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Barriers to Utilization of Malaria Preventive Measures in Rural Nigeria Among Pregnant Women

Olabosipo O. Oreyomi
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Walden University

College of Health Sciences

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Olabosipo Oreyomi

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Walden University
2019

Abstract

Barriers to Utilization of Malaria Preventive Measures in Rural Nigeria Among Pregnant
Women

by

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MPH, Walden University, 2012

MD, Grace University School of Medicine, 2002

BS, University of the District of Columbia, 1991

Dissertation Submitted in Partial Fulfillment
of the Requirements for the Degree of
Doctor of Public Health

Walden University

February, 2019

Abstract

Malaria is a mosquito transmitted tropical disease that accounts for more cases and deaths in Nigeria than in any other country worldwide. Globally malaria accounts for 300,000 deaths among young children and pregnant women annually. The promotion of the use of insecticide treated nets (ITNs) to reduce pregnant women's contact with mosquitoes has been the focus of malaria prevention efforts in Nigeria. However, the use of ITNs during pregnancy has been inexplicably low in Nigeria. A quantitative cross-sectional study was conducted to examine barriers to the utilization of ITNs among pregnant women in rural Nigeria. The social ecological model was utilized to analyze secondary data from a 2015 survey conducted in Nigeria in which 4,834 pregnant women between 15 to 49 years of age participated. The relationship between the use of ITNs and the knowledge of ITNs, traditional medicine, education, and family income was examined using multiple logistic regression modeling. Results showed that there was a significant relationship between the knowledge of ITN ($p = 0.000$), family income ($p = 0.000$), education of pregnant women ($p = 0.000$) and the use of ITN among pregnant women in rural Nigeria. However, there was no relationship between the use of traditional medicine ($p = >0.5$), and the use of ITN, perhaps because most of the women surveyed did not respond to the question about use of traditional medicine. Results of the study have important implications for positive social changes among pregnant women in Nigeria. These findings will inform strategies to increase the uptake of ITNs during pregnancy in Nigeria, improving birth outcomes, increasing maternal and child survival, and decreasing the economic burden due to malaria morbidity and mortality in rural Nigeria.

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Dedication

This dissertation is dedicated in loving memory of my son Prince Mojolaoluwa Adepoju who passed away during the course of my doctoral studies. He was very supportive and understanding at such a young age. I love you Prince. To the loving memory of my father, David Olumuyiwa Oreyomi-Wellington who instilled the importance of education in his children and believed in me.

Finally, this study is dedicated to my husband Olu Adepoju, and my sons Oluwasoji Adepoju, Temiloluwa Adepoju and Moyosoreoluwa Adepoju for their loving support and understanding through my doctoral study. My mother, Betty Oreyomi-Wellington, whose support, nurturing, prayers and belief in me will never go unnoticed. My sister for her attention and support.

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Chapter 1: Introduction

Introduction to the Study

Malaria occurs in tropical and subtropical areas of the world (Arbeitskreis Blut, 2009). It is the leading cause of illnesses and deaths in most of the countries affected by it (Arbeitskreis Blut, 2009). Malaria is one of the most devastating infectious diseases, killing more than 1 million people every year (Schantz-Dunn & Nour, 2009). Malaria is defined as the “disease of poverty caused by poverty” (as cited in Schantz-Dunn & Nour, 2009, p. 186). The malaria disease can be prevented. However, it can be a fatal disease if not treated (Mali, Steel, Slutsker & Arguin, 2009). Malaria is transmitted by the female *Anopheles* mosquito biting parasites that infects people and in turn transmits it to other humans within the community (Mali et al., 2009). After biting the human host, the parasites multiply in the blood stream and the blood stage parasites are responsible for the clinical manifestation of malaria (Center for Disease Control and Prevention [CDC], 2015a). After 8 to 30 days of malaria infection, the disease begins with flu-like symptoms that include fever, headache, muscular aches and weakness, vomiting, diarrhea, chills, and sweats (Bartoloni & Zammarchi, 2012). When death occurs, it may be due to brain damage (cerebral malaria) or damage to vital organs (Bartoloni & Zammarchi, 2012).

Malaria prevention methods include but are not limited to, using insecticide treated bed nets (ITNs), indoor residual spraying with insecticides, and treatment with intermittent preventive treatment in pregnancy (IPTp; Steketee & Campbell, 2010). According to the CDC, in 2016, an estimated 216 Million cases of malaria occurred

worldwide and about 445,000 people died (CDC, 2018). Most of the deaths were young children of sub-Saharan Africa (CDC, 2018).

The most vulnerable to malaria infection are women and young children. In fact, pregnant women are 3 times more likely to suffer severely from malaria compared to nonpregnant women (Schantz-Dunn & Nour, 2009). Pregnant women usually have more severe malaria symptoms and outcomes, with higher rates of miscarriage, anemia, intrauterine demise, premature delivery, low-birth-weight neonates, and neonatal death (Schantz-Dunn & Nour, 2009). Infected pregnant women have about 50% mortality rate in malaria endemic areas with the highest rate of infection occurring during the second trimester (Schantz-Dunn & Nour, 2009). This high burden of disease supports the need for malaria prevention and treatment efforts as part of antenatal care in endemic areas, (Schantz-Dunn & Nour, 2009). Some adults who live in malaria endemic areas have developed some acquired immunity to malaria infection due to immunoglobulin production from prior childhood malaria infections (Schantz-Dunn & Nour, 2009). However, for pregnant women, the malaria immunity diminishes during pregnancy, hence making them more vulnerable to malaria infection (Schantz-Dunn & Nour, 2009).

Malaria is a public health issue in more than 100 countries, with more than half of the world's population at risk (Kaiser Family Foundation, 2013). Sub-Saharan Africa and parts of Asia and Latin America are the hardest hit regions for significant malaria epidemics (Kaiser Family Foundation, 2013; WHO, 2013). Malaria affects about 3.3 billion people or half of the world's population, and in 2010, Africa had about 216 million malaria cases and about 655,000 deaths (Otsemobor et al., 2013).

Africa is the continent most affected by malaria due to the predominant parasite species, local weather conditions, scarce resources, and socioeconomic instability that have hindered malaria control and prevention activities (CDC, 2012a). While malaria is a less prominent cause of deaths in other areas of the world, it can still cause substantial disease and incapacitation in Africa and in rural regions of some countries in South Asia and South America (CDC, 2012a). Malaria in Africa is responsible for a 1.3% growth penalty per year in some African countries (Aderaw & Gedefaw, 2013) causing deaths in about 10,000 pregnant women and 200,000 infants annually (Hartman, Rogerson & Fischer, 2010). About 90% of all malaria deaths occur in sub-Saharan Africa, costing Africa more than \$12 billion in lost gross domestic product each year (Aderaw & Gedefaw, 2013). While malaria is preventable and treatable, it can cause significant morbidity and mortality among young children and pregnant women, especially in regions that are poor (Kaiser Family Foundation, 2013). Various organizations have helped to increase access to malaria prevention and treatments in the effort to reduce morbidity and mortality (Kaiser Family Foundation, 2013). Due to efforts to address malaria, the disease has been eliminated in parts of the Americas, Europe, and Asia (Kaiser Family Foundation, 2013). Such efforts have not been successful in sub-Saharan Africa or did not reach many of the hardest hit regions (Kaiser Family Foundation, 2013). While access to prevention and treatment has increased, and malaria morbidity and mortality have been reduced, the use of the malaria preventive measures remains limited, and many challenges continue to complicate control efforts (Kaiser Family Foundation, 2013).

About the Nigerian Community

Nigeria's total population was about 166.2 million in 2012, and it represents 2.35% of the world's total population (Shofoyeke, 2014). It is the most populous country in Africa and is situated on the Gulf in West Africa (Federal Republic of Nigeria, 2016). The population reflects a male dominance; however, the major health problem is the mortality rate among women and children due to preventable disease (Federal Republic of Nigeria, 2016). Malaria is the main cause of morbidity and mortality in Nigeria, and it poses one of the major public health challenges in the country (Djouaka et al., 2016). Nearly half of the population experiences at least one episode of the disease (Onyeneho, Idemili-Aronu, Igwe, & Iremeka, 2015). Children under 5 years of age and pregnant women share about half of the country's malaria burden (Onyeneho et al., 2016).

Many challenges continue to complicate prevention strategy efforts in malaria transmission countries (Kaiser Family Foundation, 2013). These challenges include, but are not limited to, poverty, poor sanitation, and weak health systems (Kaiser Family Foundation, 2013).

Malaria as the Health Issue

Malaria accounts for more cases and deaths in Nigeria than in any other country worldwide (Adeyemo-Salami, Farombi, & Ademowo, 2015). There are about 300,000 deaths annually from malaria compared with 215,000 deaths per year caused by HIV/AIDS (Adeyemo-Salami et al., 2015). Malaria is the leading cause of mortality in children under five and contributes to the estimated 11% of maternal mortality (Onyeneho et al., 2015). In addition, a very high malaria prevalence rate (62.4%) among

women attending traditional birth homes was found in Southwest Nigeria (Onyeneho et al., 2015).

Background of Study

Malaria is a disease of poverty affecting those who live in malaria prone rural areas who have poorly constructed dwellings with little or no barriers against mosquitoes (UNICEF, 2003). Effective and preventive tools such as the ITNs have been shown to reduce overall child mortality by 20% when a child sleeps under them consistently and correctly (UNICEF, 2003). The correct use of ITNs can save six child lives per year for every one thousand children sleeping under them (UNICEF, 2003). In Nigeria, those from poor households live in high malaria endemic areas (Mazumdar & Mazumdar, 2007). Ownership of malaria preventive measures is low in areas where there is high prevalence of malaria (Mazumdar & Mazumdar, 2007). Families in these areas are more exposed to mosquito breeding sites due to presence of traditional pit toilets and stored drinking water (Mazumdar & Mazumdar, 2007). Pregnant women and children under 5 years from these poor households are prone to mosquito bites because they have lower chances of sleeping under bed nets. (Mazumdar & Mazumdar, 2007). Members of the rural community are usually low income earners who engage in occupations that take them outdoors, such as farming (agriculture is the main source of national survival) and food development (Olatunji, Ehebha, & Ifeanyi-Obi, 2013). These farmers are usually exposed to harsh weather, difficult working posture, and long hours due to use of local farm tools (Olatunji et al., 2013). These conditions predispose them to illnesses and infections such as malaria, leading to loss of employment, income, and assets (Olatunji et

al., 2013). These farmers spend 13% of their total household expenditure on malaria alone.

There are about 300 million cases of malaria that result in more than one million deaths across the globe every year, with 90% occurring in Africa, mostly children (Uzochukwu et al., 2013). In Nigeria, malaria is responsible for 60% of outpatient visits, 30% of childhood deaths, 25% of deaths in children under 1 year, and 11% of maternal deaths (Uguru, Onwujekwe, Tasié, Uzochukwu, & Ezeoke, 2010). Approximately, 132 billion Naira (\$838,564,000) is estimated as financial loss from malaria due to treatment costs, prevention, loss of person-hours, and so forth. (Uguru et al., 2010). The malaria disease is clearly contributing to low productivity, poverty, and reduced school attendance in Nigeria. In the effort to combat the burden of the disease on the country's economy, the Ministry of Health along with other partners are implementing control strategies that include the use of ITNs, prompt malaria cases treatment, and IPTp for women (Kokwaro, 2009). However, the country still faces challenges in implementing these strategies due to structural and behavioral barriers among its citizens (Kokwaro, 2009).

Control programs for malaria are currently faced with fewer resources and uncertain future funding to maintain and accelerate the progress made against the disease (Fullman, Burstein, Lim, Medlin & Gakidou, 2013). The need to determine interventions that give the greatest protection against malaria morbidity and mortality is critical (Fullman et al., 2013). Such interventions include the use of ITNs by pregnant women (Kokwaro, 2009).

Mass use of ITNs protects the population against malaria, particularly children under the age of 5 years (Ye, Patton, Kilian, Dovey, & Eckert, 2012). Providing free ITNs to people who do not own one should lead to a universal ownership of ITNs that could collectively protect the population (Ye et al., 2012). Evidence has shown that when a large number of people use ITNs while sleeping, the morbidity and child mortality due to malaria can be reduced (Ye et al., 2012). In their study, Ye et al (2012) investigated the effect of free mass distribution in achieving equity in mosquito net ownership and use. Households were randomly selected to receive the treated nets versus the nontreated nets. Results indicated that the use of ITNs reduced the mortality rate of children under five. In addition, the results showed that ITNs are one of the most cost-effective interventions costing 10 dollars each to purchase and distribute (Ye et al., 2012). Another study conducted in Africa and Thailand where pregnant women were randomized to receive treated nets or no nets showed that ITNs reduced the frequency of placental malaria and peripheral parasitemia at the time of delivery (Gamble, Ekwaru & Kuile, 2006). Results also showed an increase in birth weight, and decrease in fetal loss (Gamble et al., 2006).

ITNs serve as a form protection that has been shown to reduce malaria illness, severe disease, and deaths in regions where the disease is prevalent (CDC, 2012c). Treated bed nets with an insecticide are more protective against malaria than untreated nets (CDC, 2012c). The insecticide not only kills or repels mosquitoes, they also kill other insects as well (CDC, 2012c). The treated nets repel mosquitoes, reducing the number that enter into the house (CDC, 2012c). If high use of treated nets is achieved within a community, the life span of the mosquitoes will shorten (CDC, 2012c).

Pyrethroid insecticides are the only treatment approved for the ITNs. They pose very low risk to humans but are very toxic to insects (CDC, 2012c). The treatment is not easily broken down unless it is washed or exposed to sunlight. However, the ITN lasts for at least 3 years even after repeated washing (CDC, 2012c). Widespread deployment of ITNs has been shown to be a very successful contribution to the malaria control strategy (Kokwaro, 2009). However, the impact of the high distribution of ITNs can be diminished if vulnerable populations such as pregnant women do not use them (George et al., 2011; Kokwaro, 2009). A study conducted by George et al (2011) focused on the awareness of malaria among people living in malaria endemic areas. Results of the study showed that most of the respondents were aware of malaria symptoms, treatment, and prevention; however, they were unaware of complications and fatalities caused by malaria. Another study conducted in a rural area by Onabanjo and Nwokocha (2012) focused on the effect of low utilization of ITNs among pregnant women on the high prevalence of malaria among them. The study also focused on factors that contributed to the transmission, prevention, and treatment of malaria that in turn increased the prevalence of the disease (Onabanjo and Nwokocha, 2012). Results of the study revealed that the use of ITNs was low among pregnant women, which contributed to the burden of malaria and maternal mortality (Onabanjo and Nwokocha, 2012). Similar findings resulted from a study conducted in Nigeria to identify facilitators and inhibitors for the use of ITN among pregnant women (Ezire, Adebayo, Idogho, Bamgboye, & Nwokolo, (2015). The Ezire et al (2015) study revealed that owning a net does not necessarily translate to usage. The study showed that 93.2% of respondents have heard of ITN,

82.6% were confident they could use an ITN, 64.6% owned an ITN, but only 19.2% used it (Ezire et al., 2015). Furthermore, the study revealed that ownership of a net or the number of nets owned by pregnant women were not critical deciders on whether the net was used (Ezire et al., 2015). Thus, based on these previous studies, it appears that pregnant women have knowledge of ITNs and have access to ITNs and own them; however, they do not use ITNs. These inconsistencies demonstrate that there is a lack of understanding of factors that influence the use of ITNs to prevent malaria. In this study I intended to seek selected factors that can inform strategies to improve the use of ITNs among pregnant women in rural Nigeria.

Problem Statement

Malaria remains a public health threat in Nigeria despite the availability of effective preventive measures such as the use of ITNs and IPTp (Akaba, Otubu, & Onafowokan, 2013). A study by Akaba et al. (2013) showed that 42.6% of pregnant women owned ITNs and of those 18% used it. The study also showed that the use of ITN during pregnancy declined compared to the prepregnant period (Akaba et al., 2013). The problem is that previous research indicated that despite availability of ITNs, their use is low. The factors associated with the low use are not fully understood yet. Pregnant women have access to ITNs but do not use them. Previous research seems to indicate that the knowledge of ITN, use of traditional herbal medicine, family income, and education may be linked to the low use of ITN. However, these findings were inconclusive. The previous studies available did not demonstrate an association between use of ITNs and the knowledge of ITN, use of traditional herbal medicine, family income, and education

among pregnant women in rural Nigeria. This is what this study assessed. Furthermore, based on the literature, there seemed to be significant gap between the ITN ownership and its use by pregnant women. A higher proportion of pregnant women in predominantly rural Nigeria owned ITNs as a result of successful penetration of the massive community level distribution campaigns in rural regions; yet, the use of the ITNs among them was low (Ankomah et al., 2012). Hence, there remains an important gap in the current literature regarding whether pregnant women's knowledge of ITN, family income, use of traditional medicine, and level of education influences their use of ITN in rural Nigeria. Therefore, this study assessed if these factors play a significant role in ITN use.

Purpose of Study

The purpose of this quantitative study was to assess the relationship between the knowledge of ITN, use of traditional medicine, education, and family income among pregnant women and the use of ITNs in rural Nigeria. The independent variables were knowledge of ITN, use of traditional medicine, education, and family income among pregnant women. The dependent variable was the use of ITNs among pregnant women.

Research Questions and Hypotheses

RQ1. Is there a relationship between knowledge of ITN among pregnant women and the use of ITNs in rural Nigeria?

H_0 1. There is no relationship between knowledge of ITN among pregnant women and the use of ITNs in rural Nigeria.

H_{a1} . There is a relationship between knowledge of ITN among pregnant women and the use of ITNs in rural Nigeria.

RQ2. Is there a relationship between use of traditional medicine among pregnant women and the use of ITNs in rural Nigeria?

H_{02} . There is no relationship between use of traditional medicine among pregnant women and the use of ITNs in rural Nigeria.

H_{a2} . There is a relationship between use of traditional medicine among pregnant women and the use of ITNs in rural Nigeria.

RQ3. Is there a relationship between education of pregnant women and the use of ITNs in rural Nigeria?

H_{03} . There is no relationship between education of pregnant women and the use of ITNs in rural Nigeria.

H_{a3} . There is no relationship between education of pregnant women and the use of ITNs in rural Nigeria.

RQ4. Is there a relationship between family income of pregnant women and the use of ITNs in rural Nigeria?

H_{04} . There is no relationship between family income of pregnant women and the use of ITNs in rural Nigeria.

H_{a4} . There is no relationship between family income of pregnant women and the use of ITNs in rural Nigeria.

Variables

Independent variables (IV): Knowledge of ITN, use of traditional medicine, education, and family income.

Dependent variables (DV): Use of ITNs.

Theoretical Framework

The study was framed with the ecological model to help understand influences on health behavior of pregnant women in Nigeria. Specifically, the social ecological model (SEM) emphasizes the interaction between individuals and the environment (Glanz, Rimer, & Viswanath, 2008) and, in this case, how it influences the uptake of ITN among pregnant women. The model takes into account the individual, community, societal, and environmental contexts of behavior and social change (Diala, Pennas, Marin, & Belay, 2013). The contexts of behavior and social change are impacted by cultural norms, traditions, societal and religious beliefs, gender roles, institutional and environmental factors (Diala et al., 2013). SEM helps with examination of the exchanges or interactions among people within their social and physical settings, over time and across levels such as personal, familial, cultural and institutional (Panter-Brick, Clarke, Lomas, Pinder & Lindsay, 2006). The first of the multiple levels of influence is the intrapersonal level or individual level. This level analyzed the variables knowledge of ITN and education level of pregnant women as they relate to individual personality that can affect the use of ITN. Biological and personality characteristics of the pregnant women are shaped by their social and physical settings. These characteristics are related to the level of education attained and the knowledge of ITN as it pertains to the use of ITNs. I used the

intrapersonal level to examine close relationships that may increase the risk of contracting malaria. With the intrapersonal level, emphasis is placed on the individual characteristics that influence behavior such as knowledge, attitudes, beliefs, and personality traits. Women do not act alone but are heavily influenced by their families and peers who contribute their range of experiences and practices towards malaria prevention among the pregnant women (CDC, 2015b; Diala et al., 2013).

SEM includes economic factors such as family income and women's willingness to follow advice of the provider (Diala et al., 2013) in the interpersonal level of the model. This level included examination of close relationships of the pregnant women that may or may not increase the use of ITNs. For the community level of SEM, I analyzed the variables "use of ITNs" and the "use of traditional medicine." At this level of the model, I used other factors outside of families and peers such as their social circles that practice cultural norms of the community to analyze their influence over whether the pregnant women will use ITNs. Pregnant women are expected to seek care in health facilities where ITNs will be provided and their use will be encouraged; however, these influences have an impact on the choices pregnant women make when it comes to malaria prevention (Diala et al., 2013). I also used the SEM to analyze the influence of whether pregnant women are expected to seek care with traditional birth attendants and whether to use traditional medicine (Diala et al., 2013).

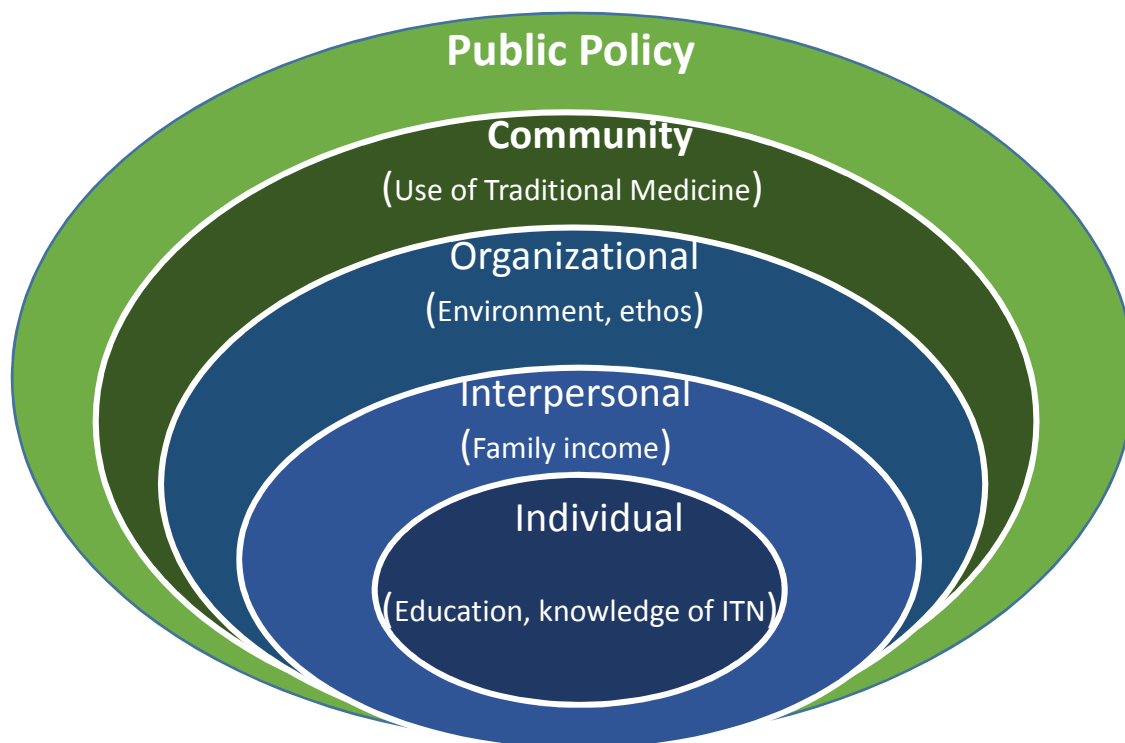


Figure 1. Social ecological model (free for public use).

Nature of the Study

In this study I answered the RQs by utilizing a cross-sectional design and secondary data. A cross-sectional design was appropriate for this study because it allowed me to investigate associations between exposure to risk factors and the outcome of interest (Levine, 2014). The secondary database utilized for this study was the Nigeria Malaria Indicator Survey (NMIS). The 2015 NMIS provides information on malaria indicators and prevalence at the national, regional, and state levels (National Malaria Elimination Programme/Nigeria, National Population Commission/Nigeria, National Bureau of Statistics/Nigeria, and ICF International, 2016). The study was quantitative and

assessed the relationship between the independent variables knowledge of ITN, use of traditional medicine, education, and family income among pregnant women and the use of ITNs. The focus of study was rural Nigeria. The dependent variable was the use of ITNs among pregnant women. For the study I used all available participants who provided complete data. Using a quantitative method has an advantage where smaller groups of participants can be used to make inferences about larger groups that may be costly to study. Using secondary data is cost effective and less time consuming.

Definitions of Terms

Health services: All services dealing with the diagnosis and treatment of disease, or the promotion, maintenance, and restoration of health (WHO, 2017).

Insecticide treated nets: Bed-nets treated with insecticides used as a protective cover against mosquito bites and malaria.

Social determinants of health: Conditions in which people are born, grow, work, live, and age, and the wider set of forces and systems shaping the conditions of daily life. These forces and systems include economic policies and systems, development agendas, social norms, social policies, and political systems (WHO, 2016).

Socioeconomic status: The social standing or class of an individual or group often measured by a combination of education, income, and occupation (American Psychological Association , 2017).

Traditional medicine: Also be referred to as herbal medicine, the sum total of the knowledge, skills, and practices based on the theories, beliefs, and experiences indigenous to different cultures, whether explicable or not, used in the maintenance of

health as well as in the prevention, diagnosis, improvement, or treatment of physical and mental illness (WHO, 2016a).

Assumptions

I assumed the secondary data obtained were accurately entered and free of error. I also assumed that the data used represents the rural population of Nigeria. Another assumption was that the measurements of low use of ITNs among pregnant women by the literature were appropriately identified.

Scope and Delimitations

The scope of the study was limited to only the rural regions of Nigeria where poverty is prevalent. The results of the study may not be generalizable to the entire country of Nigeria.

Limitations

Limitations of the study may include the use of secondary data where data for the variables in this study may not be available. Secondary data were collected for other purposes and not to answer RQs; therefore, specific information that I would like to have had may not have been available. Another limitation was that I did not participate in the data collection process and was unaware of how it was conducted. However, I was not aware of any problems that were encountered during data collection. These problems may have included respondents misunderstanding survey questions (Johnston, 2014). Such problems can be avoided by securing a reputable publishing company that can produce accurate and current data.

Significance

Malaria control remains a challenge in countries such as Nigeria where the infection is endemic (Agomo, Wellington, Anorlu & Agomo, 2009). Pregnant women are one of the most vulnerable groups due to their reduced immunity; thus, the use of protective measures such as ITN is essential in preventing malaria infection. The use of ITNs can also prevent miscarriages, anemia, neonatal deaths, and maternal deaths attributed to malarial infection. In this study I assessed the relationship between the knowledge of ITN, use of traditional medicine, education, and family income among pregnant women and the use of ITNs in rural Nigeria. Results of the study are important for pregnant women in the Nigerian communities because they will aid in implementing strategies to ensure survival and improve birth outcome. The results will be also important to similar communities, because malaria is a global disease and can be transmitted to travelers from nonprevalent malaria areas (CDC, 2012b). Malaria disease directly contributes to poverty, low productivity, and reduced school/work attendance in Nigeria (Esiedesa, 2014). Nigeria estimates financial loss from malaria in the form of treatment costs, prevention, loss of person hours, and so forth, thereby reducing the economy of the country (Esiedesa, 2014). Results of this study could be used by public health workers and healthcare professionals to promote social change by improving strategies to increase the uptake of ITN among pregnant women. Increasing the use of ITNs to prevent malaria could promote productivity and attendance at work and school, thereby improving economic growth of the country. Economic costs from the malaria disease and social costs from increase in ITN uptake could have an effect on growth and

development within rural communities in Nigeria. Furthermore, findings from the study could inform health seeking behaviors such as the use of ITNs that could prevent or reduce the spread of malaria among pregnant women.

Summary

Malaria remains a public health threat globally, particularly in sub-Saharan Africa where Nigeria continues to bear the brunt of the disease. The disease poses a greater threat to vulnerable groups such as young children and pregnant women (Agomo et al., 2009) due to reduced immunity or no immunity to malaria infection. SEM provided the theoretical framework for the study. I used the model to assess the social determinants to the endemic malaria infection among pregnant women. The endemicity of malaria disease among pregnant women indicates that more research is needed to better understand the low use of ITNs. Education is vital. It provides information on the etiology of malaria and basic understanding of transmission, prevention, and intervention strategies. Access to antenatal clinics is important in gaining entrance to malaria preventive measures and preventing adverse maternal outcomes. Insufficient family income leads to the inability to use malaria preventive measures, which creates obstacles to the success of malaria prevention. Knowledge of ITN among pregnant women is important in ITN ownership, where various cultural norms or practices can influence use of ITN among pregnant women. Analyzing the relationship between the knowledge of ITN, use of traditional medicine, education, and family income and the use of ITNs among pregnant women provides a better understanding of the barriers to use of ITNs

among pregnant women. This chapter outlined strategies and actions towards meeting the goal of prevention and elimination of malaria within the rural community of Nigeria.

The following chapter, Chapter 2, includes relevant literature that provides a concise synopsis relative to the problem of malaria infections and low use of ITNs among pregnant women in rural Nigeria.

Chapter 2: Literature Review

Introduction

Of infectious diseases that occur mostly in the tropical and subtropical areas of the world, malaria is the world's leading killer (DeGaborik, 2006). It is the leading cause of illnesses and deaths in most of the countries affected by it (Mali et al., 2007). Maternal illness and low birth weight result from *Plasmodium falciparum* mosquito infection, which occurs predominantly in Africa (WHO, 2013). The infection is usually asymptomatic; however, the parasites may be present in the placenta, which can contribute to maternal anaemia and placental parasitaemia (WHO, 2013). According to the WHO (2013), maternal anaemia and placental parasitaemia can lead to low birth weight, contribute to infant mortality, and increase the risk of severe malaria, causing spontaneous abortion, stillbirth, and prematurity (WHO, 2013). Malaria poses a major public health issue in Nigeria, which accounts for more malaria-related deaths than any other country in the world (U.S. Embassy in Nigeria [USEN], 2011, p. 1). Pregnant women and children under the age of 5 years old are the most vulnerable groups due to low or no immunity. Approximately 97 % of the Nigerian population is at risk, and malaria cases are estimated at 100 million with over 300,000 deaths annually in Nigeria (USEN, 2011, p. 1). Malaria also contributes to about 11% of maternal mortality and a prevalence of about 28% (South East region) and about 50% (South West, North Central, and North West regions) in children under age 6 to 59 months (USEN, 2011, p. 1). There are measures that are used to prevent and treat malaria. Preventive measures include, but are not limited to, the promotion of ITNs (USEN, 2011). Among other malaria preventive

measures, ITN provides simple and effective means of malaria prevention (Akaba et al., 2013). Ownership of ITNs among pregnant women is high in predominantly rural Nigeria; however, the use of these ITNs is low there (Ankomah et al., 2012). The reasons for the low use of ITNs among pregnant women are not understood. Previous literature has indicated that the knowledge of ITN, use of traditional herbal medicines, family income, and education have been linked to the low uptake of ITN; however, these findings are inconclusive (Tongo, Orimadegun & Adeyinka, 2011; Ankomah et al., 2012; Marchie & Akerele (2012); Onabanjo & Nwokocha (2012); Akaba et al., 2012).

This chapter consists of three parts. In the first section I discuss the strategies involved in the literature search. I narrate the different search engines and key words used to search for the various articles relating to the barriers to the use of ITNs among pregnant women in rural Nigeria. The second section analyzes the use of the SEM for this study. Studies have shown that social and physical environment influence a person's health behavior. This is emphasized in the frequent use of SEM in the implementation of health services and health programs (Issel, 2009, p. 27). The model takes into account individual, community, societal, and environmental contexts of behavior and social change (Diala et al., 2013). SEM involves four levels of influence: (a) intrapersonal or individual level as it relates to the knowledge of ITN and education level of pregnant women, (b) the interpersonal level as it relates to family income of pregnant women, and (c) the organizational and community levels as they relate to the use of traditional medicines. The third section provides a detailed review of the current literature as it pertains to the independent variables, knowledge of ITN, use of traditional medicines,

education, and family income of pregnant women, and the dependent variable, the use of ITNs.

Literature Search Strategy

I undertook the literature search on published literature by accessing the electronic Walden library databases (Medline, PubMed) and electronic search engines such as Google Scholar. Key words or search terms used included *malaria among pregnant women in Nigeria, pregnant women and malaria preventive measures in Nigeria, ITN use and ownership among pregnant women in Nigeria, education level of pregnant women and malaria in Nigeria, use of herbal/traditional medicines among pregnant women and malaria in Nigeria, household income of pregnant women and malaria in Nigeria*, and so forth. The search was limited to articles published from 2005 to 2015.

The analysis of the literature on malaria were based on malaria transmission, the adverse effects of the malaria disease on pregnant women, the effectiveness of ITNs as a malaria preventive measure, and variables of this study (use of ITN, knowledge of ITN, education, family income, and use of traditional medicines). The results of the literature review may contribute to a better understanding of the barriers to the uptake of ITN for malaria prevention among pregnant women in Nigeria.

Theoretical Foundation

The SEM was the theoretical framework used in this study. The model is a multilevel, interactive approach to examining health-related behaviors and conditions (McKenzie, Neiger, & Thacheray, 2009). It states that health-related behaviors and

conditions are part of a larger system that can be approached from multiple levels (McKenzie et al., 2009). The five levels of influence for the ecological model are (a) the intrapersonal level or individual level, (b) the interpersonal level, (c) the institutional or organizational level, (d) the community level, and (e) the public policy level (McKenzie et al., 2009). The intrapersonal level identifies individual characteristics that influence behavior such as the person's knowledge, attitude, and skills. The interpersonal level includes processes and groups such as family, friends, and peers who provide identity and support. The organizational level involves churches, stores, or community organizations that implement rules, regulations, and policies that constrain or promote behaviors. The community level can be social networks that involve community norms. The public policy level involves local, state, and federal agencies that implement policies and laws to regulate or support healthy practices/actions (Winch, 2012).

Focusing on the social and physical environments is important in understanding health and disease patterns. There are characteristics of the social and physical environment that shape human experience and personal behaviors (Abdulkarim, 2012). Social, political and economic systems shape behaviours of individuals and populations, which have an effect on access to resources necessary to maintain good health (Abdulkarim, 2012). Recognizing the social and environmental conditions helps identify determinants that might be responsive to interventions within the community that may lead to improved health outcomes (Abdulkarim, 2012). SEM focuses attention on the contexts of behavior when implementing interventions (Panter-Brick et al., 2006). The levels of SEM provide understanding of the factors that put people at risk of malaria and

help explain why there is low uptake of ITNs among pregnant women in Nigeria. SEM involves the interdependence and the interaction between factors and across all levels of a health problem where it emphasize on the interactions with the physical and sociocultural environments (National Institutes of Health, 2005). In SEM, the model may be used to focus attention on the social and physical settings where it examines the interplay between pregnant women and the external factors that shape their behaviours (Panter-Brick et al., 2006). This is analyzed through the various levels of SEM. Diala et al. (2013) conducted a study that focused on the perception of pregnant women regarding IPTp in malaria prevention and its adherence. In this study, the SEM took into account the individual, community, societal, and environmental contexts of behavior and social change, which included cultural norms, traditions, religious beliefs, and environmental factors (Diala et al., 2013). The study instruments were based on factors that may motivate or impede the behavior of pregnant women in preventing and treating malaria at the individual, community, and environmental levels. The individual level was related to personality and autonomy, beliefs about malaria, and efficacy of modern treatment. Women were usually influenced by immediate family or partner (Diala et al., 2013). The people the women were connected to such as spouse or family member played a role in their access to care. At the community level, interaction of the women involved people outside of the women's families (Diala et al., 2013). Such interactions may have included neighbors, peers, relatives, friends, and other people in the community. These people related to culture and norms of the community that play a role in influencing the choice(s) or behaviors of pregnant women (Diala et al., 2013). For instance, pregnant

women are expected to seek care in health facilities with providers who provide traditional medicines (Diala et al., 2013). Cultural norms that include behavior in the society—how persons interact with one another—plays an important role in the beliefs and actions of the women in Nigeria. On the environmental level (organizational and community levels), economic factors, knowledge of malaria in pregnancy, following provider's orders, waiting times, antenatal facilities, and providers' attitudes play a significant role in adhering to antenatal care services (Diala et al., 2013). However, barriers to accessing antenatal care were not adequately captured (Diala et al., 2013). The SEM model was applied to this study using ITN as the preventive measure for malaria.

Factors at all levels of SEM relate to the decisions of the pregnant women to seek antenatal care where IPTp should be provided and malaria treated if needed (Diala et al., 2013). Family and community support also play a role in the decision making of the women to seek preventive care and treatment. While Diala et al (2013) utilized SEM to focus on the perception of pregnant women on IPTp, this study used SEM to focus on the low uptake of ITNs among pregnant women. The individual level relates to educational level of pregnant women and their knowledge of ITN; the interpersonal level relates to family income; the organizational level relates to access to antenatal care; and the community level relates to the use of traditional medicines among pregnant women. (Appendix C).

Literature Review Related to Key Variables

Previous research has indicated that the knowledge of ITN, use of traditional herbal medicines, family income, and education, has been associated with low uptake of

ITN but these findings are inconclusive (Tongo et al., 2011; Ankomah, Adebayo, Arogundade, Anyanti, Nwokolo, Ladipo, & Meremikwu, 2012). Tongo et al (2011) reported that traditional herbal medications for malaria in pregnancy are a common practice among pregnant women. The authors also reported that pregnant women have lack of knowledge of ITNs. While these findings may be associated with the low uptake of ITNs, the authors stated that they may have been contributors to the low use because the respondents who did not use ITNs had no specific reasons for not doing so (Tongo et al., 2011). Similarly, Ankomah et al (2012) surveyed 2348 pregnant women in Nigeria on ITN ownership, use, knowledge, behavior, and practices. Findings showed that 28.8% of the respondents owned ITNs, 79.6 had some sort of education, and 7.5% used ITNs (Ankomah et al., 2012). The study also reported that educational level of pregnant women was not related to ITN use. However, when Ezire et al. (2015) surveyed 850 pregnant women to identify facilitators and inhibitors of ITN use among pregnant women in Nigeria, their results showed that 70% of the women were not educated, 64.6 owned ITN, and 19.2% actually used ITN. These findings revealed that educational level was associated with ITN use. Due to this gap in the findings, the relationship of ITN use among pregnant women and educational level need to be further explored. A survey by Adebayo, Akinyemi, and Eniola (2015) in rural southwest Nigeria was conducted to determine the knowledge of malaria prevention and the use of ITN. Study population included 631 pregnant women and caregivers of children under five years. Results of the study showed that 64.7% of the respondents were of low income and 75% of them used ITN (Adebayo et al., 2015). In contrast, Enato, Okhamafe, & Okpere (2007) conducted a

study to assess the knowledge and practice of malaria management among 876 pregnant women attending prenatal care in Nigeria. Results showed that 53% of the respondents were of low income and only 8.5% of them used ITN (Enato et al., 2007). These two studies appear to be inconsistent with the first study showing that majority of low income earners used ITNs and the second study showing that a very low percentage of low income earners used ITNs. This study addressed the inconsistencies in the findings from the studies. ITN is the most effective weapon against malaria (UNICEF, 2015).

According to UNICEF, 2015, ITN is one of the most effective weapons against malaria. The use of ITNs alone for malaria prevention has shown to reduce overall malaria child mortality by 20 percent when the child sleeps under them consistently and correctly (UNICEF, 2015). According to an UNICEF report the use of ITNs can save six child lives per year for every one thousand children sleeping under them (UNICEF, 2015). In Nigeria, there are higher rates of malaria infection among pregnant women who did not utilize ITN (Choonara, Odimegwu, & Elwange, 2015). Moreover, persons from poor households live in high malaria endemic areas (Mazumdar & Mazumdar, 2007).

Households in high-malaria prevalence areas have traditional pit toilets, store drinking water, and lack electricity that further contributes to the breeding of mosquitoes (Mazumdar & Mazumdar, 2007). Children under 5 years and pregnant women from poor households sleep under these conditions; hence, they are prone to mosquito bites and malaria, especially since they have lower chances of sleeping under bed nets (Mazumdar & Mazumdar, 2007). The progress to reduce the prevalence of malaria is slow, particularly in rural Nigeria where the burden of malaria is extremely high (Mazumdar &

Mazumdar, 2007). This slow progress is due in part to lack of legislation on sanitation control, illiteracy, poverty, poor environmental health, and unsuccessful effort to ensure a larger proportion of the population sleeps under ITN (Mazumdar & Mazumdar, 2007). Indeed, Mazumdar & Mazumdar (2007) indicated that only 7% of children below five years and pregnant women sleeping under ITNs.

Findings from a study conducted by Koudou, et al. (2010) stated that training and sensitization activities performed before and after net distribution had an effect on the reduction of plasmodium prevalence. The objective of the Koudou et al study was to determine if ITN was an important tool to control malaria infection in children aged 6-59 months (Koudou et al., 2010). Findings from the study showed that the overall proportion of clinical malaria cases among children under 5 years old decreased significantly after a considerable number of household members were observed sleeping under ITNs (Koudou et al., 2010). This study confirms the importance of using ITNs. While the use of ITNs has proven to be effective in reducing the high prevalence of malaria transmission, it is important for this study to determine the barriers to the use of ITNs by the target population. The use of ITNs can help prevent pregnant women and their unborn baby from being infected with the malaria disease.

Use of Insecticide Treated Nets (Dependent Variable)

Marchie & Akerele (2012) provided further information on trends of malaria infection during pregnancy and the different prevention and treatment measures utilized by pregnant women. In a survey involving 755 pregnant women selected from a state government hospital and a mission hospital during clinic visits descriptive statistics were

used. Majority of the women suffered from malaria in the first trimester (Marchie & Akerele, 2012). Results revealed that 29.2% used ordinary untreated net, 24% used insecticide, and only 25% of the women surveyed used ITNs while some of the women used combination of herbs for the treatment of malaria (Marchie & Akerele, 2012). The authors suggested that there was low use of the ITNs which contributed to the high prevalence of malaria among pregnant women. Findings of the study also revealed that the ITNs were costly and the women were not aware of the importance of early antenatal visits and ITN use for the prevention of malaria (Marchie & Akerele, 2012).

Another study conducted by Onabanjo and Nwokocha (2012), narrated the increase in maternal mortality in Africa particularly in rural and urban areas of the Ondo state in Nigeria where malaria among pregnant women was highly prevalent. The study discussed how the low use of ITNs among pregnant women contributed to the high prevalence of malaria. It also discussed other factors that contributed to the transmission, prevention, and treatment of malaria. Findings from this study suggested that the strategies to reduce the burden of malaria and maternal mortality must be based on the cultural changes at the community level. In another study, the low use of ITN was associated with the belief that the ITNs do not provide good personal protection and disturb the sleeper from getting air (Sam-Wobo, Akinroboye, Anosike, & Adewale, 2008). Gaps identified in these studies included the need to improve the educational status of the women in the effort to improve malaria prevention through adult literacy programs.

In contrast to the Marchie & Akerele (2012) study findings described earlier, Adebayo, Akinyemi & Cadmus (2015) conducted a survey showing that 75% of the pregnant women used ITN (Adebayo et al., 2015). The inconsistencies in the percentage of use of ITN among pregnant women has been explored in this study.

Treated bed nets with an insecticide are more protective against malaria than untreated nets. The insecticide does not only kill mosquitoes, it also kills other insects. These treated nets repel mosquitoes, reducing the number that enters into the house (CDC, 2012c). Thus, if a high use of the nets can be achieved within a community, the life span of the mosquitoes will shorten (CDC, 2012c). A study by Hwang, Graves, Jima, Reithinger, Kachur & MIS (2007) addressed the effects of combinations of malaria control resources such as access to artemisinin combination therapy (ACT) and ITNs to reduce malaria morbidity and mortality. Findings from this study showed that only a small proportion of the women surveyed knew the cause, signs or symptoms, and preventive measures of malaria (Hwang et al., 2007). Furthermore, women belonging to the poorest wealth quintile, without formal education, and living in the rural regions had the lower levels of malaria knowledge (Hwang et al., 2007). Thus, the authors concluded that packaging effective messages that include the use of ITNs is essential for gaining increased use of ITNs (Hwang et al., 2007).

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

other measures (Ezeama & Ezeama, 2013). To ascertain the frequency of the use of ITNs among pregnant women, a study was conducted in an antenatal clinic in a tertiary health facility in Imo State Nigeria (Ezeama & Ezeama, 2013). A total of 201 women between 18 and 50 years of age were interviewed. Results of the study showed that about 75% of the women surveyed were aware that ITNs could prevent malaria in pregnancy, but less than 50% of these women were using ITNs. Furthermore, pregnancy studies from different African nations have demonstrated the efficacy of ITNs in malaria infection prevention and its benefits in pregnancy (Singh et al., 2013). Results of such studies showed a strong correlation between the use of ITNs and the reduction in stillbirths, improvements in birth weight of babies and a reduction in anaemia in pregnant women (Singh, et al., 2013).

Consistent use of ITNs among pregnant women has been shown in randomized controlled trials to produce favorable maternal and infant outcomes (Ankomah et al., 2012). Along with other evidence-based interventions, the country of Nigeria promotes ITN use in pregnancy. However, the level of ITN utilization remains low at rates below 10% (Ankomah, et al., 2012). The Akomah's study (2012) on ITN use by pregnant women in Osogbo southwest Nigeria showed low rate of ITN ownership with 29% of pregnant women reporting it (Ankomah, et al., 2012). Out of those who owned ITNs, only 25% reported that they slept under the ITN; therefore, the ownership of ITNs does not translate to use (Ankomah, et al., 2012). ITN utilizations rates in Nigeria among pregnant women increased from 1.3% in 2003 to 2.9% in 2006 (Ankomah, et al., 2012). By 2008, the utilization rate was below 10% which further confirms that ITN utilization

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

Knowledge of Insecticide Treated Nets

Malaria is preventable, curable, and easy to treat; however, the disease can be deadly when it occurs in pregnancy if not promptly managed (Ezeama & Ezeama, 2013). Knowledge that ITN prevents against malaria is the best predictive power on ITN ownership (Ankomah, et al., 2012). According to Akaba et al., (2013), malaria preventive health behaviors as well as knowledge about malaria and the treatment seeking behaviors among pregnant women have been found to be generally poor in the rural communities of Nigeria. These factors also posed as challenges in the Roll-back Malaria implementation in Nigeria (Akaba, et al., 2013). Akaba et al (2013) conducted a study to determine the

knowledge about the prevention of malaria and the use of malaria preventive measures among pregnant women at an antenatal clinic. Out of the 403 pregnant women studied, only 9 did not have any form of education. The study revealed that pregnant women book late for antenatal clinic. These late bookings prevent women from getting the maximum benefits of antenatal care which includes improving their knowledge on malaria preventive measures such as the utilization of ITNs in pregnancy and after child birth (Akaba, et al., 2013). Despite the late bookings, a large proportion of the study population was aware that malaria was preventable, with ITN being the most common preventive measure known (Akaba, et al., 2013). The educational level of the women may have played a role in the increased awareness (Akaba, et al., 2013). A study was conducted to assess the knowledge, attitude and practice of malaria management among pregnant women attending antenatal clinics in southern Nigeria (Enato, Okhamafe, & Okpere, 2007). The study population included 875 pregnant women and a majority of them reported contracting malaria during pregnancy (Enato et al., 2007). Findings from the study revealed that knowledge of the consequences of malaria among the pregnant women studied was poor and this was likely to impair the utilization (Enato et al., 2007).

In a study conducted by Singh, Musa, Singh, & Ebere (2014), the participants had a good knowledge of malaria preventive measures but the knowledge did not translate into improved practice of preventive measures. An interview was conducted with a structured questionnaire administered to 200 randomly selected households. About 90% of the respondents reported any bed-nets as the most common protective method against malaria, while 64% of them had knowledge of ITNs. With the awareness of ITNs being

high among the respondents, only 31.9% of them were actually using it (Singh et al., 2014). Similar findings were obtained in a study conducted by Adebayo et al., 2015, where 69.4% of the study population had knowledge of ITN use. While some studies showed low knowledge of ITN use, other studies showed increased knowledge of ITN use. This creates a gap that this study addressed.

Malaria contributes to low productivity, poverty, and reduced school attendance in Nigeria (MAPS, n.d.). In the effort to combat the burden of the disease on the country's economy, the Ministry of Health along with other partners are implementing control strategies that include the use of ITNs, prompt malaria case treatment, and intermittent preventive therapy (IPT) for pregnant women (MAPS, n.d.). A cross-sectional study conducted by Esse et al., 2008 showed that health seeking behaviors and preventive measures in malaria control can help reduce this burden. A survey was carried out on 476 households in Zatta and 110 households in Adibrobo. The results showed that effective and access to health care systems are important in the prevention and treatment of malaria (Esse et al., 2008). Lack of knowledge and preventive practices of the villagers, and the differences in management and control of malaria across villages are some of the factors that contributed to the malaria burden (Okech et al., 2008). Okech et al (2008) further confirmed the need to utilize malaria preventive measures, such as ITNs, which can be done by access to resources.

Education

Compared to developed countries, maternal mortality and other maternal health indicators are worse during pregnancy in developing countries (WHO, 2015).

OnahIkeako, & Iloabachie (2006) conducted a study to identify the factors associated with the use of maternity services in south east Nigeria. The study was carried out among women with major occupations ranging from trading and civil service to substance farming and animal pasturing. Out of the 1450 women to whom the questionnaires were administered, 1095 of them responded. The results of this study revealed that about one quarter of the study population had no formal education at 301 women (27.5%) and 410 (37.4%) had primary level education (Onah et al., 2006). Educational status of women in pregnancy and delivery was highly associated with health seeking behaviors (Onah et al., 2006). The maternal mortality level was much higher in women with no education compared with women with secondary level or higher education (Onah et al., 2006). Findings in this study showed that women with low formal education, employment status, and low family income would not seek antenatal supervision (Onah et al., 2006) where they would be exposed to obtaining information on ITN use for malaria prevention.

Many interventions such as the use of preventive measures among pregnant women to reduce the burden of malaria depends on improved knowledge of the disease and its control which is enhanced by increased educational attainment (Dike, Onwujekwe, Ojukwu, Ikeme, Uzochukwu & Shu, 2006). Educational level positively influences care seeking behavior. A person's level of education is a significant predictor in ITN use because it influences knowledge the person has about malaria and how to prevent and treat it and it plays a role in their perceptions and practices in controlling the disease (Dike et al., 2006). However, the educational level need not be advanced to have a better knowledge, attitude, and perception to malaria (Dike et al., 2006). Formal

education mostly involves the teaching of reading skills, and aids in removing some of the cultural ideologies that may lead to misconceptions that affect proper and adequate malaria prevention and treatment (Dike et al., 2006). Dike et al (2006) study was conducted to determine whether a person's educational level influences their knowledge about malaria and its prevention and treatment. The study also examined how the knowledge about malaria influences people's practices in preventing and treating malaria (Dike et al., 2006). The study was conducted in four villages and questionnaires were administered to a simple random sample of 300 respondents per village. The respondents were asked about their knowledge of the causes and symptoms of malaria, the different methods of treating and preventing malaria and whether they used ITNs. Results of the study showed that people with increasing formal education were more likely to identify mosquitoes as the cause of malaria (Dike et al., 2006). The identification of mosquitoes as the cause of malaria was positively related to perception of environmental management and use of ITNs for malaria prevention (Dike et al., 2006). The study also showed that as the years of formal education increased, the acquisition and use of ITNs increased, and the perception that herbal medicine could be used to treat malaria decreased (Dike et al., 2006). However, findings obtained from the study by Akaba et al (2013) revealed that out of a study population of 403 pregnant women, the majority (89.3%) of them had secondary and tertiary education but only 18% used ITN (Akaba et al., 2013). These findings differ from the study that showed low level of education among pregnant women and low use of ITN resulting in inconsistencies in the findings (Ezire et al., 2015). While one study showed that formal education increased the use of ITNs, the

other study showed that formal education did not increase use of ITNs among pregnant women. This creates a gap in these two studies that this study addressed.

Findings from a study conducted by Adebayo et al., (2015) agree with the study by Dike et al., (2006). The acceptance and use of ITN is based on the knowledge about this preventive measure of malaria as an important tool (Adebayo et al., 2015). A questionnaire was administered to a population of pregnant women and female caregivers of children under-five, and the results showed that the overall knowledge of malaria prevention practices among the majority of the respondents was poor (Adebayo et al., 2015). This low knowledge could be due to the lack of exposure to health education messages and their poor health seeking behavior (Adebayo et al., 2015). Some of the women who had exposure to health facilities found it difficult to understand the malaria prevention information given during antenatal care which was partly due to the low level of education of the respondents (Adebayo et al., 2015). In contrast, a study by Singh, Brown, & Rogerson (2013) found that lower education was associated with significantly higher rates of ITN use among pregnant women. Yet only 25% of the pregnant women that owned ITNs actually used it (Ankomah et al., 2012). The results of the Singh et al. (2013) study contrast with the results of the study conducted by Ankomah et al., (2012), discussed earlier which concluded that the education level of pregnant women was not related to ITN use.

Family Income

Malaria is concentrated in the world's poorest countries as the disease depresses economic growth (Worrall, Basu, & Hanson, 2005). Costs of malaria vary by the

socioeconomic status of family households (Begum, Abidin, Er, & Pereira, 2012). The poor spend a significantly higher proportion of their income on preventive measures and treatment for malaria; therefore, bearing a greatest burden of the disease than families of high income households (Uguru, Onwujekwe, Uzochukwu, Igiliege, & Eze, 2009). Direct costs of malaria (expenditures on treatment and expenditures on prevention) make up 28-34% annual income of poor households and 1-2% of annual income of high income households (Begum et al., 2012). In malaria endemic countries like Nigeria, ITN is one of the preventive measures people rely on when it comes to malaria prevention (Begum et al., 2012). Indirect cost of malaria (wage lost, reduced productivity, school days missed, etc.) consumed a significant portion of annual income of households (Begum et al., 2012).

Malaria leads to low productivity and loss of income, especially since the human and economic costs associated with the declining quality of life, consultations, treatments, hospitalizations and other events related to malaria are enormous (Kimbi, Nkesa, Nyanga, Sumbele, Atashili & Atanga, 2014). In Nigeria, the use of malaria preventive measures such as ITNs can be expensive (A Moran, Fatugase, Fatugase, & Alausa, 2012). The estimated prevention expenditure accounted for 1.6% of rural (poorer) and 2.1% urban (less poor) annual household income (Worrall et al., 2005). A study by Onwujekwe, Hanson, & Fox-Rushby (2004) showed that those within the poorest socio-economic groups were less likely to own or purchase an ITN, and stated a lower willingness to pay for one. The decision to pay for an ITN was propelled by need and higher economic status (Onwujekwe et al., 2004).

Similarly, findings in the study by Worrall et al., (2005) showed a link between poverty and the use of ITNs. Socioeconomic status (occupation, housing type, rural location) are more directly related to exposure and risk of malaria (Worrall et al., 2005). Poorer households are less likely to access preventive measures or seek treatment; therefore, they may be more vulnerable to the adverse consequences of malaria infection (Worrall et al., 2005). In contrast, the findings of a study conducted by Singh et al., (2013) showed that the lowest wealth quintile or the poorest households demonstrated higher rates of ITN use among pregnant women. This contrast shows the gap in the relationship between families from poorer households and their use of ITN as a malaria preventive measure.

Traditional Herbal Medicines

Herbal medicines are used by three-quarter of the world's population with the trend of its use increasing globally (Oreagba, Oshikoya, & Amachree, 2011). Such medicines may be beneficial for some individuals, but they are not completely harmless (Oreagba et al., 2011). With this in mind, Oreagba et al., (2011) assessed the extent of the herbal medicine use and the general knowledge of its benefits and safety among the residents of Lagos Nigeria. Herbal medicine is an integral part of "traditional medicine" (Oreagba et al., 2011). According to Oreagba et al., 2011, traditional medicines are diverse health practices, approaches, knowledge and beliefs that incorporate plant, animal and/or mineral base medicines, spiritual therapies, manual techniques and exercises which are applied singularly or in combination to maintain well-being, as well as treat, diagnose or prevent illness. Despite the widespread use of traditional medicine across the

globe, adverse reactions have been reported when used alone or along with conventional or orthodox medicines and may put the health of its users at risk of toxicity (Oreagba et al., 2011). The Oreagba et al study (2011) showed that over half of the 388 respondents used herbal medicine and 52% of users experienced inexplicable adverse effects following the use of traditional medicines (Oreagba et al., 2011). Most traditional medicine users consider it to be safe and the perception of safety is attributed to its natural sources (Oreagba et al., 2011). Their use has also been associated with cultural and personal beliefs and philosophical views on health and life (Fakeye, Adisa, & Musa, 2009). This misconception is one of the reasons why pregnant women use them in Nigeria as well as other developed countries (Fakeye et al., 2009). In the study conducted by Fakeye et al., 2009, results of the study showed that pregnant women preferred to take herbal medicine compared to conventional medicines due to their belief of the efficacy of herbal medicines. In addition, the pregnant women believed that it is safer to take herbal medicines and they are cost effective (Fakeye et al., 2009)

In Nigeria, with unproven efficacy, traditional remedies against malaria have always been employed and the use is more preponderant among pregnant women (Tongo et al., 2011). This may be as a result of chemoprophylaxis with weekly pyrimethamine and chloroquine used for malaria treatment were no longer efficacious due to emergence of resistance (Tongo et al., 2011). The burden of malaria in pregnancy remains high in endemic areas such as Nigeria (Tongo et al., 2011). A study conducted by Tongo et al. (2011) evaluated the utilization rates of malaria preventive measures among pregnant women in Nigeria and their impact on pregnancy outcomes. The study included 800

mothers who were interviewed at delivery. Results showed that while 20% of pregnant women used ITNs, their use of traditional medicines for prevention of malaria in pregnancy is still a common practice among Nigerian pregnant women (Tongo et al., 2011). The study showed that the mean birth-weight was significantly higher and risk of preterm delivery were reduced by half among those who did not use traditional medicines (Tongo et al., 2011). From these results, the authors concluded that malaria prevention utilization rates are still low while that of traditional medicines is high among pregnant women (Tongo et al., 2011).

In a study conducted by Fakeye et al., 2009, the authors aimed to determine the frequency of the use of traditional medicine by pregnant women. Results revealed that 67.5% of pregnant women had used traditional medicine (Fakeye et al., 2009). Based on the results of the study, the use of traditional medicines by pregnant women in Nigeria seems to be high. Many of the women have selected traditional medicines as their form of malaria prevention instead of the use of ITN (Fakeye et al., 2009). This finding is different from the results of the study conducted by Adetoun, Morenikeji, & Odaibo (2010) in Oyo State, Nigeria where data was collected on the knowledge, attitudes, and practices of the people relative to malaria. Findings of this study showed that while 18.2% of the study population used ITNs, 19% used traditional herbal medicine. Similarly, the study by Enato et al (2007) on the knowledge, attitude and practice of pregnant women on malaria management conducted a survey on 867 pregnant women. Findings of the study revealed that 6% of the respondents used herbal medicine and 8.5%

used ITNs (Enato et al., 2007). This differs from the studies by Tongo et al (2011) and Fakeye et al (2009).

In another study conducted by Sam-Wobo, et al., (2008) the utilization of ITNs by pregnant women was very low. Results of the study showed that 68% of the study population utilized herbal treatment for malaria symptoms and 54% used the herbal drugs daily (Sam-Wobo et al., 2008). The respondents believe that daily intake in addition to forestalling attacks of malaria keeps the foetus in good condition (Sam-Wobo et al., 2008). Even 19% of the respondents combine both the herbal treatment regimens and a malaria preventive measure (Sam-Wobo et al., 2008). While the choice of using herbal treatment for malaria symptoms was observed to be very high in the Sam-Wobo et al (2008) study, ITN utilization was very low. As discussed earlier, malaria poses an adverse effect on the mother and developing foetus, and the respondents claimed to experience three to four episodes of malaria disease in a year (Sam-Wobo et al., 2008). Abdominal pain, foetal weakness due to reduced kicks, headaches, body pain, and anaemia were symptoms associated with malaria in pregnancy (Sam-Wobo et al., 2008). With the availability of orthodox antenatal clinics where women can receive proper and adequate resources against malaria for themselves and the foetus, the majority of the women utilized herbal treatment as a means to treat symptoms associated with malaria due to their belief of its effectiveness and suitability (Sam-Wobo et al., 2008). However, there seems to be a contrast in other literatures where the use of traditional medicine is low and the use of ITN is also low (Adetoun et al (2010); Enato et al (2007). Thus, these

studies bring about a gap in the findings of pregnant women in malaria and their relationships between the use of herbal medicines and the use of ITNs.

Summary

Malaria remains a public health threat globally (Akaba et al., 2013). It is important to increase efforts in addressing and reducing the transmission of malaria in developing countries, particularly for pregnant women and children (Akaba et al., 2013). In an effort to do so, there are malaria preventive measures that have been put in place to help alleviate the burden of malaria among pregnant women and children in rural Nigeria (Ankomah et al., 2012). Among several other malaria preventive measures, the utilization of ITNs have shown to be an important strategy for protecting pregnant women and their newborns from contracting the malaria; however, the uptake of such preventive measure is low (Ankomah et al., 2012). The review of the literature provided an overview of factors that may be linked to the low uptake of ITNs; however, the reasons for the low uptake are not conclusive because of the inconsistencies in the literature. The review of the literature analyzed the different variables (knowledge of ITN, use of traditional herbal medicines, family income, and education) and how each variable is linked to ITN use among pregnant women. The literature confirmed that despite successful intervention strategies to distribute ITNs in rural Nigeria, the utilization of ITNs is low among pregnant women. This study intended to explore the reasons for the low use of ITNs. Identifying the barriers to the utilization of ITNs among pregnant women will be essential to determine if they play a significant role in the use of ITNs.

Chapter 3: Research Method

Introduction

Malaria is a fatal disease that poses as a public health problem in Nigeria (Okeke, 2012). Mostly infants, young children, and pregnant women are vulnerable to contracting the disease (Agomo, 2013). In this study I sought to assess the relationship between the knowledge of ITN, traditional medicine, education, and family income among pregnant women and the use of ITNs in rural Nigeria. The methodology section of this chapter defines the pregnant women population in Nigeria. In this section I also describe how the sample was drawn and the sampling frame with the inclusion and exclusion criteria. Furthermore, procedures for gaining access to data, permissions, and procedure for recruitment of subjects are all discussed in the methodology section. I describe the threats to internal and external validity to the study as well as the ethical concerns related to data access and confidentiality.

Independent variables of the study include knowledge of ITN, traditional medicine, education, and family income among pregnant women. The dependent variable was the use of ITNs among pregnant women.

I chose a quantitative cross-sectional design for the study. This design allowed me to examine the relationship between the knowledge of ITN, traditional medicine, education, and family income among pregnant women and the use of ITNs in rural Nigeria. I measured the variables through a survey research and analyzed the data using statistical procedures. I selected a random sample of participants to answer questions about their backgrounds, past experiences, and attitudes in order to describe any pattern

of relationship between variables. The cross-sectional research design was appropriate for the study because it allowed me to assess the relationships between variables and to draw inferences about the study population. Resource constraint consistent with using secondary data for this study may have included out of date or old data, inaccurate data, small sample, and secondary data from a publishing company not reputable. However, constraints were not an issue with the study because I obtained secondary data from the national malaria database NMIS organized by the National Malaria Elimination Program (NMEP), the National Population Commission (NPopC), and the National Bureau of Statistics (NBS). The use of quantitative data helped to provide numeric description of data that was used to advance the knowledge on if the awareness of ITN, traditional medicine, education, and family income among pregnant women served as barriers to the use of ITNs in rural Nigeria.

Methodology

Target Population

Nigeria is a country of rich ethnic diversity composed of over 250 population groups. However, the three main ethnic groups are the Hausas, Yorubas, and Ibos (Maps of World, 2013). English is the official language, and it is used extensively for official purposes and in education and business transactions; however, in rural communities where the majority of the population resides, English is not spoken at all (Maps of World, 2013).

Nigeria is the world's largest producer of some crops, and its agricultural base offers great potential for growth. However, despite its agricultural resources and oil

wealth, poverty has increased considerably across the country since the late 1990s. Seventy percent of the Nigerian population lives with less than \$1.25 per day (Food security portal, 2017). In rural areas poverty is more severe and the people who live below poverty level account for 80% of the population (Gender Hub, 2016). Due to poverty, the health of the population in rural areas has been affected, especially in regard to infectious diseases such as HIV/AIDS, tuberculosis, and malaria (International Fund for Agricultural Development (IFAD), 2014). Access to resources such as schools and health centers by people of the rural population is extremely limited due to lack of investments in health, education, and water supply (IFAD, 2014). Poverty contributes to the high prevalence of malaria in rural areas of the country, particularly among pregnant women and children less than 5 years old.

The 2015 NMIS was implemented by NMEP, NPopC, NBS, and the Malaria Partnership in Nigeria. Twenty-eight percent of the population surveyed lived in urban areas and 78 percent lived in rural areas (Nigeria Population Commission, National Malaria Control Program, & Inner City Fund, 2016). One in four women (25%) surveyed lived in the North West zone (Nigeria Population Commission, National Malaria Control Program, & Inner City Fund, 2016). The majority of these women (58%) lived in areas where there were no ITNs (Nigeria Population Commission, National Malaria Control Program, & Inner City Fund, 2016). Eligible women 15-49 years old in the selected households were asked about malaria prevention during pregnancy (Nigeria Population Commission, National Malaria Control Program, & Inner City Fund, 2016). A low percentage of the rural population (34%) had access to electricity, and most women were

less likely to attend school than women living in urban centers (Nigeria Population Commission, National Malaria Control Program, & Inner City Fund, 2016). These disparities reflect the low socioeconomic status of the surveyed rural population. The North West zone has the highest percentage of uneducated and poorer women (Nigeria Population Commission, National Malaria Control Program, & Inner City Fund, 2016). With pregnant women being the target population, this study utilized secondary data from a survey conducted on respondents from the rural region (Nigeria Population Commission, National Malaria Control Program, & Inner City Fund, 2016).

Sampling and Sampling Procedures

I secured and analyzed data from a survey of pregnant women who represent the target population in rural Nigeria. The 2015 NMIS was designed to provide key malaria indicators for the whole country, for urban and rural areas separately, and for each of the six zones, namely North Central, North East, North West, South East, South and South West (Nigeria Population Commission, National Malaria Control Program, & Inner City Fund, 2016). The sampling frame used for this survey came from the 2006 population and the Housing Census of the Federal Republic of Nigeria (Nigeria Population Commission, National Malaria Control Program, & Inner City Fund, 2016). Nigeria is divided into 36 states and one Federal Capitol Territory, making it 37 states for the purpose of the sampling frame. Each state is divided into local government areas and each local government area is divided into localities (Nigeria Population Commission, National Malaria Control Program, & Inner City Fund, 2016). Furthermore, each locality is subdivided into convenient areas referred to as census enumeration areas (Nigeria

Population Commission, National Malaria Control Program, & Inner City Fund, 2016). The primary sampling unit, referred to as a cluster for 2015 NMIS, is defined based on the census enumeration areas from the 2006 enumeration area census frame (Nigeria Population Commission, National Malaria Control Program, & Inner City Fund, 2016). I used a stratified, two-stage cluster design to select the 2015 NMIS sample. In the first stage, I selected nine clusters from each state so that each state could be represented (Nigeria Population Commission, National Malaria Control Program, & Inner City Fund, 2016). This resulted in 333 clusters for the country, 138 in the urban areas and 195 in the rural areas (Nigeria Population Commission, National Malaria Control Program, & Inner City Fund, 2016). I selected about 8,000 households in 329 clusters for the survey as the representative sample, with a target of 1,338 women interviewed per zone (Nigeria Population Commission, National Malaria Control Program, & Inner City Fund, 2016). In the second stage, all women age 15-49 from the households were interviewed and respondents were asked questions about malaria prevention during pregnancy

Households were listed and a mapping exercise was carried out for each cluster in June and July 2015 (Nigeria Population Commission, National Malaria Control Program, & Inner City Fund, 2016). As a result, the list of households from this exercise served as the sampling frame for household selection in the second stage (Nigeria Population Commission, National Malaria Control Program, & Inner City Fund, 2016). All households were listed and global positioning system receivers were used to record the coordinates of the 2015 NMIS sample clusters (Nigeria Population Commission, National Malaria Control Program, & Inner City Fund, 2016). The second stage selection process

included 25 households in each cluster. All women aged 15-49 who were permanent residents of the households or visitors present in the household the night before the survey were eligible to be interviewed (Nigeria Population Commission, National Malaria Control Program, & Inner City Fund, 2016). The sample size was selected to guarantee that key survey indicators could be produced for each of the country's six geographical zones (Nigeria Population Commission, National Malaria Control Program, & Inner City Fund, 2016).

Fixed sample size and power of study. The NMIS identified 8,106 women eligible for the interview and 8,034 women completed it, resulting in a response rate of 99%. Out of the 8,034 women participants, 4,834 women were from the rural region. The inclusion criterion was age and the exclusion criterion was women urban residents, resulting in the sample size of $n = 4,834$. Because this study's focus was on pregnant women in rural Nigeria, I calculated the power using the fixed sample size of 4,834 responders. I used the G*Power analysis tool (Version 3.1.9.2) to calculate the power of study. A compromise power analysis was conducted to compute implied alpha and power (given beta/alpha ration, sample size, and effect size) using the software package, G*power (Version 3.1.9.2; Faul & Erdfelder, 2009). I used the sample size of 4,834 along with an odds ratio of 2. The odds ratio was determined from previous research (Ankomah et al., 2012; Auta, 2012; Belay & Deressa, 2008) using the effect size recommendation as follows: OR = 1.68, 3.47, and 6.71 being equivalent to Cohen's $d = 0.2$ (small), 0.5 (medium), and 0.8 (large) effect sizes (Chen, Cohen, & Chen, 2010). The beta/alpha ratio was set to 1. This was determined using the G*Power 3.1 manual (March 1, 2017) which

indicates “assuming that both α and β error are equally costly then a value of “1” should be used (p. __).” Lastly, the X disruption was set to binomial.

The compromise analyses revealed the statistical power for the given parameters would be .99 for detecting a small effect (see Table 1.). Thus, there would be more than adequate power (i.e., power = .80) for a small effect size given the statistical test of logistic regression.

Table 1

*Output Parameters of the Compromise Power Analysis Conducted in G*Power*

Output parameters	Value
Critical z	5.31
Alpha error probability	1.07e-07
Beta error probability	1.07e-07
Power (1-beta error probability)	0.99

Use of Archival Data

The 2015 NMIS was used for the malaria study. Personal interview methods were used to collect data from eligible respondents from households using a prescribed format questionnaire. According to Nigeria Population Commission, National Malaria Control Program, & Inner City Fund, (2016), all questionnaires were properly edited by a designated team. Gaining access to the database included a registration process. Registration to obtain access to data was completed online by completing a form that included the title of the study, institution of the applicant, and an abstract of the study.

Once registration was accepted, authorization to download the data set was sent (Appendix C). The recode manual includes rationale for coding, coding standards, model questionnaires and description of the variables (Appendix C).

Instrumentation and Operationalization of Constructs

The 2015 NMIS was implemented by the National Malaria Elimination Programme (NMEP), the National Population Commission (NPopC), the National Bureau of Statistics (NBS), and the Malaria Partnership in Nigeria from October to November 2015 (Nigeria Population Commission, National Malaria Control Program, & Inner City Fund, 2016). ICF International provided technical assistance through the Demographic and Health Surveys (DHS) program, a project funded by the United States Agency for International Development (USAID). Support and technical assistance were provided by USAID in the implementation of population and health surveys in countries globally (Nigeria Population Commission, National Malaria Control Program, & Inner City Fund, 2016). The survey instrument used for the pregnant women population was also used for men, women, and children under 5 populations.

Three questionnaires were used in the survey. The household, woman's (individual), biomarker questionnaires (Nigeria Population Commission, National Malaria Control Program, & Inner City Fund, 2016). The questionnaires were based on the standard NMIS Questionnaires developed by the Roll Back Malaria and DHS programs, and they were adapted to reflect the population and health issues relevant to Nigeria (Nigeria Population Commission, National Malaria Control Program, & Inner City Fund, 2016). They were translated to Nigeria's three main languages: Yoruba,

Hausa, and Ibo (Nigeria Population Commission, National Malaria Control Program, & Inner City Fund, 2016). The household questionnaire was used to identify eligible women for individual interview and children 6-59 months who were eligible for anemia and malaria testing (Nigeria Population Commission, National Malaria Control Program, & Inner City Fund, 2016). It was also used to list all members and visitors of selected households (Nigeria Population Commission, National Malaria Control Program, & Inner City Fund, 2016). Information that were collected included age, sex, and education (Nigeria Population Commission, National Malaria Control Program, & Inner City Fund, 2016). Data on age and sex were used to identify the women eligible for the woman's survey (Nigeria Population Commission, National Malaria Control Program, & Inner City Fund, 2016). Other data collected included ownership and use of mosquito nets (Nigeria Population Commission, National Malaria Control Program, & Inner City Fund, 2016). The woman's questionnaire collected data from women aged 15-49 who were pregnant at the time of the survey or have been pregnant before. These women were asked questions on (i) characteristics such as education, media exposure; (ii) birth history and childhood mortality; antenatal care and malaria prevention for most recent birth and pregnancy; malaria prevention and treatment; (iv) and knowledge about malaria (Nigeria Population Commission, National Malaria Control Program, & Inner City Fund, 2016).

The 2015 NMIS data were collected through questionnaires programmed on tablet (Nigeria Population Commission, National Malaria Control Program, & Inner City Fund, 2016). Household and Women's questionnaires were uploaded onto the tablet in English and the three main local languages (Nigeria Population Commission, National Malaria

Control Program, & Inner City Fund, 2016). The tablets were used to facilitate the transfer of files such as data and completed questionnaires electronically from the survey team members to the supervisors (Nigeria Population Commission, National Malaria Control Program, & Inner City Fund, 2016). The supervisors then transferred data for data processing. Potential issues that may affect the validity of the questionnaire include mistakes made during data collection and data processing, such as failure to interview the correct household, data entry errors, and interviewer or respondent misunderstanding the questions. However, numerous efforts were made to minimize such issues. Data management officers monitored and supervised submission of completed interview data daily. They also provided technical assistance to ensure functioning of the tablets and liaised with the teams to manage data transfers (Nigeria Population Commission, National Malaria Control Program, & Inner City Fund, 2016). They made visits to the field to assist teams with resolving serious situations such as fixing or replacing tablets. Data received from the tablets were edited, weighted, cleaned, and tabulated using the Census Survey Processing (CSPRO) software program (Nigeria Population Commission, National Malaria Control Program, & Inner City Fund, 2016). The data were also registered and checked for any inconsistencies and outliers (Nigeria Population Commission, National Malaria Control Program, & Inner City Fund, 2016).

Seven variables from the dataset are relevant to this study. The variable code, variable name, measurement scale, value, and definition of the variables are displayed in Table 2.

Table 2

Definition of Variable, Coding, and Measurement Scale

Original Variable name	Variable name Description	Measurement Scale	Variable Code Value	Variable code Definition
EDUC_WMN	Woman education level	Ordinal	0	No education
			1	Primary
			2	Secondary
			3	Higher
WEALTH_INDEX	Family income	Ordinal	1	Low
			2	Middle
			3	High
AGE_WMN	Woman's age in years	Continuous	15-49	Years
HERB_MEDS	Use of Traditional Medicine	Nominal/ Dichotomous	0	No
			1	Yes
ITN_KNOW	Knowledge of ITN	Nominal/ Dichotomous	0	No
			1	Yes
ITN_USE	Use of ITN	Nominal/ Dichotomous	0	No
			1	Yes
RESIDENCE	Type of place Residence	Nominal	1	Rural
			2	Urban

Data Analysis Plan

The secondary data obtained for this study was cleaned and analyzed using the Statistical Program of Social Sciences (SPSS) version 23. For the analysis including four categorical IVs with a bivariate DV, a factorial logistic regression was conducted. This analysis can be used when there are two or more categorical independent variables and a dichotomous dependent variable (Field, 2009).

This study was not the primary study for the 2015 NMIS data collection; therefore, the dataset required data cleaning that included data coding and identification. The variables were analyzed to answer the RQs. The seven variable names from the dataset were renamed. The recoded names and variable labels are shown in Table 2. Variable V102 is defined as the place of usual residence of the respondent. It differentiates between urban and rural. The education level variable is V106. It is a standardized variable where the level of education is provided in the following categories: no education, primary, secondary, and higher (higher than secondary school). Herbal medicine given to a respondent as home remedy for malaria is denoted by variable name H15D\$1. The wealth index was used in place of the family income variable. It is denoted by the variable name HV270 and it is used as an indicator of economic status of households. It was calculated using data on household's ownership of consumer goods, dwelling characteristics, source of drinking water, sanitation facilities, and other assets such as bicycles and televisions (Nigeria Population Commission, National Malaria Control Program, & Inner City Fund, 2016). Each of the assets is assigned a weight or factor score which was generated through principal component analysis, and the results

of the asset scores were standardized in relation to a standard normal distribution (Nigeria Population Commission, National Malaria Control Program, & Inner City Fund, 2016). Each asset was assigned a score and summed up for each household. Scores for individuals were based on the total score of the household in which they reside (Nigeria Population Commission, National Malaria Control Program, & Inner City Fund, 2016). Interviewed households were separated into low, middle, and high. An asset index was developed on the basis of data from the whole country sample and was used for all the wealth index tabulations for the dataset. For variable S507B, it was defined as pregnant women having the knowledge that sleeping inside an ITN/LLIN can prevent malaria, and variable S508B was defined as the pregnant women sleeping inside an ITN/LLIN to prevent malaria.

Research Questions and Hypotheses

RQ1. Is there a relationship between knowledge of ITN among pregnant women and the use of ITNs in rural Nigeria?

H₀1. There is no relationship between knowledge of ITN among pregnant women and the use of ITNs in rural Nigeria.

H_a1. There is a relationship between knowledge of ITN among pregnant women and the use of ITNs in rural Nigeria.

RQ2. Is there a relationship between use of traditional medicine among pregnant women and the use of ITNs in rural Nigeria?

H₀2. There is no relationship between use of traditional medicine among pregnant women and the use of ITNs in rural Nigeria.

H_{a2} . There is a relationship between use of traditional medicine among pregnant women and the use of ITNs in rural Nigeria.

RQ3. Is there a relationship between education of pregnant women and the use of ITNs in rural Nigeria?

H_{03} . There is no relationship between education of pregnant women and the use of ITNs in rural Nigeria.

H_{a3} . There is a relationship between education of pregnant women and the use of ITNs in rural Nigeria.

RQ4. Is there a relationship between family income of pregnant women and the use of ITNs in rural Nigeria?

H_{04} . There is no relationship between family income of pregnant women and the use of ITNs in rural Nigeria.

H_{a4} . There is a relationship between family income of pregnant women and the use of ITNs in rural Nigeria.

Table 3

Recoded Variables From the NMIS/DHS Database

Original variable name	Rename	Variable description
V102	RESIDENCE	Type of place or residence
V106	EDUC_WMN	Highest educational level
V138	AGE_WMN	Eligible women in the household
H15D\$1	HERB_MEDS	Given home remedy: herbal medicine
HV270	WEALTH_INDEX	Wealth index
S507B	ITN_KNOW	Knowledge of ITN
S508B	ITN_USE	Use of ITN

Potential Threats to Validity

Potential threat to validity when using secondary data is measurement errors due to poor training of field workers. A pretest training for 20 field workers took place from August 16 to August 22, 2010. Participants were trained on how to administer the questionnaires and collect biomarkers. Questionnaires were modified based on findings from the pretest (Nigeria Population Commission, National Malaria Control Program, & Inner City Fund, 2016). For the fieldwork, 86 were trained from September 16 to September 30, 2010 on interviewing techniques and field procedures (Nigeria Population Commission, National Malaria Control Program, & Inner City Fund, 2016). Nigeria Demographic Health Survey (NDHS) and Nigeria Population Commission developed a

research team that maximized data quality (Nigeria Population Commission, National Malaria Control Program, & Inner City Fund, 2016). The team included interviewers, nurses, laboratory scientists, supervisor/editor (team leader), and one driver (Nigeria Population Commission, National Malaria Control Program, & Inner City Fund, 2016). The supervisors were responsible for the quality of the work. They ensured proper interviewing techniques and testing protocols were carried out (Nigeria Population Commission, National Malaria Control Program, & Inner City Fund, 2016). Coordinators monitored field work activities to ensure high standards of data collection and after data were entered, they reviewed data frequencies and tables to identify data inconsistencies and errors (Nigeria Population Commission, National Malaria Control Program, & Inner City Fund, 2016). Data with errors were flagged and reviewed for follow up and resolution (Nigeria Population Commission, National Malaria Control Program, & Inner City Fund, 2016). Quality Control trailed the teams to re-administer the surveys, if needed after the field work (Nigeria Population Commission, National Malaria Control Program, & Inner City Fund, 2016). This was an attempt to increase the reliability of the instrument and validity of the measurement.

Another potential threat to validity could include data entry errors, unclear data, and field workers not following proper interview procedures. These potential threats were minimized on the NMIS by recruiting experienced personnel to conduct data entry activities. Additionally, supervisors monitored the data entry and editing assignment, tracked progress, and ensured quality and timeliness of the data entry process.

Supervisors also monitored proper labeling, and data entry verification (Nigeria Population Commission, National Malaria Control Program, & Inner City Fund, 2016).

Ethical Procedures

Ethical issues that could arise include not obtaining informed consents from the participants, not informing the participants about the risks and benefits involved with the study, and data confidentiality. Ensuring that the participants were well informed of the risks and benefits involved in the study and obtaining informed consents from them addressed these potential ethical issues. While the 2015 NMIS data is accessible to the public, registration to the Demographic and Health Survey (DHS) website is required. Study information and personal information were provided in order to obtain authorization to utilize dataset.

Summary

Pregnant women in Nigeria are the target population and not all the target population can be studied. Therefore, a sample of the study population was studied to answer the RQs. The sample was described in terms of the demographic characteristics that was obtained from the 2015 NMIS/DHS Program database. In this chapter, the methodology for the study was discussed. Different sections to the study methodology that include target population, sampling procedure, instrumentation and operationalization of constructs, ethical procedure, threats to validity were also discussed. The target population included women aged 15-49 who resided at selected households. These households served as the sampling frame and a fixed sample size was obtained. Based on the effect size, alpha, and fixed sample size, the power of the study was

determined as a 99% probability of detecting a significant difference given that the null hypothesis were false. In addition, the chapter discussed and noted how the questionnaires used for the survey were properly edited. Variables from the dataset that were needed for the study were recoded and defined. Potential threats to the validity of the data were discussed and ethical issues that may have occurred during data collection were reviewed.

Chapter 4: Results

Introduction

The purpose of this study was to assess the relationship between the knowledge of ITN, use of traditional medicine, education, and family income and the use of ITNs among pregnant women in rural Nigeria. There are four RQs associated with this study. The RQs and hypotheses were as follows:

RQ1. Is there a relationship between knowledge of ITN among pregnant women and the use of ITNs in rural Nigeria?

H_01 . There is no relationship between knowledge of ITN among pregnant women and the use of ITNs in rural Nigeria.

H_{a1} . There is a relationship between knowledge of ITN among pregnant women and the use of ITNs in rural Nigeria.

RQ2. Is there a relationship between use of traditional medicine among pregnant women and the use of ITNs in rural Nigeria?

H_02 . There is no relationship between use of traditional medicine among pregnant women and the use of ITNs in rural Nigeria.

H_{a2} . There is a relationship between use of traditional medicine among pregnant women and the use of ITNs in rural Nigeria.

RQ3. Is there a relationship between education of pregnant women and the use of ITNs in rural Nigeria?

Null H_03 . There is no relationship between education of pregnant women and the use of ITNs in rural Nigeria.

H_{a3} . There is no relationship between education of pregnant women and the use of ITNs in rural Nigeria.

RQ4. Is there a relationship between family income of pregnant women and the use of ITNs in rural Nigeria?

H_{04} . There is no relationship between family income of pregnant women and the use of ITNs in rural Nigeria.

H_{a4} . There is no relationship between family income of pregnant women and the use of ITNs in rural Nigeria.

In this chapter I describe how the sample represents the population of interest. I discuss the results of the statistical analysis. The results are illustrated and used to answer the RQs.

Results

This chapter starts with the results of the descriptive analysis focusing on the sociodemographic characteristics of the study participants. The chapter includes a report of the findings for all four RQs and hypotheses. The chapter includes tables and values to illustrate the results.

Table 4 shows the sociodemographic characteristics of the women participants in this study. Their age characteristics differ with 20.9% between the age of 25 to 29 years and 5.5% between age 45 to 49 years old, with a mean age of 27.82 years old and standard deviation of 8.621 years.

Table 4

Sociodemographic Characteristics of Women Participants in Rural Nigeria

	Frequency	Percent
<i>Age group</i>		
Mean 27.82 Mode 25 Std. d. 8.621		
15-19	845	17.5
20-24	960	19.9
25-29	1009	20.9
30-34	773	16.0
35-39	567	11.7
40-44	414	8.6
45-49	266	5.5
<i>Total</i>	4834	100.0
<i>Women Educational Level</i>		
<i>No education</i>	2406	49.8
<i>Primary</i>	835	17.3
<i>Secondary</i>	1355	28.0
<i>Higher</i>	238	4.9
<i>Total</i>	4834	100.0
<i>Family Income</i>		
<i>Low</i>	2501	51.7
<i>Middle</i>	1176	24.3
<i>High</i>	1157	23.9
<i>Total</i>	4834	100.0

As regards their education and income, 49.8% of the women had no education and 51.7% of the women in the survey are poor.

From Table 5, it can be seen that most of the women surveyed have no knowledge of ITNs (75.4%) while 78% do not use ITNs. Most of the respondents did not respond to the traditional medicine question (72.9%) and the variable cannot be used to answer RQ2. However, of the 1307 who responded, 1.7% (22/1307) stated that they used traditional medicine and 98.3% (1285/1307) did not.

Table 5

Knowledge of ITN, Use of Traditional Medicine, and Use of ITN of Women Participants

	Frequency	Percent
Knowledge of ITN		
<i>No</i>	3646	75.4
<i>Yes</i>	1188	24.6
<i>Total</i>	4834	100.0
Use of Traditional Medicine		
<i>No</i>	1285	26.6
<i>Yes</i>	22	0.5
<i>No response</i>	3527	72.9
<i>Total</i>	4834	100.0
Use of ITN		
<i>No</i>	3769	78.0
<i>Yes</i>	1065	22.0
<i>Total</i>	4834	100.0

Table 6

Cross Tabulation of Use of ITN and Knowledge of ITN

		<u>Use of ITN [Number (%)]</u>		
		Yes	No	Total
Knowledge	Yes	931 (78.4%)	257 (21.6%)	1188 (100%)
of				
ITN	No	133 (3.6%)	3513 (96.4%)	3646 (100%)
Total		1064 (22.0%)	3770 (78.0%)	4834 (100%)

The table shows that 78.4% of the women who had knowledge of ITN utilized ITN while only 3.6% of the women who did not have ITN knowledge utilized ITN.

In Table 7, high Chi square value of 2917.075 and p value of 0.00 (p -value < 0.05) shows that the knowledge of ITN among pregnant women is significantly associated with the use of ITN. Therefore, the null hypothesis was rejected while the alternative hypothesis is accepted that there is a relationship between knowledge of ITN among pregnant women and use of ITNs among women in rural Nigeria.

Table 7

Chi Square Table of Use of ITN and Knowledge of ITN

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	2917.075	1	.000
N of Valid Cases	4834		

Table 8

Cross Tabulation Table of Use of ITN and Use of Traditional Medicine

		<u>Use of ITN [Number (%)]</u>		
		Yes	No	Total
Use of	Yes	4 (18.2%)	18 (81.8%)	22 (100%)
Traditional				
Medicine	No	266 (3.6%)	1019 (96.4%)	1285 (100%)
Total		270 (20.7%)	1037 (79.3%)	4834 (100%)

Out of 4,834 participants only 1,307 (27%) responded to the traditional medicine question. Out of the respondents to the traditional medicine question, only 4 (18.2%) used traditional medicine and also used ITN. The number of respondents to this question was not enough to represent the rural population of Nigeria; therefore, RQ2 cannot be answered using this variable.

Table 9

Fisher's Exact Test table of Use of ITN and Use of traditional medicine

	Value	Df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Fisher's Exact Test				1.000	.511
<i>N</i> of valid cases	1307				

In the table above, the Fisher's exact test is used to test the association between the use of traditional medicine among pregnant women and use of ITN because the cell size is less than 5. The p-value shows that the use of traditional medicine among pregnant women has no significant effect on the use of ITN. This may be due to the low response of the respondents to the "use of traditional medicine" question. Therefore, for this variable the null hypothesis cannot be rejected and we conclude that there is no relationship between the use of traditional medicine and use of ITN among pregnant women in rural Nigeria.

Table 10

Cross Tabulation Table of Use of ITN and Women Educational Level

		<u>Use of ITN [Number (%)]</u>		
		Yes	No	Total
Women	No education	340 (14.1%)	2067 (85.9%)	2406 (100%)
educational	Primary	192 (23.0%)	643 (77.0%)	835 (100%)
level	Secondary	428 (31.6%)	926 (68.4%)	1354 (100%)
	Higher	105 (44.1%)	133 (55.9%)	238 (100%)
Total		1065 (78.0%)	3769 (22.0%)	4834 (100%)

The table above shows that about half of the women surveyed had no education. Women with no education (14.1%) used ITN while 85.9% did not use ITN. Out of 4834 surveyed women, only 238 of them had higher education (higher than secondary school). About 44% of them used ITN while 55.9% did not use ITN. This answered RQ3 where the level of education of pregnant women is related to the use of ITNs in rural Nigeria.

Table 11

Chi Square Table of Use of ITN and Women Educational Level

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	228.816	3	.000
N of Valid Cases	4833		

In the table above, high Chi square value of 228.816 and p value of 0.00 (p-value < 0.05) shows that the level of education of pregnant women is associated with the use of ITN. Therefore, the Null Hypothesis was rejected in favor of the alternative hypothesis that there is a statistically significant relationship between level of education of pregnant women and use of ITNs among women in rural Nigeria.

Table 12

Cross tabulation table of Use of ITN and Family Income

		<u>Use of ITN [Number (%)]</u>		
		Yes	No	Total
Family	Low	405 (16.2%)	2096 (83.8%)	2501 (100%)
Income	<i>Middle</i>	285 (24.2%)	891 (75.8%)	1176 (100%)
	<i>High</i>	375 (32.4%)	82 (67.6%)	1157 (100%)
Total		1065 (78.0%)	3769 (22.0%)	4834 (100%)

The table above shows that 83.8% of pregnant women with low family income did not use ITN and 16.2% used ITN. While 67.6% of pregnant women in rural Nigeria who have high family income did not use ITN, 32.4% used ITN. Thus, the use of ITN by pregnant women increased with the increase in family income. Increase in household wealth index or family income is denoted by household's ownership of consumer goods, dwelling characteristics, source of drinking water, sanitation facilities, and other assets such as bicycles and televisions.

Table 13

Chi-square table of Use of ITN and Family income

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	124.703	2	.000
N of Valid Cases	4834		

In the table above, high Chi square value of 124.703 and p value of 0.00 (p-value < 0.05) shows that family income of pregnant women is associated with the use of ITN. Therefore, the Null Hypothesis was rejected in favor of the alternative hypothesis that there is a statistically significant relationship between family income of pregnant women and use of ITNs among women in rural Nigeria.

Logistic Regression

Table 14

Omnibus Tests of Model Coefficient (Chi-Square)

	Chi-square	Df	Sig.
<i>Step</i>	2737.233	6	.000
<i>Block</i>	2737.233	6	.000
<i>Model</i>	2737.233	6	.000

The model coefficient is statistically significant (P-value < 0.005) for the education level, ITN knowledge and family income on the use of ITN among pregnant women. The Null hypothesis was rejected for the three independent variables in favor of the alternate hypothesis that there is a statistically significant relationship between the

level of education, ITN knowledge, family income of pregnant women and use of ITN among pregnant women in rural Nigeria.

Table 15

Model Summary

-2 Log likelihood	Cox & Snell R square	Nagelkerke R square
2357.732 ^a	.432	.664

Table 15 shows 43.2 % Cox & Snell R² and 66.4 % Nagelkerke R² of the variance in the use of ITN among pregnant women and correctly classified 92% of the cases (Table 16).

Table 16

Classification table

Observed	Predicted			Percentage Correct
	Use of ITN			
	<i>No</i>	<i>Yes</i>		
Use of ITN	<i>No</i>	3513	257	93.2
	<i>Yes</i>	133	931	87.5
Overall Percentage				92.0

Note. Cut value is 0.500.

Classification table above includes the tabulated results for the use of ITN among pregnant women. From the total sample size of 4834, most of the women did not use ITN.

Table 17

Reasons for non-utilization of ITN by women participants

	B	S.E.	Wald	D	Sig.	Exp(B)	95% C.I. for EXP(B)	
				f			Lower	Upper
<i>EDUC_WMN</i>			15.443	3	.001			
<i>EDUC_WMN(1)</i>	.311	.164	3.588	1	.058	1.364	.989	1.881
<i>EDUC_WMN(2)</i>	.428	.156	7.515	1	.006	1.534	1.130	2.084
<i>EDUC_WMN(3)</i>	.996	.268	13.795	1	.000	2.708	1.601	4.582
<i>ITN_KNOW(1)</i>	4.489	.114	1543.753	1	.000	89.017	71.159	111.358
<i>WEALTH_INDEX</i>			.355	2	.838			
<i>WEALTH_INDEX</i> (1)	.042	.147	.083	1	.773	1.043	.783	1.390
<i>WEALTH_INDEX</i> (2)	-.053	.168	.099	1	.753	.948	.683	1.318
<i>Constant</i>	-3.492	.112	971.890	1	.000	.030		

The table above provides the extent of variation of the independent variables due to the dependent variable.

Bivariate analysis of the variables was analyzed through cross tabulations and chi square. Results of the bivariate analysis are shown in Tables 6-13.

Summary

A logistic regression was performed to ascertain the effect of education level, ITN knowledge and family income of pregnant women in rural Nigeria on the use of ITN. The logistic regression model is statistically significant (Table 14) (P-value < 0.005). The model explained 66.4% (Nagelkerke R²) (Table 15) of the variance in ITN use and correctly classified 92% (Table 16) of cases. For their likelihood of using ITN as regards the education of pregnant women in rural Nigeria, those with primary education are 1.36 times more likely to use ITN than those with no education (Table 17). Those with secondary education are 1.53 times more likely to use ITN than those with no education and those with tertiary education have 2.71 times more likelihood to use ITN than those with no education. In the knowledge of ITN, the pregnant women in rural Nigeria with the knowledge of ITN have 89.02 times more likelihood to use ITN than those with no knowledge of ITN. In terms of the family income, those with middle income have 4.3% more likelihood to use ITN than those with low family income while those with high family income have 5.2% lesser likelihood to use ITN than those with low family income among pregnant women in rural Nigeria.

For traditional medicine, the analysis above shows that of the 4834 women surveyed 3527 (79.8%) did not respond to the use traditional medicine question and only 1307 of the women responded. Out of those who responded, 22 respondents used traditional medicine (4 used ITN, 18 did not use ITN); therefore, the variable cannot be used on this study to assess its impact on the use of ITNs among pregnant women.

Chapter 5: Discussion, Conclusions, and Recommendations

Introduction

Malaria continues to be a public health concern in sub-Saharan Africa (Adebayo et al., 2015). Despite all control efforts, morbidity and mortality due to malaria are still high particularly among vulnerable groups such as pregnant women in developing countries (Adebayo et al., 2015). In Nigeria, about 70% of pregnant women suffer from malaria, which contributes to several pregnancy-related complications (Adebayo et al., 2015). According to Ankomah et al., (2012), the use of ITNs consistently has been shown to reduce adverse effects of malaria during pregnancy. Nigeria promotes ITN use in pregnancy; however, the levels of ITN use remains low at rates below 10% (Ankomah, et al., 2012). This quantitative study assessed the relationship between the knowledge of ITN, use of traditional medicine, education, and family income and the use of ITNs among pregnant women in rural Nigeria. The problem was that previous research indicated that despite availability of ITNs, their use was low. The factors associated with the low use are not fully understood. Pregnant women have access to ITNs but do not use them. I obtained secondary data and used a cross-sectional design to investigate the associations between the knowledge of ITN, use of traditional medicine, education, and family income among pregnant women and the use of ITNs. Results of the study showed that knowledge of ITN, level of education, and family income of pregnant women have an effect on the use of ITNs. However, the use of traditional medicine has no effect on the use of ITNs among pregnant women in rural Nigeria.

Interpretation of the Findings

The uses of ITNs for malaria prevention among pregnant women have been shown to be the most effective preventive measure against malaria (UNICEF, 2015). Overview of past studies showed inconsistencies between knowledge of ITN, use of traditional medicine, family income, education, and the use of ITNs.

According to the results of this study, there is a relationship between knowledge of ITN among pregnant women and the use of ITNs in rural Nigeria. The findings of my study confirm similar studies such as Tongo et al. (2011) and Ezire et al. (2015) where the knowledge of ITN use among pregnant women was related the use of ITNs. Lack of knowledge of ITN contributed to low use of ITN while knowledge of ITN facilitates the use of ITN by pregnant women.

In this study, there was no relationship between the use of traditional medicine among pregnant women and the use of ITNs in rural Nigeria. The majority of the women surveyed did not respond to the traditional medicine question and therefore the variable cannot be utilized in this study to answer RQ2. A study by Tongo et al. (2011) showed that traditional medicines against malaria were employed in Nigeria. In that study, 20.1% of the participants used ITNs and 21.7% used traditional medicine for malaria prevention. Similarly, in Fakeye et al. (2009) the use of herbal medicine among pregnant women was studied. Among the pregnant women participants, 67.5% used traditional medicine, which emphasized the widespread use of such medicines by pregnant women in Nigeria (Fakeye et al., 2009). However, in a study by Adetoun et al. (2010) and another by Enato et al. (2007), the use of traditional medicines was low.

In my study, there was a relationship between education of pregnant women and the use of ITNs in rural Nigeria. This finding was confirmed by other studies, such as Ezire et al. (2015) and Adebayo et al. (2015). A study by Ezire et al. (2015) measured what facilitated or inhibited the use of ITNs among pregnant women in Nigeria. The study showed that the higher the level of education, the higher the level of use of ITNs. Adebayo et al. (2015) also assessed knowledge of malaria prevention with emphasis on ITN use among female caregivers of children under 5 and pregnant women in rural Nigeria. It showed that low level of education of respondents was associated with their use of ITN.

In my study, there is a relationship between family income of pregnant women and the use of ITNs in rural Nigeria. Findings in my study confirmed what were found in similar studies. Adebayo et al. (2015) showed that low income earners had significantly poor knowledge of the use of ITNs. Similarly, Worrall et al. (2005) showed an association between poverty and the use of ITNs. Pregnant women from poorer households were less likely to use ITNs to prevent malaria infection (Worrall et al., 2005).

In accord with the SEM, in the study I examined factors that may motivate or inhibit the use of ITN by pregnant women. About 75.4% of the women did not have knowledge of ITN and 24.6% of the women had knowledge of ITN. Tongo et al. (2011) examined pregnant women and their uses of malaria preventive measures. The findings of this study are similar to the results obtained by Tongo et al. where low uptake of ITN use by pregnant women was associated with lack of knowledge of ITN. Most of the

women from my study were not educated. Those with no education comprised of 50% of the total sample and 17.3% had only primary education. According to Ezire et al. (2015), about 70% of the women respondents were either not educated or attained at most a primary school education. The level of education is associated with the use of ITN by pregnant women, particularly in the rural regions of Nigeria.

I also examined relationships that may or may not influence the use of ITNs with pregnant women in Nigeria, such as their family or household income. Family income of a pregnant woman was associated with the use of ITNs where 51% of the total sample were poor and did not use ITNs. Pregnant women from households with low income tended to not use ITN to prevent malaria.

The SEM further expanded the community level factors “use of ITNs” and the “use of traditional medicine” among pregnant women to encompass the influence of their social circles. I analyzed the women’s social circles that practice cultural norms of the community with regard to their use of ITNs. According to Fakeye et al. (2009) pregnant women used traditional medicines because of cultural and traditional beliefs. About 22% used ITN, and about 1.7% used traditional medicine. In my study, most of the respondents did not use ITN and because most of the pregnant women did not respond to the use traditional medicine question, the variable could not be used to assess its impact on the pregnant women’s use of ITNs. This contradicts a study that stated that about 67.5% of the pregnant women respondents used traditional herbal medicines to prevent malaria (Fakeye et al., 2009). Other studies have shown that pregnant women use one or more malaria control measures such as ITNs and traditional herbal medicines (Tongo et

al., 2011). In another study, pregnant women combined both traditional medicines and ITN for malaria prevention (Sam-Wobo et al., 2008). About 19% of the respondents combined both the herbal treatment regimens and a malaria preventive measure (Sam-Wobo et al., 2008).

Limitations of the Study

Secondary data was used for this study to analyze the relationships between the dependent and independent variables. These secondary data were collected for other purposes and not to answer the RQs of this study. Therefore, variables of interest for this study were missing or incomplete.

I am not aware of any problems that were encountered during data collection. These problems may have included respondents misunderstanding survey questions (Johnston, 2014). The survey avoided data interpretation error by securing a reputable publishing company that produces accurate and current data such as the DHS program.

Data obtained from the DHS database was not collected to answer specific RQs and hypotheses. One of the variables had to be recategorized to answer the research question. This may have resulted in some errors that may have interfered with the results of the study.

Recommendations

This quantitative study focused on the relationship between the knowledge of ITN, education, family income, traditional medicine, and the uses of ITNs among pregnant women in rural Nigeria. Findings from the study revealed that there are significant associations between the independent variables knowledge of ITN, education

and family income, and dependent variable use of ITNs. However, there is no significant association between the use of traditional medicines and use of ITNs among pregnant women. There may be other factors such as age of pregnant women and use of antenatal clinics that influence the use of ITNs among pregnant women. Further studies are needed to explore those other factors based on the results obtained from my study. I also recommend that educational strategies be implemented in the community or at antenatal clinics to educate pregnant women on the importance of using ITNs to prevent malaria. Educational strategies may include malaria prevention reading materials or media tools that will educate pregnant women during antenatal visits about malaria transmission, access to prevention tools such as ITNs, intermittent preventive drugs for pregnant women, and the importance of using the prevention tools. These reading materials may also be used to counsel pregnant women and take home to reinforce what they've learned. In addition, these materials may also be used as pictorial instructions on how to use the nets and how the nets keep mosquitoes away.

Implications

The positive social change in pregnant women in rural Nigeria that would be promoted by this study includes possible decrease in morbidity and mortality due to malaria within the community. The decrease in malaria cases would improve the overall health of the community. By using ITNs, maternal survival could be increased, birth outcomes could be improved, and adverse effects of malaria during pregnancy could be reduced. The study results could also be used to plan and design education strategies that will alleviate the burden of malaria on the community. It is anticipated that the results of

this study will inform policies that would target behavior change among pregnant women.

Because malaria is a public health problem with Africa carrying the high share of global burden, results of this study may be of interest to other stakeholders such as Roll Back Malaria and U.S. Agency for International Development, whose mission is to build strategies to control malaria.

Summary and Conclusion

The purpose of this quantitative study was to assess the relationship between the knowledge of ITN, use of traditional medicine, education, and family income among pregnant women and the use of ITNs in rural Nigeria. This study analyzed these relationships using 4834 women participants from the rural region of Nigeria. A review of the literature showed evidence of relationships between knowledge of ITN, use of traditional medicine, education, family income among pregnant women and use of ITNs; however, an important gap remained. Examining these relationships further contributes to existing research. It was hypothesized that there is a relationship between knowledge of ITN among pregnant women and the use of ITNs in rural Nigeria; there is a relationship between education among pregnant women and the use of ITNs in rural Nigeria; and there is a relationship between family income among pregnant women and the use of ITNs in rural Nigeria. Multiple regression analysis was conducted, and results revealed statistically significant relationships between knowledge of ITN and use of ITN; education of women and use of ITN; and family income and use of ITN. The relationship between use of traditional medicine and use of ITN could not be assessed due to low

response. Further research is recommended to explore the use of traditional medicine by pregnant women. Understanding the relationship may help to inform strategies to educate women that will in turn improve behavior change in using ITNs for malaria prevention.

Findings from this study highlight the importance of health education programs to improve and facilitate the health of pregnant women relative to malaria transmission. Furthermore, applying social marketing through the use of various communication tools could increase awareness within the community. Information from assessing the community for health literacy and media habits will inform the type of communication channels that can be implemented to capture their attention in order to increase the use of ITNs among pregnant women.

Educational strategies should fill the gap of pregnant women not utilizing malaria preventive measures. Such programs should plan to empower the community with preventive tools to combat the malaria disease that will in turn reduce the burden of malaria within the community particularly among pregnant women.

The malaria problem can be addressed through education and access to healthcare facilities. Educating the community will include information on how malaria is transmitted, and the types of resources available for prevention and treatment. Such resources will cater to the health needs of the community that will in turn reduce mortality and morbidity rates stemming from the prevalence of malaria. Furthermore, identifying and addressing the socioeconomic differences, and determining factors that contribute to barriers to the utilization of preventive measures leading to the prevalence of malaria will improve the health of the community. Policy makers can form

partnerships with community leaders to determine the needs of the community.

Understanding these needs can address underlying social problems on an individual, community, and national levels. Policy makers can make informed decisions and policies in the effort to improve behavioral change and the health of the community.

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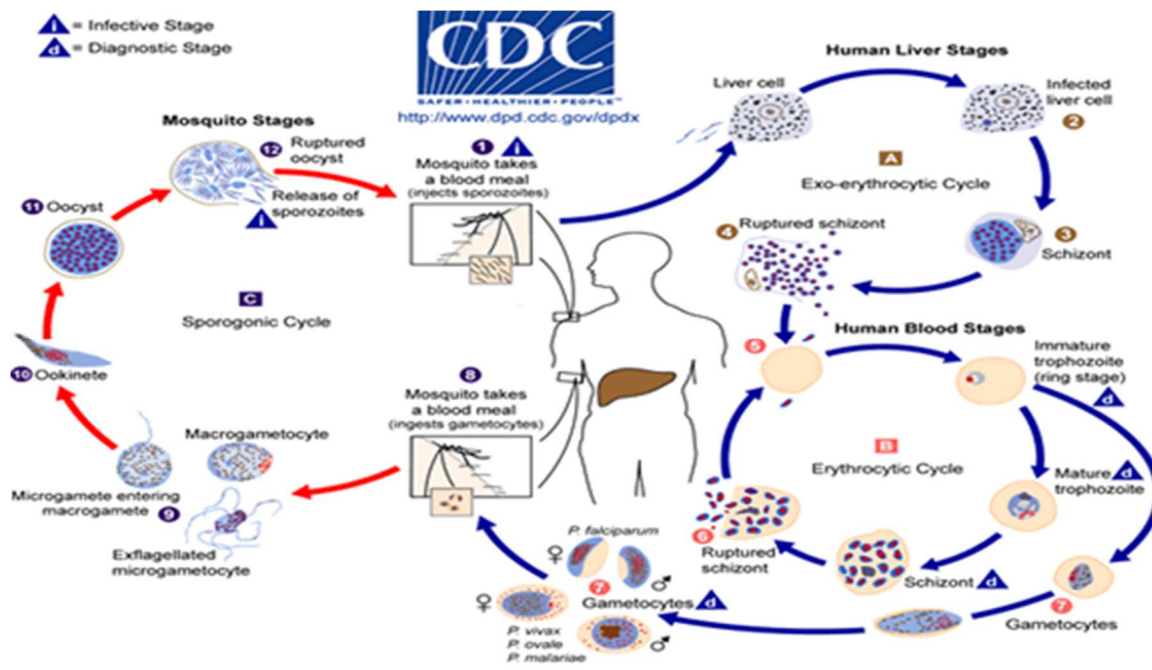
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http://www.unicefusa.org/mission/survival/malaria?gclid=CjwKEAjws7OwBRCn2Ome5tPP8gESJAAfopWscDpmxxsnITR1krZKCCqdS4uUwvakGLciAorhD_upRoCti7w_wcB

Ye, Y., Patton, E., Kilian, A., Dovey, S., & Eckert, E. (2012) Can universal insecticide-treated net campaigns achieve equity in coverage and use? The case of northern

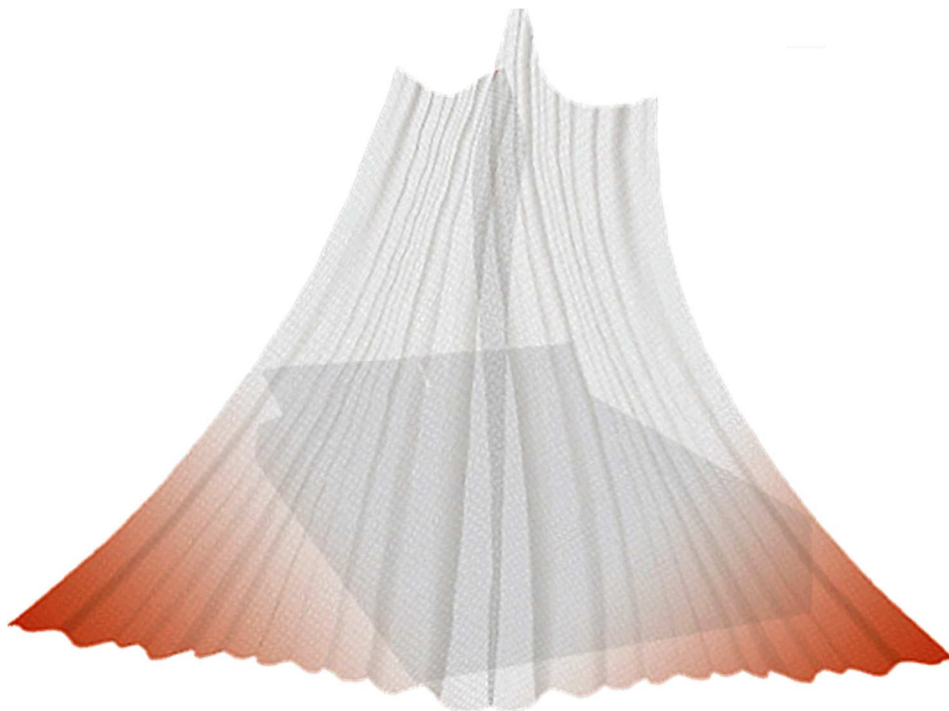
Nigeria. *Malaria Journal*, 11(32), 2-10. <https://doi.org/10.1186/1475-2875-11-32>

Appendix A: Malaria Life Cycle



SOURCE: Courtesy: Center for Disease Control and Prevention
 Available at <http://www.cdc.gov/malaria/about/biology/>

Appendix B: Insecticide Treated Net



SOURCE: UNICEF

http://www.unicefusa.org/mission/survival/malaria?gclid=CjwKEAjws7OwBRCn2Ome5tPP8gESJAAfopWscDpmxxsnITR1krZKCCqdS4uUwvakGLciAorhJD_upRoCti7w_wcB

Appendix C: Database Registration Confirmation

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May 3

You have been authorized to download data from the Demographic and Health Surveys (DHS) Program. This authorization is for unrestricted countries requested on your application, and the data should only be used for the registered research or study. To use the data for another purpose, a new research project should be submitted using the "Create A New Project" link in your user account.

All DHS data should be treated as confidential, and no effort should be made to identify any household or individual respondent interviewed in the survey. The data sets must not be passed on to other researchers without the written consent of DHS. Users are required to submit a copy of any reports/publications resulting from using the DHS data files to: archive@dhsprogram.com.

To begin downloading datasets, please login at: http://www.dhsprogram.com/data/dataset_admin/login_main.cfm . Once you are logged in, you may also edit your contact information, change your email/password, request additional countries or Edit/Modify an existing Research Project.

The files you will download are in zipped format and must be unzipped before analysis. Following are some guidelines:

After unzipping, please print the file with the .DOC extension (found in the Individual/Male Recode Zips). This file contains useful information on country specific variables and differences in the Standard Recode definition. You will also need the DHS Recode Manual: <http://dhsprogram.com/publications/publication-dhsg4-dhs-questionnaires-and-manuals.cfm> . This manual contains a general description of the recode data file, including the rationale for recoding; a description of coding standards and recode variables, and a listing of the standard dictionary, with basic information relating to each variable.

It is essential that you consult the questionnaire for a country, when using the data files. Questionnaires are in the appendices of each survey's final report: <http://dhsprogram.com/publications/publications-by-type.cfm> . We also recommend that you make use of the Data Tools and Manuals at: http://www.dhsprogram.com/accesssurveys/technical_assistance.cfm .

For problems with your user account, please email archive@dhsprogram.com. For data questions, please register to participate in the DHS Program User Forum at: <http://userforum.dhsprogram.com> .

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Password: (use the password you entered when you registered).