 2.69 (SD=0.91) often like cleaning my surroundings to prevent breeding environment for mosquitoes, 2.67 (SD=1.12) prefer insecticide treated mosquitoes net for the prevention of mosquitoes bite, 2.66 (SD=0.83) prefer wearing protective cloths for my child to prevent mosquitoes bite, 2.64 (SD=1.02) prefer mosquito coil to prevent mosquito bites, 2.62 (SD=1.10) like mosquito coil in my room, 2.62 (SD=1.16) like electric mosquito zapper to prevent mosquito bites, 2.52

(SD=1.10) feel it will be comfortable sleeping under mosquito net, 2.52 (SD=0.72) prefer insect repellent for the family to prevent mosquitoes bite and 2.51 (SD=1.06) prefer door net rather than the use of the other prevention methods. The aggregate mean score of the items is 2.69 which was found to be greater than benchmark score of 2.5. This implies that mothers of under-five children have a positive attitude towards malaria prevention strategies in North Central zone.

Research Question 3: What is the practice of malaria prevention strategies among mothers of under-five children in North Central Zone, Nigeria?

Table 4.4: **Mean scores of the practice adopted by mothers of under-five children towards malaria prevention strategies in North Central Zone, Nigeria**

Item	**Mean**	**Std. Dev.**
I wear protective cloths (long pants and long sleeve shirt) prevent mosquito bites	2.22	0.90
I use window nets to prevent mosquitoes	1.53	0.66
I cut bushes around the house to prevent mosquitoes breeding	2.23	1.04
I dispose empty containers harbouring water to avoid breading of mosquitoes	2.24	0.80
I use door net to prevent the entrance of mosquitoes to my room	3.01	1.19
I use insecticide-treated mosquito net to prevent mosquito bites	2.12	1.32
I use Indoor residual spraying of insecticide to prevent mosquitoes	2.23	0.53
I use insect repellent to prevent mosquitoes from biting my child	1.32	0.41
I use electric mosquito zapper to kill mosquitoes from biting my child	2.76	1.01
I use mosquito coil to prevent mosquitoes from entering my room	1.61	0.71
I use electric mosquito zapper to prevent mosquitoes bite	3.25	0.61
Aggregate Mean	**2.23**	**0.84**

Table 4.4 shows the mean score of the responses on the practices adopted by mothers of under-five children towards malaria prevention strategies. Although some mothers practiced use of electric mosquito zapper to prevent mosquitoes bite (3.25; SD=0.61), use door net to prevent the entrance of mosquitoes to my room (3.01; SD=1.19) and use electric mosquito zapper to kill mosquitoes from biting my child (2.76; SD=1.01). The practice of disposing empty containers harbouring water to avoid breading of mosquitoes (2.24; SD=0.80), use of indoor residual spraying of insecticide to prevent mosquitoes (2.23; SD=0.53), cutting bushes around the house to prevent mosquitoes breeding (2.23; SD=1.04), wearing protective cloths (long pants and long sleeve shirt) prevent mosquito bites (2.22; SD=0.90), using insecticide-treated mosquito net to prevent mosquito bites (2.12; SD=1.32), use of mosquito coil to prevent mosquitoes from entering my room (1.61; SD=0.71), using window nets to prevent mosquitoes (1.53; SD=0.66) and use of insect repellent to prevent mosquitoes from biting my child (1.32; SD=0.41) had mean scores of less than 2.5. The aggregate mean score of the items is 2.23 which was found to be less than the fixed mean score of 2.5. This implies that the practices adopted by mothers of under-five children towards malaria prevention strategies were poor or they do not practice malaria prevention strategies.

Research Questions 4: What is the influence of knowledge on attitude towards malaria prevention strategies among mothers of under-five children in the north-central zone, Nigeria?

Table 4.5:Mean Score of responses on the influence of knowledge on attitude towards malaria prevention strategies among mothers of under-five children

Variable	M	SD	Mean Difference
Knowledge	36.22	11.90	
			6.68
Attitude	29.54	10.75	

Table 4.5 shows the mean score aimed at finding the influence of knowledge on attitude towards malaria prevention strategies among mothers of under-five children. Knowledge has a mean of 36.22 and standard deviation of 11.90 while attitude has a mean of 29.54 and standard deviation of 10.75 with a mean difference of 6.68. The results revealed that there is less influence of knowledge on attitude towards malaria prevention strategies among mothers of under-five children.

Research Question 5: What is the influence of knowledge on the practice of malaria prevention strategies among mothers of under-five children in north-central zone, Nigeria?

Table 4.6:Mean score of responses on the influence of knowledge on the practice of malaria prevention strategies in North Central Zone, Nigeria

Variable	M	SD	Mean difference
Knowledge	36.22	11.90	
			11.68
Practice	24.54	9.19	

Table 4.6 reveals the mean score aimed at finding the influence of knowledge on the practice of malaria prevention strategies among mothers of under-five children in north-central zone, Nigeria. Knowledge has a mean of 36.22 and standard deviation of 11.90 while the practice has a mean of 24.54 and standard deviation of 9.19 with mean difference of 11.68. The results revealed that there is less influence of knowledge on practice of malaria prevention strategies among mothers of under-five children in north-central zone, Nigeria.

Research Question 6: What is the influence of demographic variables (age, level of education, number of children and occupation) on knowledge of malaria prevention strategies among mothers of under five children in north central zone, Nigeria?

Table 4.7: Mean score of responses on the influence of demographic variables (age, level of education, number of children and occupation) on knowledge of malaria prevention strategies

	Mean	SD	Mean Difference
Knowledge (Constant)	36.22	11.89	
Age	17.79	6.54	18.42
Level of Education	21.62	5.38	14.59
Number of children	19.73	6.54	16.48
Occupation	19.32	5.59	16.90

Table 4.7 shows the mean score on the influence of demographic variables (age, level of education, number of children and occupation) on knowledge of malaria prevention strategies with a mean of 36.22, 17.79, 21.62, 19.73 and 19.32 and mean difference of 18.42, 14.59, 16.48 and 16.90. Based on this outcome, there is less influence of demographic variables (age, level of education, number of children and occupation) on knowledge of malaria prevention strategies.

Research Question 7: What is the influence of demographic variables (age, level of education, number of children and occupation) on attitude of malaria prevention strategies among mothers of under five children in north central zone, Nigeria?

Table 4.8: Mean score of responses on the influence of demographic variables (age, level of education, number of children and occupation) on attitude of malaria prevention strategies

	Mean	SD	Mean difference
Attitude (Constant)	29.54	10.75	
Age	17.79	6.54	11.75
Level of Education	21.62	5.38	7.92
Number of children	19.73	6.54	9.81
Occupation	19.32	5.59	10.22

Table 4.8 shows the mean score on the influence of demographic variables (age, level of education, number of children and occupation) on attitude of malaria prevention strategies with a mean of 29.54, 17.79, 21.62, 19.73 and 19.32 while mean difference of 11.75, 7.92, 9.81 and 10.22. The mean difference indicate the difference in the mean between constant variable and each of the demographic variable which indicated that there is less influence. Based on this outcome, there is less influence of demographic variables (age, level of education, number of children and occupation) on attitude of malaria prevention strategies.

Research Question 8: What is the influence of demographic variables (age, level of education, number of children and occupation) on practice of malaria prevention strategies among mothers of under five children in north central zone, Nigeria?

Table 4.9: Mean score of responses on the influence of demographic variables (age, level of education, number of children and occupation) on practice of malaria prevention strategies

	Mean	SD	Mean difference
Practice (constant)	24.53	9.19	
Age	17.79	6.54	6.74
Level of Education	21.62	5.38	2.91
Number of children	19.73	6.54	4.80
Occupation	19.32	5.59	5.21

Table 4.9 shows the mean score on the influence of demographic variables (age, level of education, number of children and occupation) on practice of malaria prevention strategies with a mean of 24.53, 17.79, 21.62, 19.73 and 19.32 while mean difference of 6.74, 2.91, 4.80 and 5.21. Based on this outcome, there is less influence of demographic variables (age, level of education, number of children and occupation) on practice\ of malaria prevention strategies.

Hypotheses Testing

Hypothesis one: Knowledge of malaria prevention strategies among mothers of under-five children in north-central zone, Nigeria is not significant.

Table 4.10: One sample t-test analysis of knowledge of malaria prevention strategies

Variable	AggregateMean	Std.	df	t-value	P-value.
Knowledge	3.29	1.08	764	4.37	0.001

t (764)= 1.960< 0.05

The result on Table 4.10 shows knowledge of malaria prevention strategies among mothers of under-five children in north-central zone, Nigeria is significant because the t-value of 4.37 is greater than the t critical 1.960 at 764 degrees of freedom (df) and p-value of 0.001 is less than 0.05 with this observation the null hypothesis that

states knowledge of malaria prevention strategies among mothers of under-five children in north-central zone, Nigeria is not significant was rejected,.

Hypothesis Two: Attitude towards malaria prevention strategies among mothers of under-five children in north-central zone, Nigeria is not significant.

Table 4.11: One sample t-test analysis on attitude towards malaria prevention strategies

Variable	Aggregate Mean	Std.	df	t-value	P-value
Attitude	2.67	0.98	764	2.27	0.000

t (764)= 1.960< 0.05

Table 4.11 reveals that attitude towards malaria prevention strategies among mothers of under-five children in north-central zone, Nigeria was significant with p-value 0.000 and t-value of 2.27 is greater than the t critical 1.960 for the test at 764 degrees of freedom. The p-value of 0.000 is less than 0.05. Therefore, the null hypothesis that stated that attitude towards malaria prevention strategies among mothers of under-five children in north-central zone, Nigeria is not significant was rejected.

Hypothesis Three: Practice of malaria prevention strategies among mothers of under-five children in north-central zone, Nigeria is not significant.

Table 4.12: one-sample t-test analysis on practice of malaria prevention strategies among mothers of under-five children

Variable	Aggregate Mean	Std	df	t-value	P value
Practice	2.23	0.84	764	1.074	0.2

t (764)= 1.960> 0.05

Observation of Table 4.12 shows that practice of malaria prevention strategies among mothers of under-five children in north-central zone, Nigeria was not significant with p-value of 0.2. The t-value of 1.074 is less than t critical 1.960 at 764 degrees of freedom (df) and p-value of 0.2 is greater than 0.05 with this observation, therefore, the null hypothesis which states that practice of malaria prevention strategies among mothers of under-five children in north-central zone, Nigeria is not significant was accepted, revealing that the respondents do not practice malaria prevention strategies in North-Central zone.

Hypothesis four: There is no significant influence of knowledge on attitude towards malaria prevention strategies among mothers of under-five children in north-central zone, Nigeria.

Table 4.13:Pearson Product Moment Correlation coefficient on the influence of knowledge on attitude towards malaria prevention strategies

Variables	M	SD	r	df	p
Knowledge	36.22	11.90			
			0.85	764	0.003
Attitude	29.54	10.75			

Correlation is significant at the 0.05 level (2-tailed) r = 0.851 p=0.003

A critical look at Table 4.13 shows Pearson Product Moment Correlation Coefficient analysis aimed at finding the influence of knowledge and attitude towards malaria prevention strategies. The results revealed that significant influence existed between knowledge and attitude. This is because the calculated p-value of 0.003 was found to be lower than the 0.05 alpha level of significance at a correlation index value of 0.85. Therefore, the null hypothesis which stated that there is no significant influence of

knowledge on attitude towards malaria prevention strategies among mothers of under-five children in north-central zone, Nigeria was rejected. Thus, the knowledge of mothers of under five children has influence on their attitude towards malaria prevention strategies.

Hypothesis Five: There is no significant influence of knowledge on the practice of malaria prevention strategies among mothers of under-five children in north-central zone, Nigeria.

Table 4.14:Pearson Product Moment Correlation coefficient on the influence of knowledge on practice of malaria prevention strategies

Variables	M	SD	r	df	p
Knowledge	36.2168	11.8993			
			0.151	764	0.21
Practice	24.5362	9.1888			

Correlation is significant at the 0.05 level (2-tailed) r = 0.151 p= 0.21

Table 4.14 the Pearson Product-Moment Correlation analysis aimed at finding the influence of knowledge on practice of malaria prevention strategies. The results revealed that no significant influence exists between knowledge and practice. This is because the calculated p-value of 0.21 was found to be higher than the 0.05 alpha level of significance at a correlation index value of 0.151. Therefore, the null hypothesis which stated that there is no significant influence of knowledge on the practice of malaria prevention strategies among mothers of under-five children in north-central zone, Nigeria was retained.

Hypothesis Six: There is no significant influence of demographic variables on knowledge of malaria prevention strategies among mothers of under five children in north central zone, Nigeria.

Table 15:Multiple Regression analysis on influence of demographic variables on knowledge of malaria prevention strategies

	β	S.E	R	R Square	Adjusted R square	F	P
Knowledge	5.604	1.825	0.736	0.588	0.579	5.441	0.00
Age	-1.061	.056					
Level of Education	-1.054	.015					
Number of children	-1.104	.033					
Occupation	-1.012	.037					

ANOVA[a]

	Sum of Squares	df	Mean Square	F	Sig.
Regression	613.345	3	121.105	5.441	.000[b]
Residual	7331.536	762	23.229		
Total	7944.881	765			

Table 4.15 above shows the multiple regression analysis on the relationship among age, level of education, number of children and occupation as measures of knowledge. The computed outcome has weight of Age (1.061), level of education (1.054), Number of children (1.104) and occupation (1.012). The results showed the value of R (0.736) which indicated a good level of prediction. R square (0.588) indicates that there is 58.8% variability. The coefficient of determination which is the adjusted R^2 value of 0.579 implies that the variables included in the model explain 57.9% variation among age, level of education, number of children and occupation. The regression is useful for making predictions. F ratio indicates that there is significant prediction of 5.441 at 0.00 probability value, it's revealed that the regression model is a good fit of the

variables. This means that there is a significant influence of demographic variables on knowledge. Therefore, the hypothesis which stated that there is no significant influence of demographic variables on knowledge of malaria prevention strategies among mothers of under five children in north central zone, Nigeria is hereby rejected.

Hypothesis Seven: There is no significant influence of demographic variables on attitude of malaria prevention strategies among mothers of under five children in north central zone, Nigeria.

Table 4.16:Multiple Regression analysis on influence of demographic variables on attitude of malaria prevention strategies

	β	S.E	R	R Square	Adjusted R square	F	P
Attitude	4.871	1.481	0.741	0.521	0.619	4.107	0.01
Age	-1.125	.031					
Level of Education	-1.012	.053					
Number of children	-1.250	.029					
Occupation	-1.310	.027					

ANOVA[a]

	Sum of Squares	df	Mean Square	F	Sig.
Regression	527.221	3	142.117	4.107	.001[b]
Residual	5042.710	762	21.410		
Total	5569.931	765			

Table 4.16 above shows the multiple regression analysis on the relationship among age, level of education, number of children and occupation as measures of attitude. The computed outcome has β weight of Age (1.125), level of education (1.012), number of children (1.250) and occupation (1.310). The results showed the value of R (0.741) indicates a good level of prediction. R square (0.521) indicates that there is 52.1% variability. The coefficient of determination which is the adjusted R^2 value of 0.619 implies that the variables included in the model explain 61.9% variation among

age, level of education, number of children and occupation. The regression is useful for making predictions. F ratio indicates that there is significant prediction of 4.107 at 0.00 probability value, its revealed that the regression model is a good fit of the variables. This means that there is a significant influence of demographic variables on attitude. Therefore, the hypothesis which stated that there is no significant influence of demographic variables on attitude of malaria prevention strategies among mothers of under five children in north central zone, Nigeria is hereby rejected.

Hypothesis Eight: There is no significant influence of demographic variables on practice of malaria prevention strategies among mothers of under five children in north central zone, Nigeria.

Table 4.17:Multiple Regression analysis on influence of demographic variables on practice of malaria prevention strategies

	β	**S.E**	**R**	**R Square**	**Adjusted R square**	**F**	**P**
Practice	5.417	1.419	0.693	0.475	0.524	4.239	0.00
Age	-1.053	.022					
Level of Education	-1.074	.035					
Number of children	-1.142	.019					
Occupation	-1.209	.023					

ANOVA[a]

	Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**
Regression	447.129	3	119.75	4.239	.000[b]
Residual	2912.615	762	36.725		
Total	3359.734	765			

Table 4.17 above shows the multiple regression analysis on the relationship among age, level of education, number of children and occupation as measures of

practice. The computed outcome has β weight of Age (1.053), level of education (1.074), number of children (1.142) and occupation (1.209). The results shows the value of R (0.693) indicates a good level of prediction. R square (0.475) indicates that there is 47.5% variability. The coefficient of determination which is the adjusted R^2 value of 0.524 implies that the variables included in the model explain 52.4% variation among age, level of education, number of children and occupation. The regression is useful for making predictions. F ratio indicates that the there is significant prediction of 4.239 at 0.00 probability value, its revealed that the regression model is a good fit of the variables. This means that there is a significant influence of demographic variables on practice. Therefore, the hypothesis which stated that there is no significant influence of demographic variables on practice of malaria prevention strategies among mothers of under five children in north central zone, Nigeria is hereby rejected.

4.3 Discussion

This study was conducted to assess the knowledge, attitude and practice of malaria prevention strategies among mothers of under-five children in north-central zone, Nigeria. With regards to knowledge of malaria prevention strategies among mothers of under-five children. The results of this study revealed that mothers of under-five children in North Central Zone, Nigeria were knowledgeable (p=0.001) about malaria prevention strategies. This study disagreed with the study of Ashikeni, Envuladu and Zoakah (2013) which stated that the mothers of under-five children in Kuje area council Abuja had poor knowledge of the cause of malaria, its prevention and possible complications, good knowledge of the prevention of malaria among mothers of under-five children such as the use of ITNs, insecticide sprays, nets on windows and doors or protective clothing, was found to be 5.4% at baseline in the intervention group but this increased to 25% at post-intervention. This was statistically significant (p= 0.0002). In

the control group, good knowledge of prevention of malaria increased marginally from 7.7% to9.7% but this was not statistically significant (p= 0.369). The findings of the study revealed that adequate and proper health education to mothers of under-five children especially in the language they understood increased their knowledge and improved their practice of the treatment of malaria. Although prevention of malaria has been globally accepted as a significant aspect of malaria control but majority of mothers of under-five children often do not learn the tenets of prevention (Falade, Ogundiran & Bolaji, 2013; Obrist et al 2010).

This finding, therefore, supports a study conducted by Adepolu, Adeniran, Adeoye, Kassim, Oyewole and Nwuba (2013) on health education and caregivers' management of malaria among under-five in Ede North L.G.A. Osun State of Nigeria, they reported that mothers of under-five children commonly use individual preventive measures such as window and door nets, spraying of house with insecticide aerosol and mosquito coil. While the common environmental management measures among them include cutting of grasses around the houses and destroying of the mosquito breeding sites.

With regards to attitudes towards malaria prevention strategies among mothers of under-five children. It was reported that mothers of under-five children in North Central Zone, Nigeria have significant attitude towards malaria prevention strategies which is in accordance to Erhun, et al, (2005) who conducted a similar study in South-West Nigeria among mothers of under-five children reported that the attitudes of the mothers of under-five children regarding malaria prevention is positive 73.20%. Mothers of under-five children always referred their mothers of under-five children to hospital with 54.72% of them having post-secondary education and it was also reviewed that mothers of under-five children prefer the use of one preventive strategy than the other especially the use of

Insecticide-treated mosquito net. This simply shows that malaria prevention is reported to be higher among mothers of under-five children that have higher educational level. Thus it can be deduced that there is a positive association between level of education and improved perceptions of malaria prevention among mothers of under-five children.

The finding of this study is in conformity with a study conducted byHoumsou, et al, (2014) who conducted a similar study among mothers of under-five children in Nigeria; they reported that with regards to the attitude of mothers regarding malaria, 73.20% of the mothers always referred their children to hospital with 54.72% of them having post-secondary education and it was also reviewed that mothers prefer the use of one prevention strategy than the other especially the use of Insecticide-treated mosquito net. This simply shows that malaria is easily perceived among mothers that have higher educational level. A positive association between level of education and improved perceptions of malaria was also reported in Southeast Nigeria. Oyewole and Ibidapo (2007) in a study of mothers attitude to malaria prevention, treatment and management strategies associated with the prevalence of malaria in a Nigerian urban centre, reported that prevention measures adopted against mosquito bite include sleeping under net (treated and untreated), door and window screening, cover cloth, mosquito repellent/insecticides spray, environmental hygiene, herbal decoction and chemoprophylaxis.

With regards to practice of malaria prevention strategies among mothers of under-five children. This study reported that mothers of under-five children in North Central Zone, Nigeria do not significantly practice malaria prevention strategies which are in accordance with a study conducted by Erhun, Agbani and Adesanya (2005) in Ile-Ife, Nigeria. They reported that “what respondents will do first” during malaria attack showed that 35.5%, 0.9% and 13.4% of respondents will use synthetic anti -malarials,

consult a herbalist and use local herb, respectively, while 27.3%, 1.7% and 18.2% will go to the hospital, take spiritual/ritual waters for cure and just pray, respectively, with 3.0% of the respondents indicating that they will ignore the signs.. The findings of this study agrees with a study conducted by Falade et al., (2016) in south-west Nigeria who found out in their study that many of the mothers do not even believe malaria can be prevented because of series of myths and misconceptions they associated with fever in children, that practice of prevention measures like screening of windows and doors with nets, spraying the house with insecticides aerosol, application of insecticide repellent cream, wearing of long-sleeved clothes and destruction of mosquito breeding sites are not common among the mothers of under-five children.

With regards to the influence of knowledge on practice of malaria prevention this study revealed that knowledge did not have a significant influence on practice of malaria prevention strategies among mothers of under-five children. This is in agreement with a study conducted by Nofiu, Dashe and Dikki (2017) who assessed the knowledge and practice of Malaria Prevention Strategies among Mothers of under-five children in Ogun State, Nigeria. The results of the study revealed that mothers of under-five do not significantly practice malaria prevention strategies.

Oladimeji, et al, (2019) who assessed knowledge of malaria prevention among pregnant women and non-pregnant mothers of children aged under 5 years in Ibadan, South West Nigeria. The result of the study showed significant association between selected socio-demographic and clinical characteristics with patients' knowledge on malaria prevention. There was significant association between socio-economic status of the women in the study and their malaria knowledge score. The significant differences were between the lower class and the lower middle class; also between lower class and lower upper class. There was also significant difference between: women who

had primary education compared to women who had secondary and tertiary education; women who had secondary education compared to women who had no formal and primary education. In conclusion the findings indicate that socio-demographic factors such as marital and educational status greatly influence knowledge on malaria prevention and control measures. This study is also in consonance with the findings of Atulomah, et al, (2014) which assessed knowledge of mothers attending ante-natal clinic at OOUTH Sagamu, Ogun State. The study revealed that younger participants and women with non-formal education consistently reported lowest scores for knowledge. Participants' knowledge variable for the different age groups show significant difference across age groups and 28 to 32 years (N=12) scored the highest (X=12.58, SD=0.52; F (3, 133) =16.22, p<0.0001). When knowledge scores was compared among the respondents based on their level of education, it was also found out that participants' knowledge scores varied significantly across education and respondents with more than secondary education again scored the highest while participants with non-formal education scored the lowest (N=13; =8.14, SD=1.88; F (3, 133) =75.22, p<0.0001).

With regards to attitude towards malaria prevention, this study found out that mothers of under-five children have a positive attitude towards malaria prevention strategies. This study is in agreement with a study conducted by Atulomah, Farotimi, and Atulomah, (2014) which was carried out among pregnant women attending antenatal clinic at Olabisi Onabanjo University Teaching Hospital (OOUTH), Sagamu, Nigeria. They reported that, attitudinal dispositions of all the participants varied across demographic characteristics such as age and educational attainment. Using one-way Analysis of Variance (ANOVA) showed that the attitudinal dispositions of participants for the different age groups show significant difference (F =16.13, p<0.0001) with the age group of 33 to 37 years (N=11) scoring the highest (=13.25, SD=4.83), while the

lowest score was reported for age group of 18 to 22 years (=7.83, SD=2.95). Similarly, when attitudinal disposition scores was compared among the respondents based on their level of education, it was also found out that participants with non-formal education (N=13; =5.00, SD=0.93) scored the lowest compared with participants having more than secondary education who scored the highest (N=44; =10.95, SD=4.30). Thus attitudinal dispositions across educational level showed significant difference (F =75.22, p<0.0001).

With regards to practice of malaria prevention this study found out that mothers of under-five children do not practice the strategies used for malaria prevention. The findings of this study is in line with the study conducted by Atulomah, Farotimi, and Atulomah, (2014) which was conducted among pregnant women attending antenatal clinic at Olabisi Onabanjo University Teaching Hospital (OOUTH), Sagamu, Nigeria. They reported that, malaria preventive practice of all the participants varied across demographic characteristics such as age and educational attainment. Using one-way Analysis of Variance (ANOVA) showed that participants for the different age groups show significant difference (F =21.90, p<0.0001) with the age group of 33 to 37 years (N=11) scoring the highest (=19.27, SD=1.01, while the lowest score was reported for age group of 18 to 22 years (=11.33, SD=3.15). Similarly, when preventive behaviour scores for malaria was compared among the respondents based on their level of education, it was also found that participants with non-formal education (N=13; =10.15, SD=1.52) scored the lowest compared with participants having more than secondary education who scored the highest (N=44; =13.07, SD=2.48; F (3, 133) =11.89, p<0.0001). Thus malaria preventive practices across educational level showed significant difference; (F (3, 133) =11.89, p<0.0001). This study found out that demographic characteristics has less influence on the practice of malaria prevention strategies. The findings of this study is also in consonance with a similar study conducted by Kio, et al,

(2016) among mothers of under-five regarding prevention of malaria in children in Ogun State, Nigeria. The regression result as presented in Table 5 showed that out of all independent variables, the coefficient of the age of the mothers ($p< 0.1$), income level ($p< 0.05$) and frequency of malaria episode ($p< 0.05$) were significant with appropriate signs. This implies that mothers' income and frequency of malaria episode increases the probability of the respondents' using one or more preventive measure to control malaria. The coefficient for the age of the respondents ($p< 0.1$) was significant with a negative sign showing an inverse relationship between age and the probability of the respondents taking preventive measure. This implies that older women show less interest in the prevention of malaria.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Summary

This study assessed the knowledge, attitude and practice of malaria prevention strategies among mothers of under-five children in North Central Zone, Nigeria. In order to achieve the purpose of study eight (8) specific purposes of the study were stated, five research questions were raised and five hypotheses were formulated and tested using suitable statistical tests. Relevant literatures that were related to the study including empirical studies were reviewed. The study employed a multi stage sampling technique which comprised of simple random sampling techniques, proportionate sampling and purposive sampling techniques to sample the respondents of the study from the population. The researcher used a researcher-developed questionnaire made up of close-ended statements for the purpose of data collection from mothers of under-five children who served as respondents. 768 mothers of under-five children were served as respondents for the study.

The data obtained wascomputed usingStatistical Package for Social Science (SPSS) version 22. Demographic information of the respondents was described using frequency and percentage, research questions were answered using mean and standard deviation, while one-sample t-test and Pearson Product Moment Correlation Coefficient

sand multiple regression was used to test the null hypotheses at 0.05 level of significance.

5.1.1 Summary of Findings

The data collected was statistically analysed and the following findings are revealed;

1. Knowledge of malaria prevention strategies among mothers of under-five children in north-central zone, Nigeria is significant (p = 0.001).
2. Attitude towards malaria prevention strategies among mothers of under-five children in north-central zone, Nigeria is significant (p = 0.000).
3. The practice of malaria prevention strategies among mothers of under-five children in north-central zone, Nigeria was not significant (p = 0.7).
4. The influence of knowledge on attitude towards malaria prevention strategies among mothers of under-five children in north-central zone, Nigeria is significant (p = 0.003).
5. The influence of knowledge on the practice of malaria prevention strategies among mothers of under-five children in north-central zone, Nigeria was not significant (p = 0.21).
6. a. There was significant influence of demographic variables (age, level of education, number of children and occupation) on knowledge of malaria prevention strategies among mothers of under five children in north central zone, Nigeria (p=0.00).

b. The significant contribution of the demographic variables (age, level of education, number of children, occupation) is 0.579 indicating less influence.

7. a. There was significant influence of demographic variables (age, level of education, number of children and occupation) on attitude towards malaria prevention strategies among mothers of under five children in north central zone, Nigeria (p=0.01).

b. The significant contribution of the demographic variables (age, level of education, number of children, occupation) is 0.619 which indicate less influence.

8. a. There was significant influence of demographic variables (age, level of education, number of children and occupation) on practice of malaria prevention strategies among mothers of under five children in north central zone, Nigeria (p=0.00).

b. The significant contribution of the demographic variables (age, level of education, number of children, occupation) is 0.524 indicating less influence.

5.1.2 Contribution to Knowledge

1. Mothers of under-five children in North Central zone, Nigeria know about malaria prevention strategies (p=0.001). The mothers have knowledge of the use of mosquito coil (3.55) as well as insect repellent to help prevent mosquito bites (3.61).
2. Mothers of under-five children in North Central zone, Nigeria have a positive attitude towards malaria prevention strategies (p=0.000). They prefer indoor residual spraying of insecticide to prevent mosquito bites (2.70) they also prefer environmental sanitation means (cleaning of surroundings) to prevent breeding environment for mosquitoes (2.69).

3. Mothers of under-five children in North Central Zone, Nigeria do not practice malaria prevention strategies (p=0.7). The mothers do not use insect repellent (1.32) nor doors/window nets to prevent mosquitoes from biting their infants (1.53).
4. The knowledge of mothers of under-five children in north-central zone, Nigeria regarding malaria prevention strategies positively influences their attitude towards malaria prevention strategies (p=0.003).
5. The knowledge of mothers of under-five children in north-central zone Nigeria regarding malaria prevention strategies did not influence their practice of malaria prevention strategies (p=0.21).
6. The demographic variables (age, level of education, number of children and occupation) influence the knowledge of malaria prevention strategies among mothers of under five children in north central zone, Nigeria (Adjusted R square -0.0579).
7. The demographic variables (age, level of education, number of children and occupation) have influence on attitude towards malaria prevention strategies among mothers of under five children in north central zone, Nigeria (Adjusted R square -0.619).
8. The demographic variables (age, level of education, number of children and occupation) did influence the practice of malaria prevention strategies among mothers of under five children in north central zone, Nigeria (Adjusted R square -0.524).

5.2 Conclusion

On the basis of the findings, the following conclusion were made:

1. Mothers of under-five children have knowledge of malaria prevention strategies in North Central zone of Nigeria.
2. Mothers of under-five children have positive attitude towards malaria prevention strategies in North Central zone of Nigeria.
3. Mothers of under-five children do not practice the malaria prevention strategies in North Central zone of Nigeria.
4. The knowledge of mothers of under-five children has a positive influence on their attitude towards malaria prevention strategies in North Central zone of Nigeria.
5. The knowledge of mothers of under-five children does not influence their practice of malaria prevention strategies in North Central zone of Nigeria.
6. Demographic variables (age, level of education, number of children and occupation) have influence on the knowledge of malaria prevention strategies among mothers of under five children in north central zone, Nigeria.
7. Demographic variables (age, level of education, number of children and occupation) have influence on the attitude towards malaria prevention strategies among mothers of under five children in north central zone, Nigeria.
8. Demographic variables (age, level of education, number of children and occupation) have influence on the practice of malaria prevention strategies among mothers of under five children in north central zone, Nigeria.

5.3 Recommendations

On the basis of the conclusion drawn, the following recommendations were made:

1. Health educators should carry out awareness campaigns through health talks which would help to further sustain the already existing knowledge of malaria

prevention strategies among the mothers of under-five children in North-Central Zone, Nigeria.

2. Health educators in collaboration with other non-governmental and governmental agencies should conduct sensitization campaigns (through mass media or community-based outreach) that would help to further sustain the existing attitudes of mothers of under-five children in North-Central, Nigeria.
3. The Federal Ministry of Health in collaboration with the Ministry of Information and Culture should create jingles, plays and programmes focused on educating mothers of under-five children across the country on the need to utilize malaria prevention strategies so as to reduce the disease burden and promote optimal health among them.
4. Health educators and community mobilization officers should work together in educating mothers of under-five children through health talks and health education so as to help the mothers of under-five children sustain their knowledge and have more influences on their attitudes towards malaria prevention.
5. Health educators should conduct periodic symposia's and conferences for mothers of under-five children and women of child-bearing age so as to educate the mothers which would help them to practice what they have learnt concerning malaria prevention strategies.
6. Health educators and non-governmental organizations should put into consideration demography of women such as the age, level of education, family size and occupation when creating awareness campaign and sensitization so as to have more positive application of the knowledge, attitude and practice when disseminating information in the field.

5.4 Implication of the Study

The research implication is that since there is a great concern for the reduction of infant mortality which is caused by malaria disease. Children who are leaders of tomorrow needs to be protected against this endemic disease which has been taking innocent lives. Mothers of under-five children who are the caregivers nursing and protecting this little infants do not practice this preventions strategies and this has led to many infants death; contributing greatly to the incidence of infant mortality in Nigeria. Knowledge of the malaria prevention strategies among the mothers of under-five children should be taken into consideration during health talks as this would help in encouraging them to take up prevention strategies to protect against mosquito bites.

Equally of importance the State and Federal Ministry of Health should lay emphasis on health education, particularly the aspect of practice on their campaign against malaria disease. This, when incorporated would help to sustain the knowledge and positive attitude among mothers of under-five children on malaria prevention strategies and how to practice it. It is suggested therefore that qualified health educators who have the responsibility of disseminating health information should be incorporated into the health care setting. This is necessary to promote the practice of malaria prevention strategies otherwise the ugly trend of infection with malaria parasite will continue to spread in the future.

Healthcare workers including nurses and midwives who most times attend to pregnant and nursing mothers have the responsibility of giving accurate health talks at ante and post-natal clinics in the hospitals.

5.5 Suggestions for Further Studies

The following suggestions were made for further studies;

1. Assessment of awareness and utilization of malaria prevention strategies among mothers of under-five children in north-central zone, Nigeria.
2. Assessment of determinants influencing the utilization of malaria prevention strategies among others of under-five children in north-central zone, Nigeria.
3. Assessment of awareness, attitude and utilization of malaria prevention strategies among women of child-bearing age in north-central zone, Nigeria.

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APPENDIX I

DEPARTMENT OF HUMAN KINETICS AND HEALTH EDUCATION

FACULTY OF EDUCATION

AHMADU BELLO UNIVERSITY, ZARIA

QUESTIONNAIRE ON THE ASSESSMENT OF KNOWLEDGE, ATTITUDE AND PRACTICE OF MALARIA PREVENTION STRATEGIES AMONG MOTHERS OF UNDER -FIVE CHILDREN IN NORTH CENTRAL ZONE, NIGERIA

Dear Respondent,

I am a postgraduate students in the above named department. This questionnaire is designed to enable the researcher to conduct an academic research on the "Assessment of Knowledge, Attitude and Practice of Malaria Prevention Strategies among Mothers of Under-five Children in North Central Zone, Nigeria". It is purely to generate research data, any information given will be treated confidentially.

Your response and time in filling this questionnaire is highly valued and appreciated.

Thank you.

Musa Paul Hannatu

P16EDPE9004

Instruction: Please, tick [✓] the appropriate correct option provided in each box which best describes your opinion

Section A: Demographic Characteristics of the Respondents

1. Age Range of Mothers in years:

   (a) 15 – 24 years ☐

   (b) 25 – 34 years ☐

   (c) 35 – 44 years ☐

   (d) 45 years and above ☐

2. Highest Level of Education:

   (a) No formal education ☐

   (b) Primary Education ☐

   (c) Secondary Education ☐

   (d) Tertiary Education ☐

3. Number of Children per Mother:

   (a) 1 – 3 children ☐

   (b) 4 – 6 children ☐

   (c) 7 children and above ☐

4. Occupation:

   (a) Civil Servant ☐

   (b) Self-employed ☐

   (c) Full – time Housewife ☐

Instruction: Please tick (√) the option you think is most appropriate for you in the box or column provided in each section.

The keys are as follows:

SA – Strongly Agreed

A – Agreed

D – Disagreed

SD – Strongly Disagreed

Section B: Knowledge of Malaria Prevention Strategies among mothers of under-five children

S/N	Item	SA	A	D	SD
1	Mosquito coil can prevent mosquito from biting my child				
2	Insect repellent use can prevent mosquito from biting my child				
3.	Mosquito net when used can help to prevent mosquitoes from biting my child				
4	Window net when fixed properly can help to prevent mosquitoes from biting my child				
5	Door nets when fixed can help to prevent mosquitoes from biting my child				
6	Cutting bushes around the house can help to prevent mosquitoes breeding				
7	I know that disposing of empty containers harboring water can help to prevent breading of mosquitoes				
8	Use of electric mosquito zapper can help to prevent mosquitoes from biting my child				
9	Dressing the children in protective cloths such as long sleeve shirts can help prevent them from mosquito bites				
10	Indoor residual spraying of insecticide can completely prevent mosquitoes from staying in dark corners of the rooms				
11	Sleeping inside insecticide treated mosquitoes net prevent mosquitoes from biting my child				

Section C: Attitude towards Malaria Prevention Strategies among Mothers of under five children

S/N	Item	SA	A	D	SD
1	I feel it will be comfortable sleeping under mosquito net				
2	I like repellent on my child				
3	I like mosquito coil in my room				
4	I often like cleaning my surroundings to prevent breeding environment for mosquitoes				
5.	I like electric mosquito zapper to prevent mosquito bites				
6.	I prefer door net rather than the use of the other prevention methods				
7	I prefer indoor residual spraying of insecticide to prevent mosquito bites				
8	I prefer mosquito coil to prevent mosquito bites				
9	I prefer wearing protective cloths for my child to prevent mosquitoes bite				
10.	I prefer insect repellent for the family to prevent mosquitoes bite.				
11	I prefer insecticide treated mosquitoes net for the prevention of mosquitoes bite.				

Section D: Practice of Malaria Prevention Strategies by Mothers of under five

S/N	Item	SA	A	D	SD
1	I wear protective cloths (long pants and long sleeve shirt) prevent mosquito bites				
2	I use window nets to prevent mosquitoes				
3	I cut bushes around the house to prevent mosquitoes breeding				
4	I dispose empty containers harboring water to avoid breading of mosquitoes				
5	I use door net to prevent the entrance of mosquitoes to my room				
6	I use insecticide-treated mosquito net to prevent mosquito bites				
7	I use Indoor residual spraying of insecticide to prevent mosquitoes				
8	I use insect repellent to prevent mosquitoes from biting my child				
9	I use electric mosquito zapper to kill mosquitoes from biting my child				
10	I use mosquito coil to prevent mosquitoes from entering my room				
11	I use electric mosquito zapper to prevent mosquitoes bite				

APPENDIX II

RELIABILITY TEST

Result of the Cronbach Alpha Reliability test

Case Processing Summary

		N	%
Cases	Valid	50	100.0
	Excluded[a]	0	.0
	Total	50	100.0

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.833	.841	33

Item Statistics

	Mean	Std. Deviation	N
Question 1	3.5300	.07018	50
Question 2	2.5400	.19324	50
Question 3	3.2500	.55115	50
Question 4	3.5510	.55814	50
Question 5	3.3500	.61073	50
Question 6	3.2400	.62304	50
Question 7	3.1600	.72034	50
Question 8	3.2500	.75635	50
Question 9	2.3400	.73640	50
Question 10	3.8550	.60608	50
Question 11	3.4000	.51258	50
Question 12	3.3000	.45010	50
Question 13	3.4000	.66372	50
Question 14	1.9500	.07868	50
Question 15	3.4050	.71085	50
Question 16	2.5100	.85052	50
Question 17	3.1020	.54056	50
Question 18	3.2500	.54340	50
Question 19	2.3400	.47092	50
Question 20	3.2010	.75314	50
Question 21	2.4500	.61085	50
Question 22	3.6000	.25606	50
Question 23	2.3200	.72950	50
Question 23	3.6000	.26636	50
Question 24	2.3500	.82950	50
Question 25	2.2020	.41102	50
Question 26	3.0400	.61337	50
Question 27	2.0500	.24064	50
Question 28	2.6440	.61064	50
Question 29	3.2500	.32035	50

Question 30	3.0700	.30116	50
Question 31	3.6200	.21036	50
Question 32	2.1400	.70050	50
Question 33	3.1060	.47057	50

Summary Item Statistics

	Mean	Minimum	Maximum	Range	Maximum / Minimum	Variance	N of Items
Item Means	2.250	1.950	3.115	2.418	2.013	.065	33

APPENDIX III

DEPARTMENT OF HUMAN KINETICS AND HEALTH EDUCATION

AHMADU BELLO UNIVERSITY, ZARIA - NIGERIA

OFFICE OF THE HEAD OF DEPARTMENT

VICE CHANCELLOR: Professor Ibrahim Garba, B.Sc, M.Sc., (ABU); Ph.D. (London); D.I.C.

HEAD OF DEPARTMENT: Professor M. A. Suleiman, N.C.E. (OYSCE); B.Sc. (UNICAL); M.Sc, Ph.D. (ABU)

Our Ref. No. **P16EDPE9004**

16th April, 2019.

Dear Sir/Madam,

LETTER OF INTRODUCTION TO VET QUESTIONNAIRE

Usmanu Musa PAUL **P16EDPE9004** is a Post Graduate student of the above named Department. She is conducting a research on the **"Assessment of Knowledge, Attitude and Practice of Malaria Preventive Strategies among Mothers of under Five Children in North Central Zone, Nigeria"**.

In view of this, you have been appointed as one of the jurors to critically look at the instrument for your comments and contribution.

We count on your cooperation and prompt response.

Thanking you.

Yours faithfully.

Dr. Umaru Musa
Major Supervisor

APPENDIX IV

DEPARTMENT OF HUMAN KINETICS AND HEALTH EDUCATION

AHMADU BELLO UNIVERSITY, ZARIA - NIGERIA

OFFICE OF THE HEAD OF DEPARTMENT

VICE CHANCELLOR: Professor Ibrahim Garba, B.Sc, M.Sc., (ABU); Ph.D. (London); D.I.C.

HEAD OF DEPARTMENT: Professor M. A. Suleiman, N.C.E. (OYSCE); B.Sc. (UNICAL); M.Sc, Ph.D, (ABU)

Our Ref. No P16EDEPE9004

Date: 14-05-2019

Dear Sir/Madam,

PERMISSION TO ADMINISTER QUESTIONNAIRE

The bearer **Hannatu Musa Paul** P16EDEPE9004 is a Ph.D student, studying Health Education in the Department of Human Kinetics and Health Education. In partial fulfillment of the requirements of her Doctoral programme, she is conducting a research on **"Assessment of Knowledge, Attitude and Practice of Malaria Preventive Strategies among Mothers of Under-five Children in North Central Zone, Nigeria"**

Your Organization has been chosen as one of the areas which the researcher will collect information by administering the questionnaire on her respondents.

I therefore request your kind permission to allow her to administer her questionnaire, as well as extend your fullest possible cooperation which would be highly appreciated.

Thanking you.

Dr. Umaru Musa
Major Supervisor