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An Examination of the Association between Malaria Knowledge and Bed Net Use of Pregnant Women Receiving Antenatal Care at Federal Medical Centre, Abeokuta, Nigeria.

Modupe Babalola

AN EXAMINATION OF THE ASSOCIATION BETWEEN MALARIA KNOWLEDGE AND BED NET USE OF PREGNANT WOMEN RECEIVING ANTENATAL CARE AT FEDERAL MEDICAL CENTRE, ABEOKUTA, NIGERIA.

By

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A Thesis Submitted to the Graduate Faculty of Georgia State University in Partial Fulfillment of the Requirements for the Degree

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ABSTRACT

BACKGROUND: Malaria remains a big challenge in Africa where 45 countries, including Nigeria, are endemic for the disease. Pregnant women living in malaria-endemic countries are of interest because of the reduced immunity during pregnancy. Reports show that malaria control efforts by the government and other programs like Roll Back Malaria might not be effective due to limited resources. The purpose of the study is to evaluate the knowledge of pregnant Nigerian women regarding malaria and their behavior towards the use of bed net as a method for malaria control. Specifically, this study examined the effect of malaria knowledge on the use of bed net among pregnant Nigerian women. This study will provide insight for a further study.

METHODS: The study was conducted at the Federal Medical Centre Abeokuta, Ogun State, Nigeria. The study population consisted of 61 pregnant women that attended the antenatal care clinic. Questionnaires were given to women who gave their consent and the questionnaires were self administered.

RESULTS: The pregnant women had very good knowledge of the general knowledge on malaria. However, the amount of pregnant women who choose the correct answer reduced with questions pertaining to malaria's effect on the mother and fetus health. General knowledge had no effect on bed net use but the more knowledgeable the pregnant women were in regards to how malaria affected the mother's health and fetus' health, the more likely they were to use bed net. In this study, 73% of the women used bed net.

Conclusion: In this study, the use of bed net was higher than other studies and this might have been due to bed nets been distributed at the clinic. Even though many of the women used bed net

and other preventive measures, about 56% of the pregnant women had experienced malaria during their current pregnancy. General knowledge on malaria did not seem to affect bed net use; however, knowledge on the consequences of malaria affected bed net use. The pregnant women who had the knowledge of how malaria affected the fetus were more likely to use bed net. For programs like Roll Back Malaria and other government programs to reduce the mortality and morbidity rate due to malaria, it will be beneficial to provide the pregnant women tailored information about the health consequences of malaria and how malaria affects the mother and the fetus.

KEY WORDS: Malaria, Pregnant women, Knowledge, Bed Net, Nigeria

CHAPTER 1

INTRODUCTION

1.1 Background

Malaria continues to be a challenge in Africa. Forty five countries, including Nigeria, are endemic for malaria and 588 million people are at risk (World Malaria Report 2012). The disease is caused by five different species of parasites from the genus plasmodium with *plasmodium falciparum* causing the most deadly form of malaria. *P. falciparum* is also the most common type of parasite in many African countries (World Malaria Report 2012).The recent World Malaria Report showed that Nigeria and Democratic Republic of the Congo are responsible for over 40% of the estimated total deaths due to malaria (WHO | World Malaria Report 2012). Pregnant women living in malaria-endemic countries are of particular concern because of the reduced immunity during pregnancy. Also, most cases of malaria in pregnancy in areas of stable malaria transmission do not show symptoms (Anorlu et al,. 2001). Asymptomatic malaria in pregnancy is due to immunity acquired from previous exposures of malarial infections (Staalsoe et al., 2004).

Unfortunately, Malaria is a threat to both the mother and the fetus. In different parts of Nigeria, different researchers have reported different prevalence rates of malaria in pregnancy, ranging from 19.7% to 72.0% (Uneke et al., 2008). Malaria can cause maternal anemia, hypoglycemia, and even death of the mother. Ten thousand maternal anemia-related deaths are estimated to occur in sub-Saharan Africa annually (Desai et al., 2007). Malaria also causes low birth weight in the unborn child due to reduced nutrient to the placenta (Newman et al., 2003).

Pregnant women have high risk of malaria infection and they need special protection to ensure better birth outcome.

Some reports have shown that the malaria control efforts by the Government and other programs like the Roll Back Malaria program might not be successful (WHO | World Malaria Report 2012). In some African countries, high intervention coverage and good surveillance contributed to the reduction of malaria incidence and deaths by 50% between 2000 and 2006 (WHO | World Malaria Report 2008), however, reports from Nigeria has not shown similar reduction, especially when it comes to malaria in pregnancy. The lack of resources was attributed to the minimal results in Nigeria (Roll Back Malaria). In recent years, evidence has shown that the use of intermittent preventive treatment in pregnancy with sulphadoxine-pyrimethamine (IPTp-SP) and insecticide treated bed nets (ITNs) can greatly reduce the negative effects of malaria during pregnancy. Since 1998, World Health Organization has recommended these two measures (WHO | World Malaria Report 2008).

National Malaria Control Program of the Nigerian Ministry of Health uses intermittent preventive treatment (IPTp) and insecticide treated bed nets (ITNs) as the major components to reduce the health effects of malaria during pregnancy in the country (FMOH, 2005). Even though the Nigerian government promotes IPTp and ITNs for pregnant women, not all states distribute the intervention for free when women visit the clinics during pregnancy. ITN advocacy and local NGO also distribute free ITN to pregnant women regularly, however, In spite of the effectiveness of ITNs and IPT-SP, the uptake and coverage in Nigeria is very low (Akinleye et al., 2009) which is the reason for assessing the knowledge of malaria and bed net use of pregnant

women receiving antenatal care at Federal Medical Center Abeokuta, Nigeria. This study will provide insight for a further study.

1.2 GENERAL OBJECTIVE

The purpose of this study is to evaluate the knowledge of pregnant Nigerian women receiving antenatal care at Federal Medical Center Abeokuta, Nigeria regarding malaria and their behavior towards the use of bed net as a method for malaria control.

SPECIFIC OBJECTIVES

1. To determine the knowledge of the pregnant women regarding malaria.
2. To assess respondents bed net use.
3. To analyze the effect of malaria knowledge on the use of bed net among pregnant Nigerian women.

CHAPTER II

REVIEW OF LITERATURE

2.1 Overview of Malaria

Fever caused by malaria had been recorded in China from 2700 BC and Hippocrates in the 5th Century BC (Cox, 2002). The name malaria comes from 'mal'aria' which means bad air in Italian. The illness got its name because malaria is associated with wetlands (Cox, 2002; Tuteja, 2007). The scientific understanding of malaria started at the end of the 19th century when Charles Laveran, a French army surgeon noticed that there were parasites in the blood of his patients. Malaria was discovered to be transmitted by mosquitoes by Dr. Ronald Ross, a British medical officer in India while Giovanni Battista Grassi discovered that only Anopheles Mosquitoes transmitted malaria (Cox, 2002; Tuteja, 2007).

Malaria is caused by five different species of parasites from the genus plasmodium. The species include *P. falciparum, P. vivax, P. ovale, P. malariae and P. Knowlesi* (World Malaria Report 2012). *Plasmodium falciparum* causes the most deadly form of malaria and it is the type that predominates in many African countries (World Malaria Report 2012). Malaria parasites are transmitted to humans from the bite of infected female anopheles mosquitoes during the process of sucking blood to nurture their eggs. The life cycle of malaria is very complex. It begins with the infectious state, when an infected anopheles mosquito injects sporozoites into the blood of its host. The sporozoites enter and multiply in the liver cells of the infected host which leads to production of merozoities. Merozoities attack the red blood cells and multiplication continues, with the rupture of red blood cells causing the symptoms from the disease. The parasite is taken

up again by a mosquito that feeds on an infected host (Tuteja, 2007). The parasite matures in the stomach of the mosquito and infects another host continuing the cycle. Humans show symptoms of infection approximately 9 to 14 days after infected bite and the symptoms include headache, fever, joint pains, and vomiting. (Cox, 2002; Tuteja, 2007)

2.2 Burden of Malaria

About 3.3 billion people were at risk of getting infected with malaria in 2011, with the people living in sub-Saharan Africa having the highest risk of getting the disease (World Malaria Report 2012). In 2010, there were 219 million cases of malaria and 660,000 estimated deaths (World Malaria Report 2012). Malaria is the leading cause of death among children in Africa, with 86% of the deaths occurring among children under the age of five (World Malaria Report 2012). In malaria endemic countries, children less than five years of age have about four to nine episodes of malaria each year and a child dies from the illness every minute (Breman et al., 2004.) Malaria deaths are also responsible for almost three percent of the world's disability adjusted life years and about 10% of Africa's disability adjusted life years (DALY) (Breman et al., 2004). In 2008, 109 countries were endemic for malaria including 45 countries in the WHO African region and in 2011, 80% of the deaths occurred in 14 countries with Democratic Republic of the Congo and Nigeria making up 40% of the total malaria deaths globally. (World Malaria Report 2008, World Malaria Report 2012)

The burden of malaria is higher in some countries compared to others and some of the factors that increase prevalence include climate, parasites present in these countries and economic status. The relationship between climate and malaria is still under debate, however, increases in temperature and rainfall can cause mosquitoes to grow and multiply and this

increases the transmission of malaria (Fernando, 2010). *P. falciparum*, which causes the most severe type of malaria increases the mortality rate in these countries (CDC). Another factor that affects the distribution of malaria is the economic status. Malaria is greatly associated with poverty (Gallup & Sachs, 2001). The mortality due to malaria is highest in countries with lower Gross National Income. Also, countries with high percent of their population living with less than US $1.25 per person per day have higher malaria mortality rates (World Malaria Report 2012). The only parts of Africa free from malaria are areas with the richest countries on the continent (Gallup & Sachs, 2001).

Over the past quarter century, the economic growth in countries with malaria has been low, while countries that have been able to reduce malaria have been able to increase their growth afterward (Gallup & Sachs, 2001). From 1965-1990, the growth of income per capita for countries with severe malaria was 0.4% per year, while average growth for other countries without malaria was 2.3% which was about five times higher (Gallup & Sachs, 2001). The relationship between malaria and poverty could be due to malaria reducing the amount of effective work that those infected can do or poverty might promote the transmission of malaria (Gallup & Sachs, 2001). In a study done in Nepal, 6-14 days of work and 4- 14 days of school are lost on average each year due to malaria (Mills, 1993; Sachs & Malaney, 2002).

2.3 History of Control of Malaria

Malaria was endemic in most countries until the mid-19th century when 90% of the world's population lived in areas with malaria. Towards the middle of 19th century, many areas in European and North America eliminated malaria when they started cultivating lands for agriculture, and the housing situations improved (Mendis et al., 2009). After the discovery of the

parasite responsible for malaria in 1880, understanding of the cycle of malaria improved and treatments became wildly available allowing elimination in many of the countries in Europe (Mendis et al., 2009). To further eradicate the illness, in 1955, World Health Organization started the Global Malaria Eradication Programme in order to eradicate malaria from all countries. Although the program's goal of complete eradication was not accomplished, 37 out of 143 malaria endemic countries achieved elimination (Eliminating Malaria). The attempt to control malaria decreased tremendously after this. However, new interest for elimination started in the past decade. In 1998, Roll Back Malaria initiative was launched by WHO to provide global response to the disease (Eliminating Malaria). In 2005, countries that were affected by malaria signed a pledge to eliminate malaria by 2015 and in 2007, the Bill & Melina Gates Foundation called for malaria eradication. These new interests have increased investments for the control of malaria(Eliminating Malaria.; Mendis et al., 2009; Nabarro & Mendis, 2000).

2.4 Prevention Efforts

There have been improvements in reducing incidence and mortality due to malaria. This progress has been faster for countries with lower numbers of cases and deaths, however, countries with high cases and deaths due to malaria have also experienced some success in reducing incidence and mortality due to malaria (World Malaria Report 2012). From 2001 to 2010, 274 million cases and 1.1 million deaths have been prevented in many countries due to preventive measures and majority of the cases prevented and the lives saved were from 10 countries with the highest malaria burden in 2000 (World Malaria Report 2012). If the current recommended interventions are used correctly, malaria can be widely prevented. Some of the recommended interventions include insecticide-treated nets, indoor residual spraying, and

chemoprevention for vulnerable population like pregnant women and infants under the age of five (World Malaria Report 2012.)

Insecticide-treated nets (ITNs) are either long lasting insecticidal nets or bed nets that have been treated with insecticides. Insecticide treated nets have been shown to reduce the death of children due to malaria by 20% (CDC). Areas with high prevalence of malaria like sub-Saharan Africa are considered to be the most in need for control interventions. About 150 million ITNs are needed each year to protect the 780 million people in sub-Saharan Africa; the number can increase depending on how long the insecticide nets last. About 89 countries distribute ITNs for free, with 33 of them distributing the nets through antenatal clinics. To provide for the increase need of ITNs, number of manufactured beds nets increased from 6 million in 2004 to 145 million in 2010. Also, the number of people owning at least one bed nets also increased, going from 3% in 2000 to 53% in 2011 (World Malaria Report 2012). In 2012, the proportion of those sleeping under bed nets was 33%, which increased from 2% in 2000, however, the distribution of ITNs has reduced in the last two years and this can affect the progress and delay the efforts towards universal coverage (World Malaria Report 2012).

Insecticide resistance sprays (IRS) are chemical insecticides that are applied on the walls and roofs of houses. They lead to the reduction of mosquitoes with the parasite, which in turn reduces the contact with humans (CDC., WHO | Indoor residual spraying). IRS for malaria control is recommended in 80 countries and 38 of these countries are in Africa (WHO | Indoor residual spraying). Even though the intervention is used to control malaria epidemics in 42 countries and the amount of people using the intervention increased during 2006-2008, only 153 million people were reported to have been protected by IRS in 2011; this accounts for only 5%

of the population at risk of getting malaria (World Malaria Report 2012). The use of IRS has reduced due to lack of commitment from the government, lack of funds and fear of the effects on human health (WHO | Indoor residual spraying).

Chemotherapy is the use of antimalarial medicines to prevent malaria from occurring which in turn reduces malaria mortality. This intervention is geared towards the high risk groups: pregnant women, infants and children. Chemotherapy for pregnant women is called intermittent preventive treatment in pregnancy (IPTp) with sulfadoxine-pyramethamine (SP) and it is recommended for all pregnant women who attend antenatal care. WHO recommends that the first dose be taken as soon as possible in the 2nd trimester of pregnancy and the doses be given at least once a month (WHO | World Malaria Report 2012). Each dose eliminates any asymptomatic infection from the placenta and provides prophylaxis for 6 months and has been shown to reduce low birth weight. Also, due to the effectiveness, many of the malaria endemic countries in Africa adopted the prevention method. (Kayentao K, 2013).

Chemotherapy for infants is called intermittent preventive treatment in infants (IPTi) with sulfadoxine-pyrimethamine (SP-IPTi) and it is recommended to be taken with the 3 doses of diphtheria-pertussis-tetanus and measles vaccines. The third chemotherapy is recommended for children from 3-59 months and only in areas with high seasonal malaria in Africa. The use of chemotherapy maintains the concentration of the antimalarial drug which reduces the mortality rate of children due to malaria (WHO | World Malaria Report 2012.).

2.5 Malaria in Nigeria

Nigeria, as shown in figure 1, is located in West Africa and it is the most populous country in Africa with 174 million people. The country is twice as big as California and it is comprised of 250 ethnic groups with three main tribes. Malaria and yellow fever are the two major vector borne diseases (CIA). Malaria is endemic with a peak from April to October. Thirty three percent of the population lives in areas with high transmission of malaria, 67% in moderate transmission, and 3% live in low transmission (Roll Back Malaria Progress and Impact Series - Focus on Nigeria). Malaria also causes financial strain on the Nigerian economy; an estimated US $835 million is spent yearly for prevention, treatment and loss of income due to failure to work during illness (Roll Back Malaria Progress and Impact Series - Focus on Nigeria). Malaria in Nigeria is higher compared to other African countries with one quarter of malaria in Africa happening in Nigeria. In 2010, 42% of Nigerian children under the age of five were tested positive for malaria. Also, in 2008, approximately 110 million cases of malaria were reported in Nigeria with 300, 000 deaths among children under the age of five attributed to the illness. In the same year, 11% of maternal deaths were due to malaria (Roll Back Malaria Progress and Impact Series - Focus on Nigeria).

Figure 1. Map of Nigeria

Source: CIA. The World Factbook, https://www.cia.gov/library/publications/the-world-factbook/maps/maptemplate_ni.html

According to Roll Back Malaria, between 1955 and 1968, the Global Malaria Eradication Programme conducted pilot studies to evaluate the readiness of different countries to eradicate malaria and the results were not encouraging. Due to this study, malaria control was recommended for Nigeria, instead of malaria eradication. Shortly after the study, the National Malaria Control Committee was started in 1975 and the plan to reduce malaria by 25% by the year 1980 was developed (Roll Back Malaria). The plan was not achieved but it was revived when Roll Back Malaria (RBM) initiative started in 1998. RBM was a new beginning in malaria control in Nigeria; compared to other initiatives, it focused on evidence based planning and decision-making (Roll Back Malaria).

The Nigerian national strategy for controlling pregnancy in malaria focuses on three strategies and they include the use of insecticide treated nets, fast access to treatment, and intermittent preventive treatment (Ankomah et al., 2012). Between 2007 and 2010, the Nigeria National Malaria Control Programme (NMCP) increased the amount of insecticide-treated mosquito nets and over 50 million ITNs became available to the population. In addition, 42% of the household owned at least one ITN in 2010 (Roll Back Malaria). Since 2001, 166,000 children under the age of five have been saved by these interventions (Roll Back Malaria).

2.7 Malaria and Pregnancy

30 million women become pregnant in malaria-endemic areas in Africa yearly and malaria is a potential risk to them and their babies. Also, 200,000 newborn deaths can be attributed to malaria during pregnancy (Bouyou-Akotet et al., 2003). In malaria endemic countries, immunity against *plasmodium falciparum* can be achieved during the first 10-15 years of life (Bouyou-Akotet et al., 2003). However, pregnant women are at risk of been infected with malaria because their immunity reduces during malaria and this puts them at risk of anemia and other health issues including death. Women are more susceptible to malaria during their first and second pregnancy and immunity can be achieved after several pregnancies (Bouyou-Akotet et al., 2003; WHO | Lives at risk). In areas with non endemic malaria, the women have lower levels of immunity and are more likely to show symptoms during illness and are more likely to be at risk of developing severe disease or death (Lagerberg, 2008).

Malaria can double the risk of severe anemia, triple the risk of preterm birth and quadruple the risk of fetal growth restriction in the uterus (Goldenberg et al., 2003). In first time pregnancy, malaria has been reported to occur in 16% to 63% of the pregnant women and only

12% to 33% in women who have had previous pregnancies (Goldenberg et al., 2003). Malaria can cause spontaneous abortion, stillbirth, premature delivery and low birth weight in the unborn child (Bouyou-Akotet et al., 2003; WHO | Lives at risk). Severe anemia causes 10,000 deaths in pregnant women every year in Africa, with malaria causing 3-15% of anemia, 8-14% of low birth weight, and 3-8% of infant mortality (Guyatt et al., 2001; Steketee et al, 2001). Other conditions like HIV can further reduce the immunity of pregnant women leading to more symptomatic infections and increased risk of adverse outcomes for the mother and child (WHO | Lives at risk).

2.8 Bed Net and Pregnancy

Insecticides treated nets work by killing mosquitoes that land on them or repelling them, as a result reducing the contact with humans. Insecticide treated nets benefits pregnant women by reducing low birth weight and maternal anemia. WHO recommended that pregnant women start using insecticide treated nets as soon as possible during their pregnancy (WHO | Lives at risk). Studies have shown the effectiveness of ITNs and it has been recommended as a strategy to reduce adverse effects due to malaria (Gamble et al., 1996). Even though insecticides treated nets are considered the most effective method of preventing malaria in endemic areas, they are underutilized and under recommended. In 2008, Nigeria's national demographic and health survey (NDHS) did a survey to evaluate how many people used bed nets before the day of the survey; only 12% of the pregnant women slept under the net.

Many more studies have looked into the utilization of bed net among Nigerian pregnant women. A cross sectional survey done in Ibadan, Nigeria found that 82.4% of their participants had heard of ITNs, 32.0% had never seen ITNs, 44.2% owned ITNs, and only 20.9% had

positive attitude towards the use of ITNs. They also found that majority of the pregnant women did not own ITNs because they did not have access to free distribution. Many of the participants also received their information about ITNs from Antenatal clinics (Aluko et al., 2012). Another study in Edo state, Nigeria, concluded that 9.3% of the pregnant women they surveyed owned ITN and only 8% of those that had the ITN used it. They also found that availability of nets, belief in the effectiveness of the ITN, their level of education, their family size were all factors that contributed to the lack of bed net use (Wagbatsoma et al., 2010). A study looked into the perceptions of the use of ITNs in Imo State, Nigeria, and concluded that issues affecting lack of utilization of nets included high cost, the idea that the chemical used to treat the nets were dangerous, and lack of the husband support (Chukwuocha et al., 2010).

2.9 Knowledge of Malaria and Pregnancy

The knowledge of pregnant women on the health effects of malaria is important because with adequate knowledge, the women can better understand the issues facing them and can better improve their health (Iriemenam et al., 2011). Increase in knowledge is also important for proper use of prevention methods (Ouattara et al., 2011). Many studies have been done in Nigeria to evaluate the knowledge of pregnant women on the health effects of malaria. In a cross sectional study in Ibadan, Nigeria, 37% of the women had high knowledge of malaria in pregnancy (Aluko & Oluwatosin, 2012). In another study done in Ekiti state, Nigeria, which evaluated the knowledge of pregnant women attending an antenatal clinic, they found that knowledge of malaria was very good (among 1.0%), average (among 78.9%), and poor (among 20.1%) of the participants (Iriemenam et al., 2011).

A study in Edo State, Nigeria, concluded that the 69% of the pregnant women had good knowledge, however, 2.3% of the women knew how malaria affected the fetus (Wagbatsoma et al., 2010). Another study was done in Edo, which found that 89% of their respondents knew malaria bites caused malaria and 75% of them considered malaria a significant health risk during pregnancy. They also evaluated their knowledge on malaria and found that the women had poor knowledge about the consequences of malaria, with the mean score of 3.5 on a scale of 0-7, 59% of the participants scored between 3 to 4. They also concluded that the women had poor belief pertaining to the means of preventing malaria with insecticide treated nets and intermittent preventive therapy (Enato et al., 2007). These studies found general knowledge of malaria to be average and the knowledge of the consequences of malaria to mother's health and fetus' health to be very low.

Many of the study evaluated knowledge and bed net use separately; very few studies analyzed the association between knowledge and bed net use. One recent study was done in the capital of Nigeria, Abuja, and found that 43.7% of their participants had excellent knowledge of malaria and how to prevent it, 12.9% had good knowledge, 14.9% had average knowledge, 13.9% had fair knowledge and 14.6% had poor knowledge. They also found that there were no statistically significant association between knowledge of malaria and use of ITN. The reasons their participants gave for not sleeping under the bed net included heat from bed net, fear of suffocation, and many of the participants thought that bed net was not effective at preventing malaria (Akaba et al., 2013). Another study done in Ekiti, Nigeria, found that knowledge significantly influenced the use of insecticide treated nets and out of the 69% of the participants who knew about bed net use, 95% of them scored "good" on knowledge (Akinleye et al., 2011).

Both studies analyzed the association between knowledge and bed net use but their conclusions were different.

CHAPTER III

METHODS AND PROCEDURES

3.1 Background

The study was conducted at the Federal Medical Centre (FMCA) Abeokuta, Ogun State, Nigeria, a federal funded hospital. On the first visit of the pregnant women to the hospital, they were given bed nets by the hospital. The study population consisted of 61 pregnant women who attended the antenatal care clinic at the hospital. A questionnaire, with multiple choice answers, was developed that included 13 questions regarding knowledge about malaria, questions on demographics, attitudes towards malaria and participants' bed net use. The questionnaire was handed out to pregnant women who signed the consent form; the questionnaires were self administered. The questionnaire was written in English and it was approved by Georgia State University (IRB # H12482) and by the Federal Medical Center health ethics committee.

3.2 Statistical Analysis

The study assessed the knowledge of pregnant women on the health effects of malaria on pregnancy and the utilization of bed nets among the pregnant women. The data was analyzed and coded using SPSS version 20 for windows. Descriptive statistics was used to obtain the demographics variables. Chi-square analyses were used to determine whether or not knowledge was associated to bed net use. Statistical tests were considered statistically significant at a p-value of $< .05$. Odds ratio was obtained as well.

3.3 Independent and Dependent Variables

The dependent variable is bed net use. To obtain information on this variable, participants were asked "Do you use bed nets?" Independent variables included three groups: general knowledge on malaria, knowledge of malaria on mother's health, knowledge of malaria on fetus' health.

The Independent variables were constructed by using the answers from the following questions. Correct answers were coded as 1 and incorrect answers were coded as 2.

General Knowledge of Malaria

1. How is malaria transmitted?

2. What can be done to prevent malaria?

3. How else can malaria be prevented?

4. Which of these is a symptom of malaria?

Knowledge of Malaria on Mother's Health

1. Can malaria occur during pregnancy?

2. Are pregnant women more susceptible to malaria?

3. What makes pregnant women more susceptible to malaria?

4. What problem can malaria give the mother?

5. What other problem can malaria give to mother?

6. When can fansidar be used during pregnancy?

Knowledge of Malaria on Fetus' Health

1. Can malaria be a problem for the fetus?
2. What problem can malaria give to fetus?
3. What other problem can malaria give to fetus?

CHAPTER IV

RESULTS

Table 1a and 1b summarizes the demographics of the eligible pregnant women of this study. The study population consisted of 61 pregnant women and the age range of the women that responded to the questionnaire was from 24 years to 43 years, with a mean of 30 years. The range of pregnancy was from 8 to 39 weeks with the mean of 27 weeks. Pregnant women from the Yoruba tribe made up 95% of the sample. All of the women were married. About 27% of the women were primigravidae and 73.2% of them were multigravidae. Forty eight percent of the valid respondents were from Ogun state, where the study was conducted, 31% of the women were from Lagos state, 6.3% were from Osun state, and Oyo state.

Thirty three percent of the women had a household size of two, 20% had a household size of three, 33% had a household of four, and 14% had a household size of more than four. Annually, 3% of the pregnant women had an income of 129 US dollars, 12% had an income of 129 to 190 US dollars, 9% had an income of 190 to 250 US dollars, and 76% had an income of more than 250 US dollars. Twenty three percent had attended some university while 77% had a university degree. Thirty percent were civil servants that worked for the government, 26% were teachers, 25% did business, and 7% were nurses. Other occupations included scientist, doctor, lawyer, secretary, and a banker.

Table 1a: Distribution of Study Participants by Demographics

Variables	N	Mean/ Percentage (%)
Age	35	Range 24-43 years Mean 30.49 ± 4.54
Pregnancy in weeks	44	Range 8-39 weeks Mean 27.14 ± 7.73
Tribe		
Yoruba	58	95.1
Igbo	1	1.6
Hausa	1	1.6
Others	1	1.6
Marital status		
Married	61	100
Children		
0	11	26.8
1	16	39.0
2	10	24.4
3	4	9.8
Birthplace		
Lagos State	15	31.3
Ogun State	23	47.9
Osun State	3	6.3
Oyo State	3	6.3
Household size		
2	18	32.7
3	11	20.0
4	18	32.7
<4	8	14.5

Table 1b: Distribution of Study Participants by Demographics (Cont.)

Demographics	Sample Size	Percent
Income		
10,000-19,999	1	3.0
20,000-29,000	4	12.1
30,000-39,000	3	9.1
>40,000	25	75.8
Education		
Some university	13	22.8
University	44	77.2
Occupation		
Civil Servant	13	30.2
Teaching	11	25.6
Business	11	25.6
Nursing	3	7.0
Scientist	1	2.3
Doctor	1	2.3
Legal practice	1	2.3
Secretary	1	2.3
Banking	1	2.3

Table 2a and 2b show the distribution of general knowledge about Malaria. Ninety seven percent of the women knew that malaria is transmitted by mosquito. Ninety three percent knew bed nets can be used to prevent malaria, 5% answered incorrectly by choosing antibiotics. Fifty three percent knew fansidar can be used to prevent malaria and 18% answered incorrectly by choosing the option of drinking a lot of water to prevent malaria. Ninety two percent knew fever was a symptom of malaria, and 2% answered incorrectly by choosing red eye as a symptom for malaria.

Table 2a: Distribution of General Knowledge about Malaria

Variables	N	Correct %
How is malaria transmitted?		
-Mosquito with parasite	59	96.7
-Through air	0	0
-Touching others	0	0
-I do not know	0	0
-Missing	2	3.3
What can be done to prevent malaria?		
-By using antibiotics	3	4.9
-Nothing	0	0
-By using bed nets	57	93.4
-I do not know	0	0
-Missing	1	1.6
How else can malaria be prevented?		
-Drinking a lot of water	11	18.0
-Eating fruits	4	6.6
-By using fansidar	32	52.5
-I do not know	5	8.2
-Missing	9	14.8

Table 2b: Distribution of General Knowledge about Malaria (Cont.)

Variables	N	Correct %
Which of these is a symptom of malaria?		
-Fever	56	91.8
-Swollen foot	0	0
-Red eye	1	1.6
-I do not know	2	3.3
-Missing	2	3.3

Table 3a and 3b shows proportion of women who responded to questions related to malaria knowledge on mother's health. Ninety two percent of the women knew that malaria can occur during pregnancy. Seventy one percent knew pregnant women are more susceptible to malaria and 10% answered incorrectly by choosing the option "no." Fifty four percent knew decline in the immune system makes pregnant women more susceptible to malaria. Forty six percent knew anemia is a problem that malaria causes the mother and 5% answered incorrectly by choosing red eye. Sixteen percent knew malaria causes hypoglycemia in pregnant women, 18% answered incorrectly by choosing "sneezing." Fifty three percent knew fansidar can be used between 16 weeks and 32 weeks and 7% answered incorrectly by choosing the option "never."

Table 3a: Distribution of Knowledge on Malaria on Mother's Health

Variables	Sample Size	Correct %
Can malaria occur during pregnancy?		
-Yes	58	91.8
-No	1	1.6
-I do not know	0	0
-Missing	2	3.3
Are pregnant women more susceptible to malaria?		
-Yes	43	70.5
-No	6	9.8
-I do not know	5	8.2
-Missing	7	11.5
What makes pregnant women more susceptible to malaria?		
-Weight gain	0	0
-Decline in immune system	33	54.1
-Bigger stomach	0	0
-I do not know	16	26.2
-Missing	12	19.7
What problem can malaria give the mother?		
-Swollen fingers	1	1.6
-Red eye	3	4.9
-Anemia	28	45.9
-I do not know	20	32.8
-Missing	9	14.8

Table 3b: Distribution of Knowledge on Malaria on Mother's Health (Cont.)

Variables	Sample Size	Correct %
What other problem can malaria give the mother?		
-Swollen legs	4	6.6
-Sneezing	11	18.0
-Hypoglycemia	10	16.4
-I do not know	24	39.3
-Missing	12	19.7
When can fansidar be used during pregnancy?		
	4	6.6
-Never	3	4.9
-Anytime	32	52.5
-Between 16 wks and 32 wks	13	21.3
-I do not know	9	14.8
-Missing		

Table 4 shows proportion of eligible pregnant women who responded to questions related to malaria knowledge on fetus' health. Sixty seven percent of the women knew that malaria can be a problem for the fetus. Forty nine percent knew that malaria cases low birth weight in newborns, 15% answered incorrectly by choosing "red eye." 26% of the women knew hypoglycemia is another problem that malaria can cause the newborn, 3% answered incorrectly by choosing "obesity."

Table 4: Distribution of Knowledge on Malaria on Fetus

Variables	Sample Size	Correct %
Can malaria be a problem for the fetus?		
-Yes	40	65.6
-No	14	23.0
-I do not know	4	6.6
-Missing	3	4.9
What problem can malaria give the fetus?		
-Headache	1	1.6
-Low birth weight	30	49.2
-Red eye	9	14.8
-I do not know	18	29.5
-Missing	3	4.9
What other problem can malaria give the fetus?		
-Headache	1	1.6
-Hypoglycemia	16	26.2
-Obesity	2	3.3
-I do not know	27	44.3
-Missing	15	24.6

Table 5 shows the proportion of eligible women who used bed nets based on their general knowledge on malaria. For the question “how is malaria transmitted”, 72% of those that answered correctly used bed net, while 28% did not use bed net. With those that answered incorrectly, all of them used bed net. This was not statistically significant. For the question “what can be done to prevent malaria”, 76% of those that answered correctly used bed net, and 24% did not use bed net. For those that answered incorrectly, none used bed net. This was statistically significant. For the question “how else can malaria be prevented”, among those that answered

correctly, 71% used bed net and 29% did not use bed net. For those that answered incorrectly, 80% used bed net and 20% did not use bed net. This was not statistically significant. For the question "which of these is a symptom of malaria", among those that answered correctly, 70% used bed net, and 30% did not use bed net. However, for those that answered incorrectly, they all used bed net. This was not statistically significant.

Table 5: Proportion of Eligible Women Using Bed Nets Based on Reported General Knowledge on Malaria

Variables	N	% Using Bed Net	N	% Not Using Bed Net	p-value
How is malaria transmitted?					.380
-Correct	41	71.9	16	28.1	
-Incorrect	2	100.0	0	0.0	
What can be done to prevent malaria?					.004
-Correct	42	76.4	13	23.6	
-Incorrect	0	0.0	3	100.0	
How else can malaria be prevented?					.470
-Correct	22	71.0	9	29.0	
-Incorrect	16	80.0	4	20.0	
Which of these is a symptom of malaria?					.266
-Correct	38	70.4	16	29.6	
-Incorrect	3	100.0	0	0.0	

Table 6a and 6b show the proportion of eligible women who used bed nets based on their knowledge of malaria on mother's health. For the question, "are pregnant women more

susceptible to malaria", among those who answered correctly, 69% used bed net and 31% did not use bed net. For those who did not answer correctly, 82% used bed net and 18% did not use bed net. This was not statistically significant. For the question "what makes pregnant women more susceptible to malaria", among those that answered correctly, 73% used bed net and 27% did not. For those that answered incorrectly, 67% used bed net and 33% did not use bed net. This was not statistically significant. For the question "what problem can malaria give the mother", among those that answered correctly, 75% used bed net and 25% did not use bed net. Among those that answered incorrectly, 67% used bed net and 33% did not. This was not statistically significant. Among those that answered correctly to the question "what other problem can malaria give the mother", 80% used bed net and 20% did not use bed net. Among those that answered incorrectly, 72% used bed net and 28% did not use it. This was not statistically significant. Among those that answered correctly to the question "when can fansidar be used during pregnancy", 72% used bed net and 28% did not use. Among those that answered incorrectly to the question, 70% used bed net and 30% did not use. This was also not statistically significant.

Table 6a: Proportion of Eligible Women Using Bed Nets Based on Reported Knowledge on Malaria on Mother's Health

Variables	N	% Using Bed Net	N	% Not Using Bed Net	p-value
Are pregnant women more susceptible to malaria?					.403
-Correct	29	69.0	13	31.0	
-Incorrect	9	81.8	2	18.2	
What makes pregnant women more susceptible to malaria?					.669
-Correct	24	72.7	9	27.3	
-Incorrect	10	66.7	5	33.3	
What problem can malaria give the mother?					.508
-Correct	21	75.0	7	25.0	
-Incorrect	16	66.7	8	33.3	
What other problem can malaria give the mother?					.600
-Correct	8	80.0	2	20.0	
-Incorrect	28	71.8	11	28.2	

Table 6b: Proportion of Eligible Women Using Bed Nets Based on Reported Knowledge on Malaria on Mother's Health (Cont.)

Variables	N	% Using Bed Net	N	% Not Using Bed Net	p-value
When can fansidar be used during pregnancy?					.885
-Correct	23	71.9	9	28.1	
-Incorrect	14	70.0	6	30.0	
Can malaria occur during pregnancy?					.547
-Correct	41	73.2	15	26.8	
-Incorrect	1	100.0	0	0.0	

Table 7 shows the proportion of pregnant women who used bed nets based on their knowledge of malaria on fetus' health. Among those that answered correctly to "can malaria be a problem for your unborn child", 85% used bed net and 15% did not use bed net. Among those that did not answer correctly, 44% used bed net and 56% did not use. This was statistically significant. Among those that answered correctly to "what problem can malaria give the fetus", 80% used bed net and 20% did not use. For those that answered incorrectly, 64% did use bed net and 36% did not use bed net. This was not statistically significant. For those that answered correctly to the question "what other problem can malaria give to the fetus", 81% used bed net

and 19% did not use. Among those that answered incorrectly, 67% used bed net and 33% did not use bed net. This was not statistically significant.

Table 7: Proportion of Eligible Women Using Bed Nets Based on Reported Knowledge of Malaria on Fetus' Health

Variables	N	% Using Bed Net	N	% Not Using Bed Net	p-value
Can malaria be a problem for the fetus?					.001
-Correct	34	85.0	6	15.0	
-Incorrect	8	44.4	10	55.6	
What problem can malaria give to the fetus?					.181
-Correct	24	80.0	6	20.0	
-Incorrect	18	64.3	10	35.7	
What other problem can malaria give to the fetus					.295
-Correct	13	81.2	3	18.8	
-Incorrect	20	66.7	10	33.3	

Univariate Analysis

Table 8 shows the univariate analysis of association between general knowledge and bed net use. The proportions of pregnant women who knew mosquitoes with parasite transmitted malaria were less likely to use bed net than those that did not know (p=.380). Those that knew bed net prevented malaria were less likely to use bed net than those that did not know (p=.004).

Those that knew that fansidar was another means of preventing malaria were less likely to use bed net than those that did not know (p=.266).

Table 8: Univariate Analysis of Association between Selected Independent Variables and Bed Net Use

Variables	OR	95% CI	p-value
How is malaria transmitted?	.953	.893 - 1.019	.380
What can be done to prevent malaria?	.236	.147 - .380	.004
How else can malaria be prevented?	.611	.160 - 2.339	.470
Which of these is a symptom of malaria?	.927	.850 – 1.010	.266

Table 9 shows the univariate analysis of association between knowledge of malaria on mother's health and bed net use. Those that knew malaria can occur during pregnancy were less likely to use bed net than those that did not know (p=.547). Those that knew pregnant women were more susceptible to malaria were less likely to use bed net that those that did not know (p=.403). Pregnant women who knew decline in immune system caused pregnant women to be more susceptible to malaria were more likely to use bed net than those that did not know (p=.669). Those that knew malaria caused anemia were more likely to use bed net than those that did not know (p=.508). Pregnant women who knew malaria also caused hypoglycemia were

more likely to use bed net than those that did not know (p=.600). Pregnant women who knew fansidar could only be used between 16 to 24 weeks were more likely to use bed net than those that did not know (p=.885).

Table 9: Univariate Analysis of Association between Selected Independent Variables and Bed Net

Variables	OR	95% CI	p-value
Can malaria occur during pregnancy?	.976	.850 – 1.023	.547
Are pregnant women more susceptible to malaria?	.496	.094 – 2.623	.403
What makes pregnant women more susceptible to malaria?	1.333	.357 – 4.985	.669
What problem can malaria give the mother?	1.500	.450 – 5.005	.508
What other problem can malaria give the mother?	1.571	.287 – 8.595	.600
When can fansidar be used during pregnancy?	1.095	.321– 3.740	.885

Table 10 shows the univariate analysis of association between knowledge of malaria on fetus' health and bed net use. Those that knew that malaria could be a problem to the unborn child were more likely to use bed net than those that answered incorrectly (p=.001). Those that knew malaria could cause low birth weight were more likely to use bed net than those that

answered incorrectly (p=.181). Those that knew malaria caused hypoglycemia in fetus were more likely to use bed net than those that did not know (p=.295).

Table 10: Univariate Analysis of Association between Selected Independent Variables and Bed Net

Variables	OR	95% CI	p-value
	7.083	1.986 - 25.269	.001
Can malaria be a problem for your unborn child?			
What problem can malaria give to the unborn child?	2.222	.681 – 7.249	.181
What other problem can malaria give to the unborn child	2.167	.500 – 9.395	.295

Attitudes and behaviors

According to figure 2-8, 96.3% of the pregnant women could afford bed net. Forty two percent of the women did not consider malaria a problem in their area while 58% considered malaria to be a problem in their area. Fifty six percent already experienced malaria during their current pregnancy and 44% had not. All the women felt safe giving birth. Sixty seven percent gave birth previously at the hospital and 33% had never given birth. Eighty four percent treated malaria at the clinic, 12% at home, and 3.5% had never had malaria. Majority (73%) of the women used bed net and 27% did not use bed net.

Figure 2: Proportions of Nigerian pregnant women whose previous birth was at the hospital or at home.

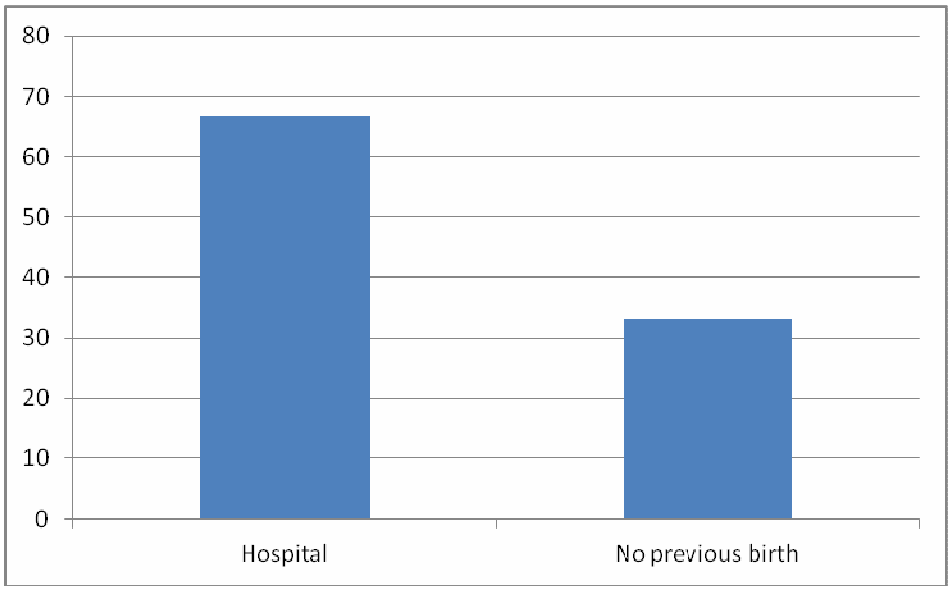


Figure 3: Porportions of Nigerian pregnant women who treat malaria at home or at the clinic.

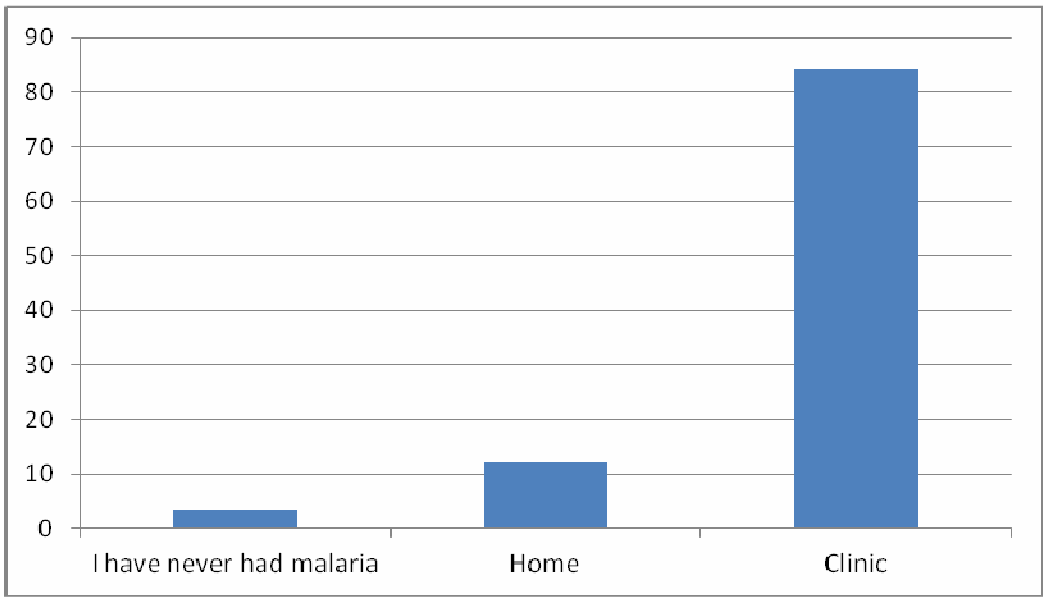


Figure 4: Proportions of Nigerian pregnant women who can afford (yes) or not afford (no) bed nets.

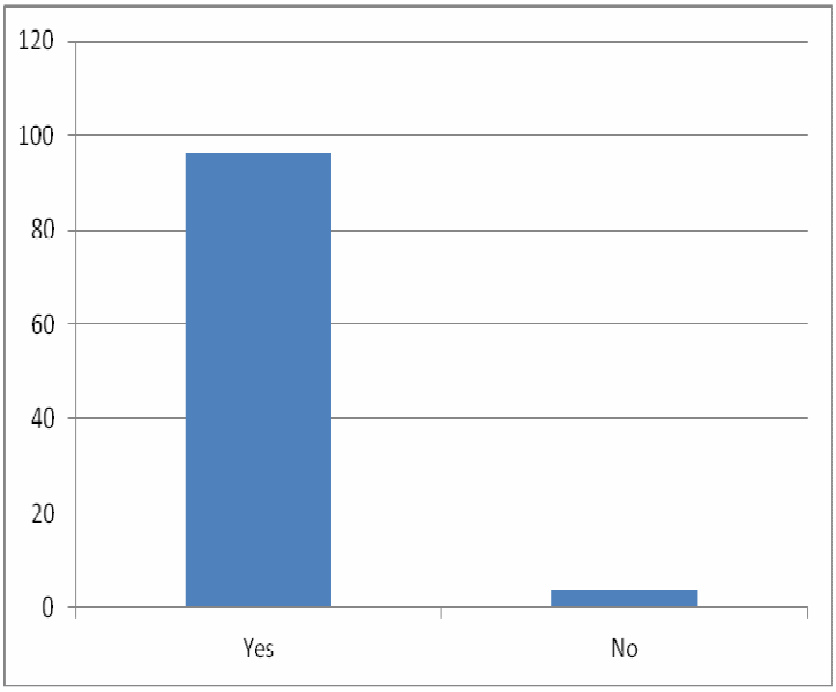


Figure 5. Proportion of Nigerian pregnant women who have had malaria during their current pregnancy.

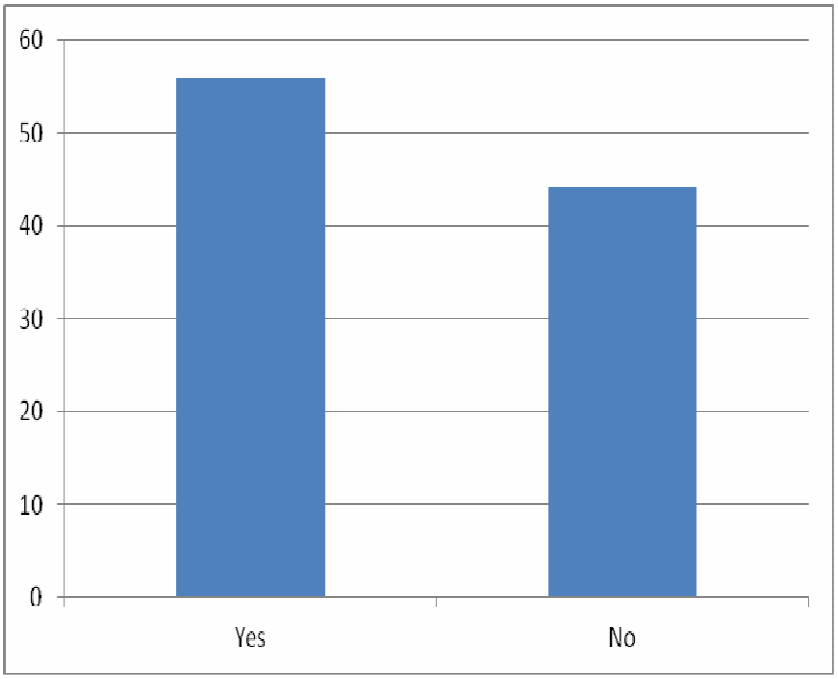


Figure 6. Proportions of Nigerian pregnant women who consider malaria a problem in their area

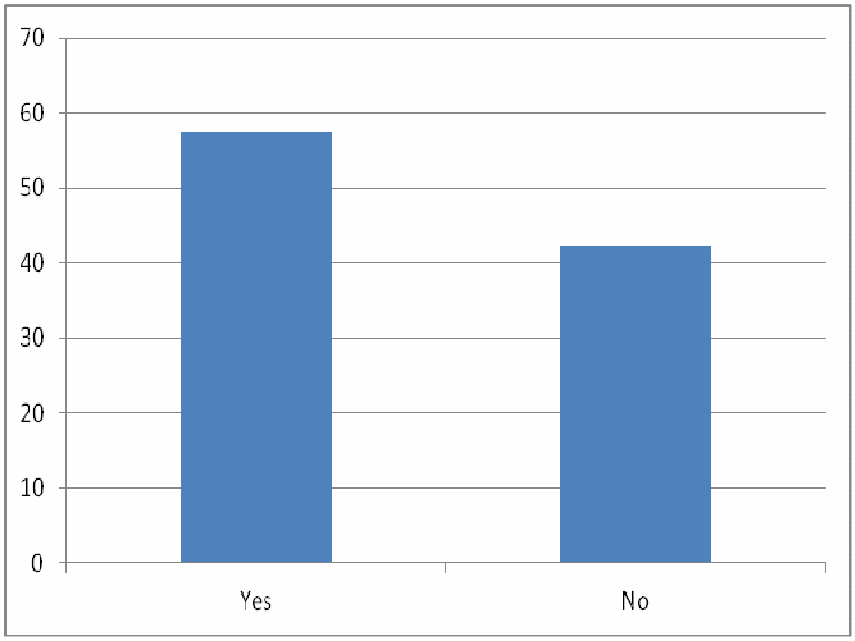


Figure 7. Proportions of Nigerian pregnant women who consider malaria medicine safe

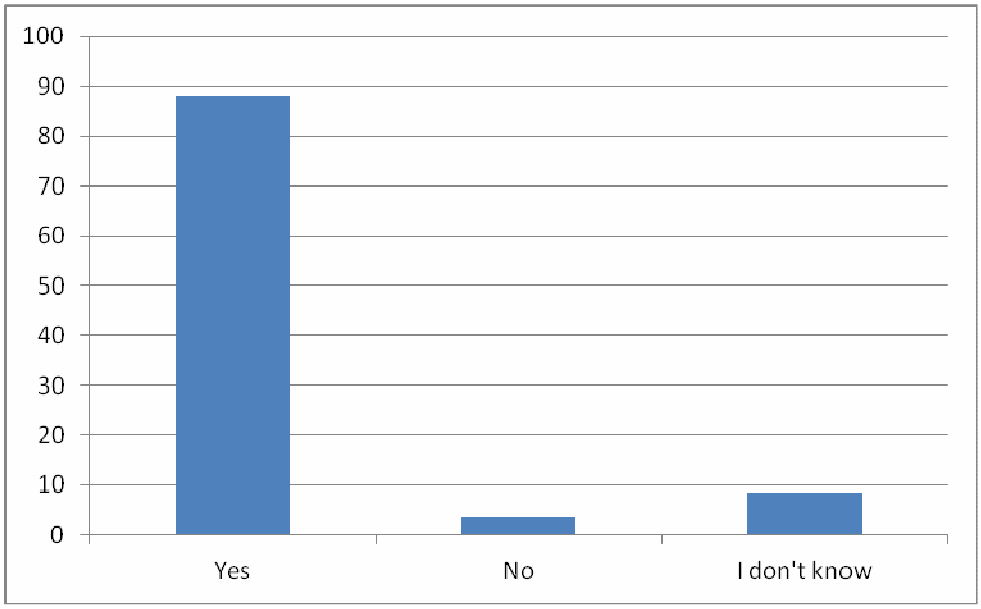
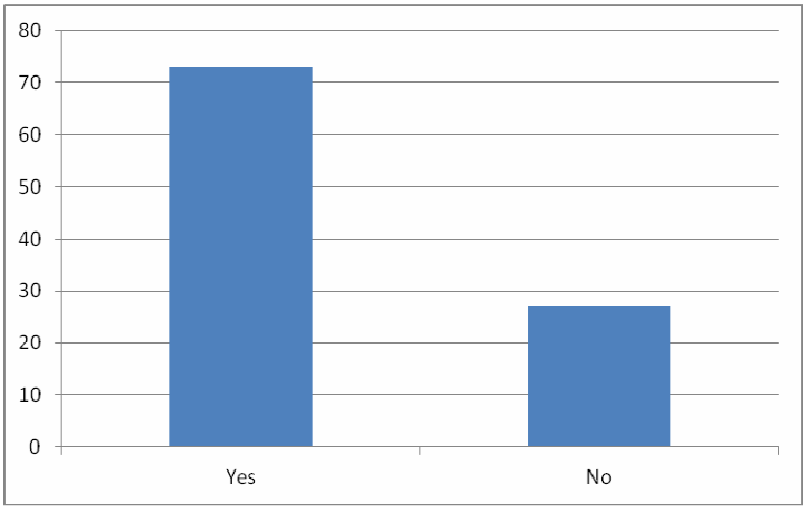


Figure 8. Proportions of Nigerian pregnant women who used bed nets



Barriers to using bed net

Among those that did not use bed net and responded to "why" , (n=14), the major reason for not using bed net was because the women used other means of prevention such as indoor residual spraying and nets on windows and doors. Heat was the second reason for not using bed net, followed by lack of comfortability from bed net use, then allegies and inability to hang bed net.

Table 11: Barriers to the Use of Bed Net among Pregnant Women

Barriers	Frequency	Percent
Other prevention methods	7	50
Heat	3	21
Bed net not comfortable	2	14
Allergic	1	7
Can not hang bed net	1	7

CHAPTER V

DISCUSSION AND CONCLUSION

Discussion

The knowledge of malaria and the use of bed net is very improtant in achieving the targets of programs like the roll back malaria program. Findings from this study shows that majority of people are either using bed net, other prevention methods such as indoor residual spraying, or covering their windows and doors with nets. However, in this study, more than half of the pregnant women had experienced malaria during their current pregnancy. One reason for this could be that the prevention methods are not been used properly. Majority of the pregnant women considered malaria a problem in their area and also considered malaria medicine safe to use. Perhaps other prevention methods such as chemoprevention could serve as a better prevention method in reducing the incidence of malaria in endemic areas.

Respondent had good knowledge of the cause of malaria with 97% of the women correctly choosing mosquitoes as the means of transmision. This is similar to the findings of 93% in Abuja, Nigeria (Akaba et al., 2013). The good knowledge about the means of transmission might indicate that malaria is a common disease in Nigeria. Ninety three percent of the women knew bed net prevented malaria, however, less women knew that fanidar was another means of preventing malaria, with only 53% choosing it as the correct answer. This shows that the message of bed net use as a means of preventing malaria is wildly accepted among these women. Many of the women had good knowledge of the symptoms with 92% choosing fever as an answer. This can help promote early treatment and reduce maternal and infant mortality and

morbidity. Three out of the four general questions had over 92% of the women responding to the correct answer. This result shows that most of the women have the knowledge about the cause of malaria and how to prevent it by using bed net.

When it comes to knowledge of malaria and how it impacts pregnancy, the percentage of women choosing the correct answer reduces. Ninety two percent of the pregnant women knew malaria can occur during pregnancy, but only 71% of the pregnant women knew pregnant women were more susceptible and only 54.1% knew the reason for greater susceptibility in pregnant women. Only 46% of the pregnant women knew anemia is a problem caused by malaria and 16.4% knew malaria caused hypoglycemia. This result shows that the knowledge of the consequence of malaria on the mother's health is low. This finding was similar to that of another study that found that knowledge about the consequences of malaria was low among pregnant women (Enato et al., 2007).

The questions evaluating the knowledge of malaria on fetus health were among the lowest knowledge. Only 67% percent knew that malaria affected the fetus. Less than 50% knew that malaria caused the fetus to have low birth weight and only 26% knew hypoglycemia was another problem caused by malaria to the fetus. These findings are similar to another study that found that only 2.3% of the women knew how malaria affected the fetus (Wagbatsoma et al., 2010). Many of the pregnant women had general knowledge about malaria; however, many of them did not know exactly how malaria affected the mother or the fetus.

General knowledge about malaria did not seem to be associated with increase in bed net use. This might be due to the perception of malaria as a common illness since many of the women had experienced it. Because of this, having the general knowledge about malaria might

not affect bed net use. However, pertaining to the majority of the questions evaluating the knowledge of malaria on mother's health, those that were knowledgeable were more likely to use bed net. However, the findings were not significant. The questions that had the most effect on bed net use happened to be those that assessed malaria's effect on the fetus. Women who knew malaria could be a problem to the fetus were seven times more likely to use bed nets and this was statistically significant. Those who knew the problems malaria caused the fetus were twice more likely to use bed net but the finding was not statistically significant.

Findings from this study show that the knowledge of malaria on fetus health was very low. However, with those that had the knowledge, they were more likely to use bed nets. Perhaps, educating pregnant women on how malaria affects the fetus' health can increase the amount of women who use bed net. In this study, the amount of pregnant women who used bed nets were more than what was presented in other studies (Wagbatsoma et al., 2010) and this could have been due to the fact that bed nets were given at the antenatal clinic where the study was conducted, which made it readily available. Also, majority of the women could afford bed nets and this was not a huge barrier for the participants.

Limitations

There are several limitations associated with this study. The sample size of 61 women is the main limitation. Since the sample size was small, the association between knowledge and bed net use could have been affected. Also, less analyzes were done with the data because of the small sample size. Another limitation is that the result cannot be generalized because most of the women had a college degree and were all from the same clinic. Also, because the study was conducted at one hospital, the results cannot be generalized to other parts of the country that

have different tribes than those in the study. Since the study was a cross-sectional study, cause and effect could not be determined between knowledge of malaria and bed net use, association was the only thing that could be analyzed.

Conclusion

The result from this study shows that pregnant women have general knowledge about the cause of malaria and how to prevent it. However, they seem to be less knowledgeable when it comes to the consequences of malaria on the health of the mother and fetus. The more knowledgeable the pregnant women were about the health effects of malaria on mother and fetus health, the more likely they were to use bed net. Therefore, intervention programs should focus on delivering tailored and targeted information about the consequences of malaria on the mother's health and especially on the fetus health, which had the lowest knowledge. For the roll back malaria program and other government programs to achieve their goals, more education should be provided and the focus should be on consequences of how malaria affects the health of the mother and the fetus since this had more impact on whether the pregnant women used bed net or not.

References

Akaba, G., Otubu, J., Agida, E., & Onafowokan, O. (2013). Knowledge and utilization of malaria preventive measures among pregnant women at a tertiary hospital in Nigeria′s federal capital territory. *Nigerian Journal of Clinical Practice*, *16*(2), 201. doi:10.4103/1119-3077.110162

Akinleye, S. O., & Ajayi, I. O. (2011). Knowledge of malaria and preventive measures among pregnant women attending antenatal clinics in a rural local government area in Southwestern Nigeria. *World health & population*, *12*(3), 13–22.

Akinleye, S. O., Falade, C. O., & Ajayi, I. O. (2009). Knowledge and utilization of intermittent preventive treatment for malaria among pregnant women attending antenatal clinics in primary health care centers in rural southwest, Nigeria: a cross-sectional study. *BMC pregnancy and childbirth*, *9*, 28. doi:10.1186/1471-2393-9-28

Aluko, J. O., & Oluwatosin, A. O. (2012). Utilization of insecticide treated nets during pregnancy among postpartum women in Ibadan, Nigeria: a cross-sectional study. *BMC pregnancy and childbirth*, *12*, 21. doi:10.1186/1471-2393-12-21

Ankomah, A., Adebayo, S. B., Arogundade, E. D., Anyanti, J., Nwokolo, E., Ladipo, O., & Meremikwu, M. M. (2012). Determinants of insecticide-treated net ownership and utilization among pregnant women in Nigeria. *BMC Public Health*, *12*, 105. doi:10.1186/1471-2458-12-105

Anorlu, R. I., Odum, C. U., & Essien, E. E. (2001). Asymptomatic malaria parasitaemia in pregnant women at booking in a primary health care facility in a periurban community in Lagos, Nigeria. *African journal of medicine and medical sciences*, *30 Suppl*, 39–41.

Bouyou-Akotet, M. K., Ionete-Collard, D. E., Mabika-Manfoumbi, M., Kendjo, E., Matsiegui, P.-B., Mavoungou, E., & Kombila, M. (2003). Prevalence of Plasmodium falciparum infection in pregnant women in Gabon. *Malaria Journal*, *2*(1), 18. doi:10.1186/1475-2875-2-18

Breman, J. G., Alilio, M. S., & Mills, A. (2004). Conquering the Intolerable Burden of Malaria: What's New, What's Needed: A Summary. *The American Journal of Tropical Medicine and Hygiene*, *71*(2 suppl), 1–15.

Chukwuocha, U. M., Dozie, I. N. S., Onwuliri, C. O. E., Ukaga, C. N., Nwoke, B. E. B., Nwankwo, B. O., … Adindu, B. C. (2010). Perceptions on the use of insecticide treated nets in parts of the Imo River Basin, Nigeria: implications for preventing malaria in pregnancy. *African journal of reproductive health*, *14*(1), 117–128.

Cox, F. E. G. (2002). History of Human Parasitology. *Clinical Microbiology Reviews*, *15*(4), 595–612. doi:10.1128/CMR.15.4.595-612.2002

Desai, M., ter Kuile, F. O., Nosten, F., McGready, R., Asamoa, K., Brabin, B., & Newman, R. D. (2007). Epidemiology and burden of malaria in pregnancy. *The Lancet infectious diseases*, *7*(2), 93–104. doi:10.1016/S1473-3099(07)70021-X

Eliminating Malaria: Learning from the Past, Looking Ahead. (n.d.). *Roll Back Malaria*. Retrieved March 7, 2013, from http://www.rollbackmalaria.org/ProgressImpactSeries/report9.html

Enato, E. F. O., Okhamafe, A. O., & Okpere, E. E. (2007). A survey of knowledge, attitude and practice of malaria management among pregnant women from two health care facilities in Nigeria. *Acta Obstetricia et Gynecologica Scandinavica*, *86*(1), 33–36. doi:10.1080/00016340600984670

Gallup, J. L., & Sachs, J. D. (2001). The economic burden of malaria. *The American Journal of Tropical Medicine and Hygiene*, *64*(1 suppl), 85–96.

Gamble, C. L., Ekwaru, J. P., & ter Kuile, F. O. (1996). Insecticide-treated nets for preventing malaria in pregnancy. In *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd. Retrieved from http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD003755.pub2/abstract

Goldenberg, R. L., & Thompson, C. (2003). The infectious origins of stillbirth. *American journal of obstetrics and gynecology*, *189*(3), 861–873.

Guyatt, H. L., & Snow, R. W. (2001). The epidemiology and burden of Plasmodium falciparum-related anemia among pregnant women in sub-Saharan Africa. *The American journal of tropical medicine and hygiene*, *64*(1-2 Suppl), 36–44.

Iriemenam, N. C., Dosunmu, A. O., Oyibo, W. A., & Fagbenro-Beyioku, A. F. (2011). Knowledge, attitude, perception of malaria and evaluation of malaria parasitaemia among pregnant women attending antenatal care clinic in metropolitan Lagos, Nigeria. *Journal of vector borne diseases*, *48*(1), 12–17.

Kayentao K, G. P. (2013). Intermittent preventive therapy for malaria during pregnancy using 2 vs 3 or more doses of sulfadoxine-pyrimethamine and risk of low birth weight in africa: Systematic review and meta-analysis. *JAMA*, *309*(6), 594–604. doi:10.1001/jama.2012.216231

Lagerberg, R. E. (2008). Malaria in Pregnancy: A Literature Review. *Journal of Midwifery & Women's Health*, *53*(3), 209–215. doi:10.1016/j.jmwh.2008.02.012

Mendis, K., Rietveld, A., Warsame, M., Bosman, A., Greenwood, B., & Wernsdorfer, W. H. (2009). From malaria control to eradication: The WHO perspective. *Tropical Medicine & International Health: TM & IH*, *14*(7), 802–809. doi:10.1111/j.1365-3156.2009.02287.x

Mills, A. (1993). The household costs of malaria in Nepal. *Tropical medicine and parasitology: official organ of Deutsche Tropenmedizinische Gesellschaft and of Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ)*, *44*(1), 9–13.

Nabarro, D., & Mendis, K. (2000). Roll back malaria is unarguably both necessary and possible. *Bulletin of the World Health Organization*, *78*(12), 1454–1455.

Newman, R. D., Hailemariam, A., Jimma, D., Degifie, A., Kebede, D., Rietveld, A. E. C., … Parise, M. E. (2003). Burden of malaria during pregnancy in areas of stable and unstable transmission in Ethiopia during a nonepidemic year. *The Journal of infectious diseases*, *187*(11), 1765–1772. doi:10.1086/374878

Ouattara, A. F., Raso, G., Edi, C. V., Utzinger, J., Tanner, M., Dagnogo, M., & Koudou, B. G. (2011). Malaria knowledge and long-lasting insecticidal net use in rural communities of central C?te d'Ivoire. *Malaria Journal*, *10*, 288. doi:10.1186/1475-2875-10-288

Prevention, C.-C. for D. C. and. (n.d.-a). CDC - Malaria - About Malaria - Biology - Malaria Parasites. Retrieved March 27, 2013, from http://www.cdc.gov/malaria/about/biology/parasites.html

Prevention, C.-C. for D. C. and. (n.d.-b). CDC - Malaria - Malaria Worldwide - How Can Malaria Cases and Deaths Be Reduced? - Insecticide-Treated Bed Nets. Retrieved March 27, 2013, from http://www.cdc.gov/malaria/malaria_worldwide/reduction/itn.html

Roll Back Malaria Progress and Impact Series - Focus on Nigeria. (n.d.). *Roll Back Malaria*. Retrieved March 7, 2013, from http://www.rollbackmalaria.org/ProgressImpactSeries/report11.html

Sachs, J., & Malaney, P. (2002). The economic and social burden of malaria. *Nature*, *415*(6872), 680–685. doi:10.1038/415680a

Staalsoe, T., Shulman, C. E., Bulmer, J. N., Kawuondo, K., Marsh, K., & Hviid, L. (2004). Variant surface antigen-specific IgG and protection against clinical consequences of pregnancy-associated Plasmodium falciparum malaria. *Lancet*, *363*(9405), 283–289. doi:10.1016/S0140-6736(03)15386-X

Steketee, R. W., Nahlen, B. L., Parise, M. E., & Menendez, C. (2001). The burden of malaria in pregnancy in malaria-endemic areas. *The American journal of tropical medicine and hygiene*, *64*(1-2 Suppl), 28–35.

Tuteja, R. (2007). Malaria - an overview. *The FEBS journal*, *274*(18), 4670–4679. doi:10.1111/j.1742-4658.2007.05997.x

Uneke, C. J., Iyare, F. E., Oke, P., & Duhlinska, D. D. (2008). Assessment of malaria in pregnancy using rapid diagnostic tests and its association with HIV infection and hematologic parameters in South-Eastern Nigeria. *Haematologica*, *93*(1), 143–144. doi:10.3324/haematol.11695

Wagbatsoma, V. A., & Aigbe, E. E. (2010). ITN utilization among pregnant women attending ANC in Etsako West Lga, Edo State, Nigeria. *Nigerian journal of clinical practice*, *13*(2), 144–148.

WHO | Indoor residual spraying. (n.d.). *WHO*. Retrieved March 7, 2013, from http://www.who.int/malaria/publications/atoz/htm_mal_2006_1112/en/index.html

WHO | Lives at risk: malaria in pregnancy. (n.d.). *WHO*. Retrieved March 12, 2013, from http://www.who.int/features/2003/04b/en/

WHO | World Malaria Report 2008. (n.d.). *WHO*. Retrieved March 6, 2013, from http://www.who.int/malaria/publications/atoz/9789241563697/en/index.html

WHO | World Malaria Report 2012. (n.d.). *WHO*. Retrieved February 23, 2013, from http://www.who.int/malaria/publications/world_malaria_report_2012/report/en/index.html

Appendix1. Questionnaire

Malaria Knowledge and Bed Nets use of Nigerian pregnant women

Demographic and Health Information

ID OF PARTICIPANT: ☐☐☐☐☐☐☐

Demographics

D/O/B: _____ *Place of Birth:* _____

Tribe	0 ☐ Yoruba 2 ☐ Igbo 3 ☐ Hausa 4 ☐ Others: Specify_____

Marital Status Are you now married, widowed, divorced, separated, or have you never been married?	0 ☐ married 2 ☐ widowed 3 ☐ divorced 4 ☐ separated 5 ☐ never married
How many children do you have?	Natural: ☐☐ Step: ☐☐ Adopted: ☐☐
Education What is the highest level of education you have completed?	0☐ Less than High School 1☐ High School 2☐ Some College 3☐ College

Occupation

What is your present occupation? _____

Are you currently employed?	0☐ No 1☐ Yes

Income

What is your family's total annual income?

0 ☐ < 10,000
1 ☐ 10,000-19,999
2 ☐ 20,000-29,999
3 ☐ 30,000-39,000
4 ☐ >40,000

What is your household size? That is number people In your household

1 ☐ One
2 ☐ Two
3 ☐ Three
4 ☐ Four
5 ☐ Greater than four

How many weeks is your pregnancy?	
Can you afford a bed net without financial troubles?	0 ☐ No 1 ☐ Yes
Have you had malaria during this pregnancy?	0 ☐ No 1 ☐ Yes
Do you consider malaria a problem in your area?	0 ☐ No 1 ☐ Yes
Do you feel safe giving birth in the hospital?	0 ☐ No 1 ☐ Yes
Has your previous birth been at the hospital or at home?	0 ☐ Hospital 2 ☐ At home 3 ☐ Other: Specify_____ 4 ☐ No previous birth
When you have malaria do you treat at home or come to the clinic?	0 ☐ I have never had malaria 2 ☐ I treat at home 3 ☐ I treat at the clinic

Do you think that malaria medicines are safe?	☐Yes ☐No ☐I do not know
How is malaria transmitted?	☐ Malaria is transmitted by a mosquito with a parasite biting into the skin ☐Malaria is transmitted through air ☐Malaria is transmitted through touching others ☐I do not know
What can be done to prevent malaria?	☐ Using antibiotics ☐ Nothing ☐Bed nets ☐I do not know
How else can malaria be prevented?	☐ By drinking a lot of water ☐ By eating fruits ☐ By using Fansidar ☐ I do not know

Which of these is a symptom of malaria?	☐Fever ☐Swollen foot ☐Red eye ☐I do not know
Can malaria occur during pregnancy?	☐Yes ☐No ☐I do not know
Are pregnant women more susceptible to malaria?	☐Yes ☐No ☐I do not know
What makes pregnant women more susceptible to malaria?	☐Weight gain ☐Decline in immune system ☐Bigger stomach ☐I do not know

Can malaria be a problem for the fetus?	☐Yes ☐No ☐I do not know
What problem can malaria give the mother?	☐Swollen fingers ☐Red eye ☐Anemia ☐I do not know
What other problem can malaria give to mother?	☐Swollen leg ☐Sneezing ☐Hypoglycemia ☐I do not know
What problem can malaria give to fetus?	☐Headache ☐Low birth weight ☐Red eye ☐ I do not know

What other problem can malaria give to fetus?	☐Headache ☐Hypoglycemia ☐Obesity ☐ I do not know
When can fansidar be used during pregnancy?	☐Never ☐Anytime ☐Between 16 weeks and 32 weeks ☐I do not know

Do you use bed nets?	☐Yes ☐No ☐I do not know If yes, Why_____ If No, Why_____

APPENDIX 2. Georgia State University IRB Approval

INSTITUTIONAL REVIEW BOARD

Mail: P.O. Box 3999 In Person: Alumni Hall

Atlanta, Georgia 30302-3999 30 Courtland St, Suite 217

Phone: 404/413-3500

Fax: 404/413-3504

October 3, 2012

Principal Investigator: Okosun, Solomon Ike

Student PI: Modupe Babalola

Protocol Department: Institute of Public Health

Protocol Title: Malaria Knowledge and Bed Net Use of Pregnant Women Receiving Antenatal Care At Federal Medical Centre, Abeokuta, Nigeria.

Submission Type: Application H12482

Review Type: Expedited Review, Category 7

Approval Date: October 3, 2012

Expiration Date: October 2, 2013

The Georgia State University Institutional Review Board (IRB) reviewed and approved the above referenced study in accordance with 45 CFR 46.111. The IRB has reviewed and approved the research protocol and any informed consent forms, recruitment materials, and other research materials that are marked as approved in the application. The approval period is listed above.

Federal regulations require researchers to follow specific procedures in a timely manner. For the protection of all concerned, the IRB calls your attention to the following obligations that you have as Principal Investigator of this study.

1. For any changes to the study (except to protect the safety of participants), an Amendment Application must be submitted to the IRB. The Amendment Application must be reviewed and approved before any changes can take place

2. Any unanticipated/adverse events or problems occurring as a result of participation in this study must be reported immediately to the IRB using the Unanticipated/Adverse Event Form.

3. Principal investigators are responsible for ensuring that informed consent is properly documented in accordance with 45 CFR 46.116.

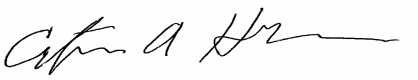
    - The Informed Consent Form (ICF) used must be the one reviewed and approved by the IRB with the approval dates stamped on each page.

4. For any research that is conducted beyond the approval period, a Renewal Application must be submitted at least 30 days prior to the expiration date. The Renewal Application must be approved by the IRB before the expiration date else automatic termination of this study will occur. If the study expires, all research activities associated with the study must cease and a new application must be approved before any work can continue.

5. When the study is completed, a Study Closure Report must be submitted to the IRB.

All of the above referenced forms are available online at https://irbwise.gsu.edu. Please do not hesitate to contact Susan Vogtner in the Office of Research Integrity (404-413-3500) if you have any questions or concerns.

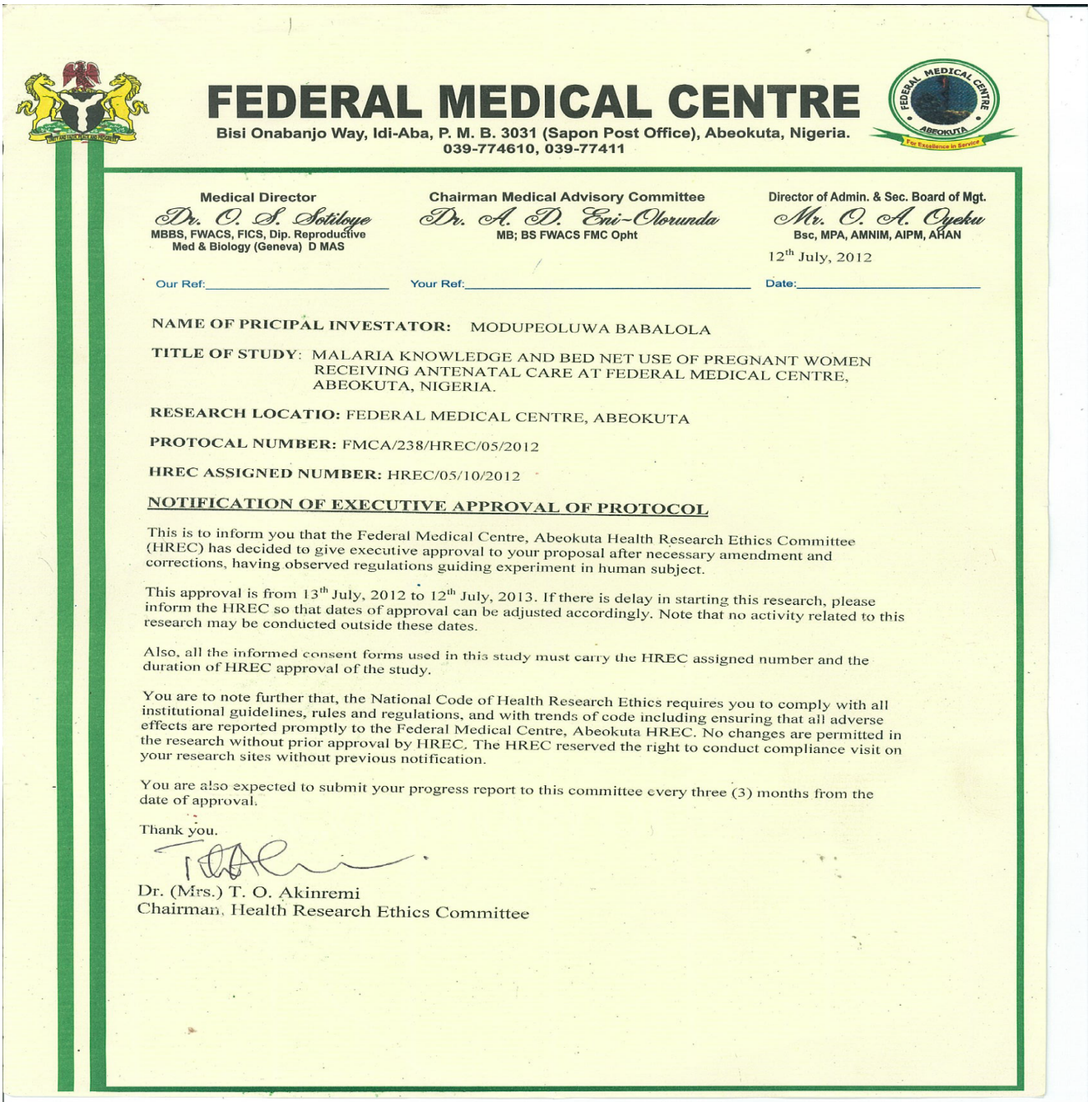
Sincerely,



Cynthia A. Hoffner, IRB Vice-Chair

Federal Wide Assurance Number: 00000129

Appendix 3: Federal Medical Center Health Ethics Committee Approval



FEDERAL MEDICAL CENTRE

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039-774610, 039-77411

Medical Director
Dr. O. S. Sotiloye
MBBS, FWACS, FICS, Dip. Reproductive Med & Biology (Geneva) D MAS

Chairman Medical Advisory Committee
Dr. A. D. Eni-Olorunda
MB; BS FWACS FMC Opht

Director of Admin. & Sec. Board of Mgt.
Mr. O. A. Oyeku
Bsc, MPA, AMNIM, AIPM, AHAN

12th July, 2012

Our Ref:_____ Your Ref:_____ Date:_____

NAME OF PRICIPAL INVESTATOR: MODUPEOLUWA BABALOLA

TITLE OF STUDY: MALARIA KNOWLEDGE AND BED NET USE OF PREGNANT WOMEN RECEIVING ANTENATAL CARE AT FEDERAL MEDICAL CENTRE, ABEOKUTA, NIGERIA.

RESEARCH LOCATIO: FEDERAL MEDICAL CENTRE, ABEOKUTA

PROTOCAL NUMBER: FMCA/238/HREC/05/2012

HREC ASSIGNED NUMBER: HREC/05/10/2012

NOTIFICATION OF EXECUTIVE APPROVAL OF PROTOCOL

This is to inform you that the Federal Medical Centre, Abeokuta Health Research Ethics Committee (HREC) has decided to give executive approval to your proposal after necessary amendment and corrections, having observed regulations guiding experiment in human subject.

This approval is from 13th July, 2012 to 12th July, 2013. If there is delay in starting this research, please inform the HREC so that dates of approval can be adjusted accordingly. Note that no activity related to this research may be conducted outside these dates.

Also, all the informed consent forms used in this study must carry the HREC assigned number and the duration of HREC approval of the study.

You are to note further that, the National Code of Health Research Ethics requires you to comply with all institutional guidelines, rules and regulations, and with trends of code including ensuring that all adverse effects are reported promptly to the Federal Medical Centre, Abeokuta HREC. No changes are permitted in the research without prior approval by HREC. The HREC reserved the right to conduct compliance visit on your research sites without previous notification.

You are also expected to submit your progress report to this committee every three (3) months from the date of approval.

Thank you.

Dr. (Mrs.) T. O. Akinremi
Chairman, Health Research Ethics Committee