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Impact of Socioeconomic Status and Health-Seeking Behavior on Malaria in Pregnancy

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This is to certify that the doctoral dissertation by

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Abstract

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BPharm, University of Nigeria, 1992

MPH, University of Ilorin, 2009

MPA, Enugu State University of Science and Technology, 2012

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

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Abstract

Malaria in pregnancy remains a public health challenge in Nigeria despite the fund appropriation for malaria control. The health challenges of malaria in pregnancy vary with populations and there is limited knowledge on the impact of the socioeconomic status and health-seeking behavior on malaria in pregnancy in Nigeria. The objective of this cross-sectional quantitative survey was to examine whether socioeconomic status and health-seeking behavior predict malaria in pregnancy in Nigeria using the social cognitive theoretical model. The data from a 2015 Nigeria Malaria Indicator Survey was used in this study. Data were analyzed using chi-square, binary, and multivariate logistics regression analyses. The study demonstrated that socioeconomic status (wealth index/income [Poorest: OR 2.709, 95% CI 1.869-3.928, *p* 0.000; Poorer: OR 1.791, 95% CI 1.256-2.555, *p* 0.00] and no education: OR 2.868, 95% CI 1.761-4.671, *p* 0.000) made significant contributions in predicting malaria in pregnancy. The research results also showed that socioeconomic status is a predictor of health-seeking behavior (wealth index/income [Poorest: OR 0.414, 95% CI 0.244-0.705, *p* 0.001], no education: OR 0.329, 95% CI 0.174-0.622, *p* 0.001 and primary education: OR 0.348, 95% CI 0.191-0.636, *p* 0.001). Additionally, the study findings showed that malaria in pregnancy determined the choice of formal health-seeking behavior by pregnant women (malaria in pregnancy: OR 0.551, 95% CI 0.469-0.648, p 0.000). The results of this research might guide Nigeria's Ministry of Health to develop approaches on women empowerment that would focus on socioeconomic status and health-seeking behavior of women such as programs to improve women's education and income generation.

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Dedication

This dissertation is dedicated in remembrance of my father, Godfrey Ogboogu Nwankwo-Ofia Udenweze, whose insistence on my doctoral pursuit made it a reality. He introduced me to public health early in my school days when he enlisted me in the house-to-house enumeration process of Primary Health Care.

I equally remember all the stillbirths, maternal and fetal deaths, whose primary cause of death is malaria during pregnancy, who could not afford the user-fees for a formal medical attention. I also remember those women and children who had survived adverse pregnant outcomes due to malaria in pregnancy.

I dedicate this treatise to the health workers in rural Nigeria, who render selfless medical services, in the most unfavorable conditions, to their communities.

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To my chair, Dr. Daniel Nwabufo Okenu, who guided me to complete this dissertation. I appreciate your support, counsel, and patience throughout this dissertation process. I am happy to have been under your tutelage. To Dr Ernest Ekong, my committee member, who died two weeks before my oral defense, may your soul rest in Christ. To Dr Egondu Onyejekwe, my substantive committee member, thank you for filling the gap. To Dr. Mountasser B. Kadrie, my URR member, whose constructive reviews scaled-up the study's academic value. I am glad for your contributions.

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To my pleasant wife, Ifeoma Ifeanyi-Udenweze, whose support, cheerful encouragement and understanding pushed me to completing this study. And my children: Chizitere, Kamsiyochukwu and Ezechukwuchirim, who endured moments of my absence in this doctoral pursuit. I thank my mother, Juliana Chikaodili Udenweze, and siblings Benedicta, Maureen, Jane-Frances, Obinna, Gloria, Obioma, Ebele, and Chinedu, for their care. We will soon celebrate Maureen's doctorate too.

Lastly, I thank God for His provisions that enabled me to complete this study. Great is thy faithfulness, Oh God!

Table of Contents

List of Tables

List of Figures

Chapter 1: Introduction to the Study

Malaria in pregnancy (MiP) is a serious public health challenge in Nigeria and other Sub Saharan Africa countries where malaria is endemic. Each year, 30 million pregnancies are threatened by malaria in endemic countries throughout Africa (National Population Commission, [NPC], National Malaria Control Programme, [NMCP], & ICF International, 2012). MiP is a major risk factor for pregnant women and their children in Nigeria (Wogu, Nduka, & Wogu, 2013). In Nigeria, almost 50% of the population (approximately 80 million people) experiences at least an incident of malaria with a resultant 300,000 deaths per year (World Health Organization [WHO], 2013). Pregnant women are three times more susceptible to malaria and its effects than nonpregnant women with consequent predisposition to complications in pregnancy such as neonatal and maternal deaths (Chinweuba et al., 2017).

Adequate understanding of the impact of socioeconomic status (SES) and health-seeking behavior on MiP will aid policy makers, government institutions and agencies, governmental organizations, nongovernmental organizations (NGO), civil society organizations (CSO), community-based organizations (CBO), opinion leaders and all stakeholders, to take informed decisions towards malaria elimination among pregnant women in Nigeria. It will redirect the policy makers' over concentration on the proximal causes of malaria to the distal but major causes of malaria. Furthermore, it will empower pregnant women to understand the reason MiP persists despite their efforts to control the vector. This study will bring to fore the need for all stakeholders to consider SES and

health-seeking behavior in malaria control activities for a holistic intervention to control malaria especially during pregnancy.

This chapter will provide a summary of the selected topic, a precis of research related to the study topic, the background and appropriate literature about the theme of the study. Chapter 1 includes the independent variables, dependent variable, covariates, research questions, and hypotheses. It illustrates key definitions as well as the purpose of the study, the study's significance and the theoretical framework. A more robust expression of the literature is in the next chapter.

Background

According to Dickinson, Randell, Kramer, and Shayo, (2012) the government and other agencies that are involved in malaria control programs neglect the distal and fundamental causes of malaria during the planning stages of malaria control interventions. These often-disregarded variables, households' and individuals' SES, and sociocultural behaviors form the primary causes of malaria disease risk and the resultant impact on the health of people in developing countries (Dickinson et al., 2012).

Nigeria recorded a high Maternal Mortality Rate of 814/100,000 live births (WHO, 2015a). MiP accounted for about 6,500 (11%) of these documented maternal deaths (Federal Ministry of Health, 2012b; Kyu, Georgiades, Shannon, & Boyle, 2013; United States Embassy Nigeria, 2011; Wogu et al., 2013). Even this estimate was misleading as the accurate proportion of the burden of MiP remains underestimated (Mbachu et al., 2017). A reliable estimate of MiP remains difficult due to lack of accurate and good quality data (Desai et al., 2007). Most Sub Saharan Africa (SSA) countries,

including Nigeria, use routine national reporting system such as Health Management Information System (HMIS), District Health Information System, (DHIS2), and Integrated Disease Surveillance & Response, (IDSR), datasets to estimate the number of women that are affected by the adverse effects of MiP and the population at risk (Desai et al., 2007). Adopting this approach to estimate the burden of MiP ignores important data such as unidentified and unreported pregnancies which includes pregnancies that never attended antenatal care (ANC) clinics, pregnancy losses and pregnancies that were attended to by unskilled birth attendants especially in rural settings (Desai et al., 2007). There are also uncaptured data of pregnant women who seek care in traditional medicine vendors', herbalists' and religious homes in rural Nigeria among women of low SES.

The global success achieved by reducing the transmission of malaria in endemic countries by 5 million cases in 2015 was transient as more cases were recorded in 2016 (216 million cases) than the previous year (WHO, 2017a). Researchers have linked the identified disparity in seeking formal health care by urban and rural women to SES differences (Nigeria Demographic and Health Survey, [NDHS], 2013). Furthermore, scholars have also associated various sociocultural, socioeconomic, behavioral and environmental factors with the persistent occurrence of malaria in children below five years (Adefemi, Awolaran, & Wuraola, 2015; Donovan, Siadat, & Frimpong, 2012). However, the area of research that is still unclear is the influence of socioeconomic and behavioral variables on MiP in Nigeria. The results of this study may fill the existing gap in examining the impact of SES and health-seeking behavior on the occurrence of MiP in Nigeria.

This research may further clarify the ambiguous outcome of some studies on the association of SES on malaria at micro level (Sonko et al., 2014). It will further establish the influence of MiP on health-seeking behavior during pregnancy.

Problem Statement

In 2015, the Maternal Mortality Rate in Nigeria was estimated at 814/100,000 live births (WHO, 2015a). This is translated to approximately 58,000 maternal deaths annually. About 11% of these maternal deaths were attributed to MiP (Federal Ministry of Health, 2012b; Kyu et al., 2013; United States Embassy Nigeria, 2011; Wogu et al., 2013). Pregnant women are at high risk of malaria infection especially during the first trimester of pregnancy (Rijken et al., 2012). MiP predicates premature birth, low birth weight (LBW), maternal and neonatal anemia, all conditions associated with increased risk of spontaneous abortion, stillbirth, and neonatal and maternal death (Gomez et al., 2014; Katz et al., 2013; Rijken, et al., 2012; Wogu et al., 2013). Muhammad et al. (2016) attributed these adverse birth outcomes to pregnant women's poor access to preventive measures.

Scholars have linked socioeconomic and behavioral elements with the continued scourge of malaria (Sonko et al., 2014). Though some researchers have studied MiP in Nigeria, they focused their studies on its prevalence (Gunn et al., 2015; Obianumba, 2012); the level of coverage and access to long lasting insecticide nets (LLINs) and artemisinin combination therapy (ACTs) amongst pregnant women and children below five years of different SES groups (Mbachu et al., 2012) and malaria prevention practices and delivery outcomes (Muhammad et al., 2016). Other studies focused on the harmful

outcomes of MiP (Wogu et al., 2013) and the number of pregnancies protected from malaria in Nigeria using the coverage of insecticide treated nets and intermittent preventive therapy in pregnancy (ITN/IPTp) (Yusuf et al., 2016). Some other researchers documented knowledge, attitude, perception, and burden of MiP in Nigeria (Dhiman et al., 2012; Ezebialu et al., 2012; Onyeneho et al., 2015; Rijken et al., 2012; Takem et al., 2013; Taylor et al., 2013). An area of investigation that remains to be clarified is how SES and health-seeking behavior predict the occurrence of malaria in pregnancy. This dissertation will fill the gap.

Rubin et al. (2014) characterized SES as person's existing collective and economic condition. Quantitatively, SES was measured in terms of income level (wealth index), educational level and occupation in this study. SES, as a sociostructural factor, is grounded on individual's social, cultural, and economic experiences (Ostrove & Cole, 2003). SES, therefore, influences an individual's behaviors. Scholars established an association between low SES and malaria infection (Ayele, Zewotir, & Mwambi, 2012; Ayele, Zewotir, & Mwambi, 2014; Dickinson et al., 2012; Sonko, et al., 2014). A part of this study will investigate the association of SES with an aspect of malaria, MiP, which has limited publications. Furthermore, studies demonstrated an association between malaria and poverty at macro levels (Castro & Fisher, 2012; Dickinson et al., 2012; Ricci, 2012; Tusting et al., 2013). At macro level, the major elements that established the association between malaria and poverty, the nature of the relationship and the course of this linkage remains weak (Castro & Fisher, 2012) and uncertain (Dickinson et al., 2012). Conversely, at micro levels, studies showed both established association and no

association (Sonko et al., 2014; Tusting et al., 2016). This necessitates further examination of the relationship between SES and malaria at micro level. Another part of this study will further strengthen the discourse to clarify whether there is an association or no association between SES and MiP as espoused by Sonko et al. (2014).

Health-seeking behavior embodies the actions an individual actively performs to ensure healthy living, either to treat ill health or to manage disabilities (Poortaghi et al., 2015). El Kahi, Rizk, Hlais, and Adib (2012) categorized health-seeking behavior as formal and informal. Formal health-seeking behavior entails seeking professional healthcare help in health facilities where skilled health workers attend to clients/patients while informal health-seeking behavior include seeking medical help from unskilled practitioners such as herbalists, patent medicine vendors (PMV), drug shops, native doctors, traditional birth attendants (TBA), family members, relatives, and self-help. Whereas formal health-seeking behavior is a best practice in disease management, pregnant women still engage in informal health-seeking behavior when they take ill (Brooks, Singh, & Hamer, 2008). Seeking health needs in a health facility, with skilled health workers, allows for accurate diagnosis and timely case management (WHO, 2015b). When pregnant women engage in formal health-seeking behavior, it allows health workers to identify danger signs and risky conditions on time and therefore prevents avoidable complications. If health workers are familiar with the health-seeking behavior of their attending communities, they will be prepared to reach all vulnerable populations (Dixit et al., 2016). Uzochukwu and Onwujekwe (2004) argued that the treatments that pregnant women resort to when the symptoms of malaria occur are

determined by sociocultural and behavioral elements. There is a knowledge gap in how MiP predicts health-seeking behavior in Nigeria. Additionally, researchers are yet to verify if SES determines the choice of health-seeking behavior when malaria occurs in pregnancy among Nigerian women. This dissertation will fill the gaps.

Purpose of the Study

This study explored how SES and health-seeking behavior contribute to the incidence of malaria during pregnancy in Nigeria. A cross-sectional survey, using a quantitative research method and secondary data sets, was applied to examine the relationship between the independent and dependent variables. The secondary data from 2015 Nigeria Malaria Indicator Survey (NMIS) database was used. The constructs of the social cognitive theory (SCT), (Bandura, 1986) were used to examine how SES and health-seeking behavior contribute to the incidence of MiP. The independent variables were SES and health-seeking behavior while the dependent variable was MiP.

Research Questions and Hypotheses

This study explored the relationship between SES and health-seeking behavior on MiP among Nigerian women.

Research Question 1**:** Is there an association between socioeconomic status and incidence of malaria in pregnancy among Nigerian women?

$H_0$1: There is no association between socioeconomic status and incidence of malaria in pregnancy among Nigerian women controlling for age, ethnicity, antenatal visits, marital status, religion, coverage by health insurance and region of residence.

H_a1: There is an association between socioeconomic status and incidence of malaria in pregnancy among Nigerian women controlling for age, ethnicity, antenatal visits, marital status, religion, coverage by health insurance and region of residence.

Research Question 2: Does socioeconomic status predict health-seeking behavior during malaria in pregnancy in Nigeria?

H_02: **S**ocioeconomic status does not predict health-seeking behavior during malaria in pregnancy in Nigeria, controlling for age, ethnicity, antenatal visits, marital status, religion, coverage by health insurance and region of residence.

H_a2: **S**ocioeconomic status predicts health-seeking behavior during malaria in pregnancy in Nigeria, controlling for age, ethnicity, antenatal visits, marital status, religion, coverage by health insurance and region of residence.

Research Question 3: Are there differences in malaria incidence and different health-seeking behavior among pregnant women in Nigeria?

H_03: There is no difference in malaria incidence and different health-seeking behavior among pregnant women in Nigeria, controlling for age, ethnicity, antenatal visits, marital status, religion, coverage by health insurance and region of residence.

H_a3: There is difference in malaria incidence and different health-seeking behavior among pregnant women in Nigeria, controlling for age, ethnicity, antenatal visits, marital status, religion, coverage by health insurance and region of residence.

Theoretical Framework

This study adopted the social cognitive theory (Bandura, 1986) to examine the impact of socioeconomic status and health-seeking behavior on malaria in pregnancy in

Nigeria. SCT postulates that learning takes place in a social context with a dynamic and mutual interaction of the person, environment, and behavior (Glanz, Rimer, & Viswanath, 2008). SCT uses four constructs in its study of human behaviors. They are self-efficacy/behavioral capability, outcome expectation, reciprocal determinism, and facilitation (Glanz et al., 2008).

MiP is influenced by a few factors that are related to the pregnant woman, the vector and the environment. The SCT provides the behavior change standard that attempts to understand the mutual association between personal factors, behavior and environmental influences (Glanz et al., 2008; Sharma & Romas, 2012). The Nigeria Demographic and Health Survey (2013) affirmed a positive correlation between SES and health-seeking behavior of women in rural and urban areas. Eastin and Sharma (2015) applied SCT in a related study to examine breastfeeding in African American women. Various socioeconomic, cultural, behavioral, and environmental factors predict MiP (Donovan et al., 2012) and malaria in children (Adefemi et al., 2015). The knowledge of the benefits of a behavior and beliefs about the behavior arouses interest in initiating and continuing the behavior (Lewlallen & Street, 2010). This was earlier demonstrated by Glanz et al. (2008) when they asserted that people's behaviors are determined by what they know, have been taught, past experiences, expectations, availability of tools, resources or environmental changes and the interactions of all these factors. SCT recognizes people's capacity to reconstruct the environment to suit their intentions. Therefore, individuals learn from their experiences and by studying others and the outcome of the actions of others (Minkler, 2010). This study adopted selected constructs

of SCT in its investigation of the relationship between SES and health-seeking behavior on MiP in Nigeria. The selected constructs include behavioral capability (knowledge and skills to perform a given behavior), expectations (anticipated outcomes of a behavior), and self-efficacy (confidence in one's ability to act and overcome barriers). Application of this theory helped to understand the issues that arose in regard to how SES and health-seeking behavior affect MiP.

Nature of the Study

This study applied a quantitative research method using secondary data from the 2015 National Malaria Indicator Survey (NMIS) source. The retrospective quantitative method examined the impact of SES and health-seeking behavior on malaria in pregnancy in Nigeria. The research employed SES and health-seeking behavior as the independent variables while MiP was the dependent variable. Multivariate logistics regression was used to analyse the relationship of the two independent variables and one dichotomous dependent variable.

Definition of Variables

Dependent Variable

Malaria in pregnancy: This is the occurrence of malaria during the period of pregnancy according to the clinical and laboratory standards as defined by the World Health Organization (2000). It will be categorized as *yes* and *no*.

Independent Variables

Socioeconomic status*:* This was defined as the pregnant woman's existing collective and economic condition. Quantitatively, it was measured in terms of income

level (wealth index), educational level and occupation (Rubin et al., 2014; Tusting et al., 2013). Wealth index was categorized as poorest, poorer, middle, richer, and richest (NMIS, 2015). Educational level was characterized as no education, primary, secondary, and tertiary while occupation was grouped as unemployed, self-employed, and employed (NMIS, 2015).

Health-seeking behavior: This was defined as the actions an individual actively performs to ensure healthy living, either to treat ill health or to manage disabilities in a standard health facility, herbalists' homes, native doctors' clinics, traditional birth attendants (TBA) homes, family members, relatives, and self-help. It was categorized as 'formal' and 'informal' (Poortaghi, et al., 2015).

Age*:* This is the number of years a pregnant woman has lived up to the time she got pregnant

Ethnicity*:* This was defined as the pregnant woman's tribe. It was classified as Hausa, Igbo, Yoruba and others.

Antenatal visit: This was defined as the number of contacts a pregnant woman had with a skilled health worker after being pregnant up until the delivery of the child (WHO, 2017b). The visits were categorized as <4 and >4.

Marital status*:* This was defined as being in or not being in a relationship at the time of being pregnant. It was categorized as single, married/co-habiting, divorced/separated/widowed.

Religion: This is the pregnant woman's preferred mode of belief in the existence or nonexistence of God or gods and the activities she performs with the worship of them. It was categorized Christianity, Islam, and traditional/others.

Coverage by health insurance: This is the pregnant woman's choice of enrolment in the National Health Insurance Scheme (NHIS) where resources are pooled for health care needs. It was classified as yes and no.

Region of residence: This is the geo-political region in Nigeria where the pregnant woman resides. It was tagged as East, North, South and West.

Education: This is the level of formal education attained by the pregnant woman at the time of data collection. It was labelled as no education, primary, secondary and tertiary.

Occupation: This was defined as the job or profession of the pregnant woman as at the time of pregnancy. It was grouped as unemployed, self-employed and employed.

Income: This is the amount of money the pregnant woman earns from work or business. It was characterized by wealth index in this dissertation. The DHS program coded wealth index as poorest, poorer, middle, richer and richest.

Poverty: This was used interchangeably as low SES where the individual lacked enough money to take care of basic needs.

Assumptions

It was assumed that all the pregnant women in Nigeria participated in the malaria indicator survey. It was also assumed that the women's assertion of being pregnant was

true. We also assumed that all the self-reported responses to the survey questions were correct.

These assumptions were important because inclusion of all the pregnant women in the survey and proper responses to the survey questions would highlight the true sample size and enhance the validity and reliability of the study.

Scope and Delimitation

The data were collected from the 2015 Nigeria Malaria Indicator Survey. The main area of interest was to explore how SES and health-seeking behavior predict malaria in pregnancy among Nigerian women. The data was collected throughout the whole country. We did not employ the theories of health belief model (Rosenstock, 1974) and the Andersen behavioral model (Andersen, 1968) although they would have been relevant in the study. Non-pregnant women were excluded from the study. The outcome of the study is generalizable because the surveys utilized nationally representative data. However, causality cannot be established due to its cross-sectional design.

Limitations

A major limitation of the study was the absence of possible confounders in the secondary data such as gravidity, parity, nearest health facility type, timeliness of ANC initiation, trimester of pregnancy, type of health insurance, nearness to health facility, housing quality and co-morbidities of the pregnant women. In addition, the cross-sectional study does not establish causality. We could not infer, for instance, that low SES and preference for informal health-seeking behavior led to the occurrence of malaria in pregnancy or vice versa. Another limitation was the possible denial of pregnancy

especially when the woman was single or the pregnancy was disputed. In some areas of Nigeria, single mothers were denigrated and maligned. Furthermore, incomplete data and missing data from the secondary data sets would also limit the study because it would reduce the sample size. The issue of incomplete data was handled by deleting such data. Additionally, family members might not have cooperated with the survey teams and might have provided wrong answers to self-reported questions. In this study, I used secondary data in the investigation of the impact of SES and health-seeking behavior on malaria in pregnancy in Nigeria. There is, therefore, nothing I could do to address any bias that could have arisen during data collection. Moreover, the DHS data sets did not include information on alternative medicine which serves as a readily available option for medical care especially to women of low SES and rural origin.

Significance

In this dissertation I examined the relationship between SES and health-seeking behavior on malaria in pregnancy. I explored these neglected aspects of malaria control initiatives (Dickinson et al., 2012; Sonko, et al., 2014). The result of this research further highlighted the need to consider SES and health-seeking behavior of intended beneficiaries during the planning stages of any malaria control initiatives. This would equally help governments, government institutions and ministries, and policy makers to make informed decisions on how to improve the outcomes of malaria control programs. Malaria has been a major public health challenge in Nigeria, more so, in pregnant women where it causes about 11% of maternal death (Federal Ministry of Health, 2012b; Kyu et al., 2013; United States Embassy Nigeria, 2011; Wogu et al., 2013). The insights from

this study would highlight the necessity to take into account SES and health-seeking behavior in malaria control programs so as to reduce the maternal and infant morbidities and deaths due to malaria in pregnancy. It would equally inspire the lawmakers to promulgate laws that would protect pregnant women and ensure adequate and free health care services for these vulnerable groups.

Summary and Transition

Nigeria has one of the worst global Maternal Mortality Rates of 814/100,000 live births (WHO, 2015a). Malaria during pregnancy was the primary cause of these 6,500 maternal deaths (Federal Ministry of Health, 2012b; Kyu et al., 2013; United States Embassy Nigeria, 2011; Wogu et al., 2013). According to Mbachu et al. (2017) this burden of malaria in pregnancy in Nigeria was undervalued. A major gap that exacerbated the burden of malaria in pregnancy in Nigeria was government's preference to address the immediate causes of malaria in pregnancy to the fundamental and root causes of malaria in pregnancy (Dickinson et al., 2012). Among these ignored foundations were SES and health-seeking behavior. Addressing the SES and health-seeking behavior of women should form the fulcrum of malaria control programs. However, government was yet to adopt this strategy. Chapter 1 focused on the description of the study topic using background, problem statement, purpose and nature of the study, research questions and hypotheses and a brief insight into the theoretical framework. Chapter 2 will concentrate on the literature review, search strategy, variables of interest and a more detailed discourse on the theoretical framework.

Chapter 2: Literature Review

Introduction

Malaria in pregnancy has been a recurring public health challenge in Nigeria and other SSA countries. Of the 120–300 million recorded malaria cases with consequent 600,000 deaths annually, about 50 million occur during pregnancy and 60% occur in Africa (Barofskya, Anekweb, & Chaseca, 2015) and 29% in Nigeria (NMEP, NPC, NBS, & ICF International, 2016). In Nigeria, the annual financial losses ascribed to malaria are about 132 billion naira ($400 million); these are quantified as treatment costs, prevention and control activities and loss of man-hours (Federal Ministry of Health, 2005; 2005b). Malaria in pregnancy is a high risk factor especially during first trimester of pregnancy (Rijken, 2012). Although adult women develop immunity to malaria in regions of high malaria transmission, such as Nigeria, they lose it during pregnancy due to the accompanying physiological changes. The maternal mortality rate of 814/100,000 live births in Nigeria translated to about 58,000 maternal deaths (WHO, 2015). An estimated 11% (6,500) of these deaths were documented as MiP deaths (Federal Ministry of Health, 2012b; United States Embassy Nigeria, 2011; Wogu et al., 2013). Researches had supported the high burden of malaria in pregnancy (Dhiman et al., 2012; Taylor et al., 2013; Ezebialu et al., 2012; Rijken et al, 2012, Takem et al, 2013). The plethora of documented information on the burden and risk of malaria in pregnancy informed the decision by Nigeria's Federal Ministry of Health to develop and implement National Malaria Strategic Plans (NMSP). The fourth NMSP covers the period 2014-2020 (NMEP et al., 2016). The main objective of NMSP 2014-2020 is to ensure that Nigeria attains

pre-elimination status (less than 5,000 cases per 100,000 persons) and to reduce malaria related deaths to zero by 2020 (NMEP et al., 2016). Another effort by the Federal Ministry of Health to reducing malaria in Nigeria is the recommendation that pregnant women should receive at least two doses of Sulfadoxime/Pyrimethamine (SP) combination in its National Antimalarial Treatment Policy (Yusuf et al., 2016). This is in compliance with the recommendations of the World Health Organization (WHO, 2013).

In Nigeria, prevention of malaria infection targets the vector, the reservoir, and the causative agent (Chinweuba et al., 2017). The prevention programs focus on how to stop the mosquito from infecting the human host and on effective case management when malaria infection eventually occurs despite all precautions and preventive measures that human beings adopt. Malaria prevention programs are yet to pay attention to the social and behavioral features of the illness. Most studies on malaria in pregnancy in Nigeria concentrated on other attributes of the illness. For instance, Chinweuba et al. (2017) demonstrated how the pregnant woman's knowledge, culture and accessibility of health facility determined their health-seeking behavior. Adefemi et al. (2015) reviewed the social and environmental determinants of malaria in children that are below five years while Donovan et al. (2012) used health facility data and community survey to examine seasonal and socioeconomic variations in clinical and self-reported malaria.

Malaria has always been associated with poverty (de Castro & Fisher, 2012; Ricci, 2012; Tusting et al., 2013). However, studies have produced mixed results on the association between SES and malaria at micro (household and population) level (Sonko et al., 2014). Scholars have argued on the dual causation between malaria and low SES,

where poor households suffer from regular bouts of malaria that in turn keeps them in poverty (Ricci, 2012; Sonko et al., 2014). However, more information is needed to further understand the impact of SES on malaria in pregnancy. This study will highlight the gap.

Pregnant women still engage in informal health-seeking behavior when they are infected with plasmodium. Patients adopt informal health-seeking behavior when they seek for health care needs in unorthodox places such as patent medicine vendors, native doctors, herbalists, relatives, and self-care (Diala et al., 2013; El Kahi et al., 2012). Patronizing these medical outlets might occur because of lack of resources to pay user-fees in a standardized health facility and other sociocultural and behavioral elements (Uzochukwu & Onwujekwe, 2004). Such facilities do not employ qualified health workers, so, they offer suboptimal services with its attendant health risks. Dixit et al. (2016) demonstrated that health care workers need to be familiar with the health-seeking behavior of community members in their catchment areas to meet their health needs. The outcome of this research will fill the existing knowledge gap of health care workers on the effect of malaria in pregnancy on health-seeking behavior during pregnancy in Nigeria. It will also create more awareness among pregnant women on the need to adopt formal health-seeking behavior when malaria occurs. This study will investigate the effect of malaria in pregnancy on health-seeking behavior and on how SES correlate with health-seeking behavior to define the incidence of malaria in pregnancy in Nigeria.

Though little is known on the relationship between socioeconomic status, health-seeking behavior, and their interactions to determine malaria in pregnancy, researchers

have separately linked SES and health-seeking behavior for the ongoing transmission of malaria in endemic countries. This cross-sectional survey proposes to use quantitative methods and secondary data to investigate the association between SES and health-seeking behavior on malaria in pregnancy in Nigeria. The study focuses on SES, health-seeking behavior, age, ethnicity, ANC visits, marital status, religion, coverage by health insurance and region of residence.

The remaining part of Chapter 2 will include a robust literature review as it relates to SES, health-seeking behavior, and malaria in pregnancy with focus on Nigeria. Chapter 2 will also include the search strategies used to review the literature and the theoretical framework that was adopted in the discourse. Part of the chapter will highlight the keywords and terminologies that were used in the study. This will aid interested scholars to duplicate the study. Other studies with similar variables of interest formed the focus of the literature. The independent variables were SES and health-seeking behavior while the dependent variable was malaria in pregnancy. Additionally, the chapter will present a literature review matrix with a summary of significant researches evaluated for this study. Finally, chapter two will present comparable investigations to justify the research method and design as well as highlight the gaps in the literature. Chapter 3 will include a detailed description of the research methodology that was applied in this study.

Literature Search Strategy

An online search was performed to locate current literature on the effect of SES and health-seeking behavior on malaria in pregnancy using the same variables of interest. The primary database used was Malaria in Pregnancy Library database. This library is a

comprehensive bibliographic database created by the Malaria in Pregnancy Consortium. It is updated every four months with a standardized protocol to search more than 40 sources, including PubMed, Web of Knowledge, and Google Scholar (van Eijk, 2015). Other databases that were used include Medline, PsycINFO, Cumulative Index to Nursing and Allied Health Literature (CINAHL), EBSCO, PubMed, ProQuest, Science Direct, Google Scholar, Centers for Disease Control and Prevention, and World Health Organization. All documents were accessed electronically through the Walden University Library website. The author ignored duplicate studies and investigations that were published in other languages other than the English language and used Boolean filters to limit irrelevant articles, both by keywords and publication dates. The databases presented peer-reviewed publications and official government documents from 2000 to 2018, although the author focused on articles that were not more than five years post publication. The author used the following search items: socioeconomic status, health-seeking behavior, prevalence of malaria infection, malaria in pregnancy, fundamental causes, malaria diagnosis, maternal health, continuum of care and social cognitive theory.

Inclusion criteria

Literature material used for this examination had to meet the following requirements:

1. Research publication dates ranged from 2000 to 2018 (except for few relevant and significant documents).
2. Peer-reviewed journal publications or governmental agency documents.
3. Journal articles that met the target population.
4. Journal articles that discussed malaria and or malaria in pregnancy.

Exclusion criteria

Literature resources were not used if they fall into the following criteria:

1. The literature did not support this study.
2. The literature did not meet the inclusion criteria.
3. The literature did not comply with the target population.
4. The literature that did not highlight the theme of this study.

Theoretical Framework

The theoretical approach that guided this study was SCT as propounded by Albert Bandura (Bandura, 1986). It was formerly known as The Social Learning Theory. Albert Bandura demonstrated that learning was integration of the learner's personal characteristics, the behavior patterns, and the environment (Bandura, 1977; 2001). Scholars apply this model widely in studies dealing with behavioral change due to its focus on the dynamic multilevel interactions of personal, behavioral and environmental factors that are associated with behavior adoption and decision making.

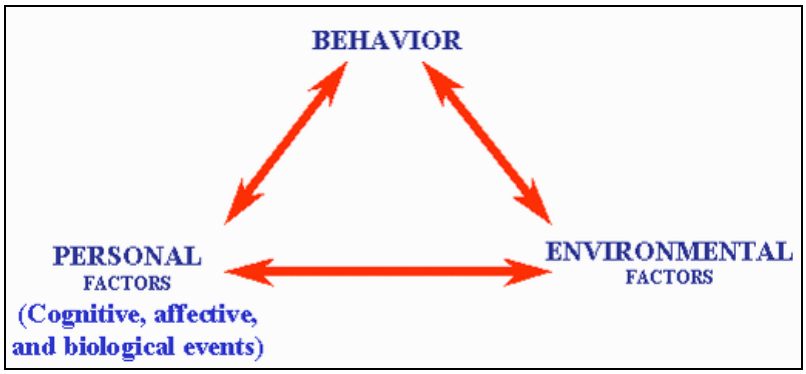

Figure 1. Overview of social cognitive theory and of self efficacy. Source: Pajares (2002). Retrieved from http://www.emory.edu/EDUCATION/mfp/eff.html.

Pajaras, (2002) explained personal factors as knowledge, emotions, biological factors, attitude and expectations of an individual while environmental factors were typified by social norms and values, social network, influence on others and access in the community. The behavioral factors refer to practice, skill and self-efficacy. The interaction between the personal and the environmental factors involved viewpoints, beliefs and intellectual skills acquired and enhanced by social influences. The interface between the personal and behavioral factors was guided by individual thoughts and actions while the interaction between the environmental and behavioral factors involved the reciprocal relationship between the individual's behavior and the environment (Bandura, 1986).

The SCT model suggests that people learn from their own experiences, from observing others and from the benefits of these actions (National Cancer Institute, 2005). These mutually bring about the conscious appeal to perform or not to perform future behavior (Burke & Mancuso, 2012). This, therefore, suggested that the multi-gravidae pregnant women are better disposed to assessing formal health-seeking behavior; consequently, the incidence of malaria amongst the multi-gravidae pregnant women would be less than the primigravidae.

Malaria in pregnancy was influenced by a variety of factors that were associated with the mother, the mosquito and their environment. The SCT offered a vigorous behavior change model that seeks to understand the dynamic relationship between personal factors, behavior and environmental influences (Eastin & Sharma, 2015; Minkler, 2010; Sharma & Romas, 2012). SCT adopted four constructs in its study of

human behavior. They were self-efficacy/behavioral capability, outcome expectation, reciprocal determinism and facilitation (Glanz et al., 2008). The rationale for selecting this theory was to demonstrate that it was necessary to review the multilevel components and interactions that led to a personal decision making when studying malaria in pregnancy.

Similar Studies' Use of the Social Cognitive Theoretical Model

Omona, (2009) applied the SCT in a quantitative design to assess the appropriateness of social marketing as a tool to fight malaria in SSA. The author's objectives were to contribute to the continuing debate and search for a better strategy for combating malaria in SSA and to contribute to theory building on social marketing. He used content analysis and literature review in the study. The results revealed that social marketing may not be appropriate to control malaria in SSA where poverty is widespread, the policy makers and politicians neglect the health sector and the recommended 5% investment of the countries' GDP on health is not met.

In another study, Adanri, (2017) used the SCT model in a cross-sectional quantitative design to study the relationship between maternal health literacy, antenatal care visits, and development of medical conditions during pregnancy and pregnancy outcomes. The author employed Lisa Chew's health literacy assessment tool in a sample of 130 women in Shomolu local government area in Nigeria. Analysis with Binary Logistics Correlations revealed that only health challenges that started during pregnancy affected pregnancy outcomes.

Arori, (2011) employed the socio cognitive theoretical model to assess the influence of socioeconomic factors, knowledge level, attitudes, and practices of 360 Gusii people of Kenya on malaria prevention. The author evaluated the relationship between defined study participants' socioeconomic factors and their knowledge and behavioral change to control malaria. Furthermore, the researcher applied the pre-post-test approach to assess the impact of health education program on the malaria preventive behaviors of the study participants. Statistical analysis using repeated measures one-way ANOVA, Chi-square, and Cramer's V test result established association between socioeconomic factors and lay person health education program (LPHEP) on study participants' malaria preventive behaviors.

The SCT is complex and comprehensive. This underscores why scholars limit its application to one or two of its variables such as self-efficacy and outcome expectations (Braungart, & Braungart, 2007). No publication was found in the literature review that applied SCT to address malaria in pregnancy. However, other few studies (Arori, 2011; Omona, 2009) presented the use of SCT in malaria investigations in Nigeria and elsewhere.

Study Area

Nigeria is the most populous country in Africa. The sub Saharan African nation is in West African sub region. It has a total land mass of 923, 768 square kilometers (Adigun, Gajere, Oresanya & Vounatsou, 2015). Nigeria has an estimated population of 198 million people with a rural population of 67.2% (NPC, 2012). The tropical country has wet and dry seasons. The dry season is characterized with cold and dusty Harmattan

whereas the wet season is typified with torrential rains. The wet and dry seasons span through half yearly cycles respectively. Dry season extend from October to March whereas wet season occurs from April through September. The average annual rainfall ranges between 550mm in some part of the north mainly in the fringes of Sahara Desert to 4,000 mm in the coastal region around Niger delta area in the south (Adigun, Gajere, Oresanya, & Vounatsou, 2015). Nigeria's temperature range is between 25°C and 40°C. The Nigeria's climate supports a mangrove swamp forest in the Niger Delta and Sahel Savannah in the north. In Nigeria, malaria transmission is throughout the year in most parts of the country. Plasmodium falciparum accounts for more than 95% of malaria parasitaemia and most forms of severe malaria infection in Nigeria (Mouzin, 2012). Plasmodium malariae and Plasmodium ovale infections also occur in Nigeria. The 2010 Nigeria Malaria Indicator Survey categorized the country into five ecological sections: mangrove swamps, rain forest, guinea savannah, Sudan savannah and Sahel savannah. These ecological divisions have different malaria intensity, season and duration (Programme NMC, 2010). The duration of transmission season increases from north to south for three months in the north and throughout the year in the south (Mouzin, 2012). About 30%, 3% and 67% of Nigeria's population reside in a high to very high, low and moderate transmission areas (Mouzin, 2012).

Figure 2: Map of Nigeria
Source: Central Intelligence Agency (CIA, 2016). Africa: Nigeria. The World Fact book: Africa: Nigeria," by Central Intelligence Agency, 2016. Retrieved from https://www.cia.gov/library/publications/resources/the-world-factbook/goes/cm.html

Literature Review Related to Key Concepts and Variables

The underlying key study concept is malaria in pregnancy among Nigeria women. The variables of interest are socioeconomic status, health-seeking behavior, age, ANC visit, and marital status. Others include coverage by health insurance, education, occupation, religion, income (wealth index), parity, and gravidity. This section will expand on literature with similar variables.

Health and Political Structure in Nigeria

Nigeria has a projected population of 198 million (NPC, 2012). The country is divided into 36 states with the Federal Capital Territory in Abuja and 774 local government areas. The Federal Government of Nigeria divided the country into six geo-political zones (north-central, north-east, north-west, south-east, south-south and south-west) for ease of administration (NPC & ICF International, 2014). The 2013 Nigeria Malaria Indicator Survey documented malaria transmission that is seasonal in intensity and duration across the six geo-political zones (NPC & ICF International, 2014). In the northern regions of Nigeria, malaria duration spans through three months or less while in the southern regions, malaria duration is recurrent.

The health care delivery system in Nigeria operates at three levels: primary, secondary and tertiary. The primary health care (PHC) system is the first level of contact of individuals, families and communities with the national health system, bringing health care very close to the people (Alenoghena, Aigbiremolen, Abejegah & Eboreime, 2014). The Federal Government of Nigeria, through decree number 29 of 1992, established the Primary Health Care Development Agency (NPHCDA) to coordinate the implementation of PHC programs (Federal Ministry of Health Nigeria [FMOHN], 2004; Magawa, 2012). Health care delivery is in the concurrent legislative list. As such, the local, state and Federal Governments are responsible for primary, secondary and tertiary health care respectively (Federal Republic of Nigeria Constitution, 1999). There are three types of primary health centers in Nigeria. These include: The Comprehensive Health Centers (CHC); the Primary Health Centers (PHC); Health Clinics and Health Posts (Obionu,

2007). Community Health Extension Workers (CHEW) and junior CHEW are supposed to manage the PHCs, health clinics and health posts; they are expected to spend 80% and 20% of their duty time in communities and health facilities respectively (FMOHN, 2004). Secondary level health services are provided by general hospitals while tertiary level health services are domiciled at specialists' and teaching hospitals.

There are public, private and faith-based health facilities or their combinations in Nigeria. Although the federal government's employees enjoy universal health coverage under the National Health Insurance Scheme (NHIS), patients and clients are expected to pay for their health care needs except at primary health care level. However, the national intermittent preventive therapy during pregnancy (IPTp) guidelines mandated health care providers to administer at least two doses of sulphadoxine-pyrimethamine (SP) in the second and third trimesters of pregnancy at no cost to pregnant women attending focused ANC in public and faith-based health facilities by Directly Observed Treatment (DOT) (Ameh et al., 2016, FMOHN, 2005). Despite this national policy, the IPTp coverage in Nigeria is very low. About 23% of pregnant women received antimalarial medication during pregnancy and 15% received two or more doses (NPC & ICF International, 2014; Onwujekwe et al., 2012). A study conducted in Mali presented similar outcomes (Klein, et al., 2016). Additionally, the health-seeking behavior of a large proportion of pregnant women is informal when they have malaria symptoms (Diala et al., 2013). This is very noticeable in the northern region of Nigeria where many Muslim women are in seclusion and are not free to make decisions about attending a health facility. The low uptake of

IPTp and the preference for informal health-seeking behavior continue to expose the pregnant women to malaria with its consequent outcomes.

Studies related to Malaria in Pregnancy

Globally, the malaria control development partners and funding agencies, in collaboration with government and her agencies, recorded a major achievement in reducing the morbidity and mortality attributable to malaria between 2000 and 2010 (Bhatia, Rastogi, & Ortega, 2013; Fact Sheet-Malaria, n.d.). Bhatia et al., (2013) recorded a malaria mortality decline of 26% globally and a 33% reduction in African region. An approximated 1.1 million lives were saved globally probably due to scaling-up of malaria control interventions. However, the World Health Organization, (2017a) in her annual world malaria report, warned that the recorded success in reducing malaria morbidity and mortality has stalled. As a consequence, the world may not achieve the global malaria targets for 2020 and beyond. The WHO Global Technical Strategy for Malaria had set a target for reducing the malaria incidence and mortality rates by 40% by 2020 (WHO, 2012; 2015c). The WHO noted that the world may not achieve this target if malaria control development partners and funding agencies, other stakeholders and governments do not collaborate to stem the recent surge in malaria incidences after the unprecedented progress in malaria control efforts between 2000 and 2010.

Malaria in Pregnancy

According to Desai et al. (2007), pregnancy increases the vulnerability of women to malaria. The susceptibility to malaria is due to the accompanying immune suppression, a necessary mechanism to forestall the rejection of the fetus (Ataide, Mayor, & Rogerson,

2014). Apart from the immune suppression, the Plasmodium falciparum-infected erythrocytes can accumulate or sequester in the placenta, making it unavailable in the peripheral blood and thus undetectable by all known malaria diagnostic tests. Malaria in pregnancy is often asymptomatic. The presence of unnoticeable plasmodium in the placenta is associated with poor fetal growth, premature labor resulting in LBW babies, spontaneous abortion and maternal anemia, (Amegah et al., 2013; Desai et al., 2007; Rogerson et al., 2018). Malaria in pregnancy, therefore, predisposes the pregnant women and the babies to adverse pregnancy outcomes.

P. falciparum accumulates in several sites of the body as a protein called P. falciparum erythrocyte membrane protein, PfEMP1. This protein has a number of variants and often evades removal by the spleen and immune system because it can accumulate in many sites in the body. The PfEMP1 that mediates placental sequestration is a unique variant, termed VAR2CSA, which binds to chondroitin sulfate A, CSA (Salanti et al., 2004). VAR2CSA has strong affinity for the placenta and the parasites can only thrive during pregnancy. Salanti et al. (2004) demonstrated that VAR2CSA is only found in females and it is parity-dependent, thus multigravida women have more protective antibodies and are relatively more protected from the aftermaths of placental infection than the primigravidae women. The scholars also showed that women with high plasma levels of anti-VAR2CSA IgG antibodies were delivered of babies with adequate birth weight than women with low levels of the antibodies. Women can only be exposed to VAR2CSA when they are pregnant. During first pregnancy, if they experience the initial exposure to infected erythrocytes, the pregnancy outcome may be fatal to the

mother and especially the fetus due to lack of immunity. In Nigeria and other SSA countries, where malaria is endemic, the end results of pregnancy associated malaria, PAM, in multigravida women are milder than in areas of lower transmission of malaria. The foregoing explains the reason both primigravidae and multigravida women are vulnerable to malaria in pregnancy and its complications such as coma, acute lung injury in the mother, miscarriage and stillbirth in areas of low malaria transmission (Desai et al., 2004).

Burden of Malaria in Pregnancy

In Sub Sahara Africa, the burden of malaria in pregnancy has been a topical issue (Dhiman et al., 2012; Ezebialu et al., 2012; Rijken et al., 2012; Takem & D'Alessandro, 2013; Taylor et al., 2011; WHO, 2017a; Yusuf et al., 2016). MiP has been demonstrated to have adverse consequences on the pregnant woman, the fetus and the newborn. These undesirable effects include preterm birth, LBW, spontaneous abortion, congenital infection and maternal death (Chinweuba et al., 2017; Onwujekwe et al., 2012; Wogu et al., 2013). Anemia, as a consequence of MiP, is very pronounced in the primi-gravidae and secondi-gravidae women than in subsequent pregnancies (Malaria Consortium, 2007; WHO, 2004). Yusuf et al., (2016) used data from the 2012 National HIV/AIDS and Reproductive Health Survey (NARHS Plus) to explore insecticide treated nets ITN/IPTp coverage, its associated factors, and the number of pregnancies protected from malaria in 22,438 and 118,187 pregnant women and women with live birth in the previous five years respectively. The cross-sectional study revealed that education and SES were associated with IPTp use. Moreover, about 11% (4) of the 36 states achieved the 80%

Roll Back Malaria (RBM) target for ITN coverage and none of the states achieved the 100% target for IPTp. Other scholars also reported low IPTp coverages (Hill et al., 2013, Klein et al., 2016; Onwujekwe et al., 2012). Researchers Onyeneho et al. (2015) conducted a cross-sectional study using qualitative strategy based on in-depth interviews and focus group discussion designs to collect data from 246 study participants on their knowledge, attitude and perceptions towards sleeping under insecticide-treated bednets and uptake of at least two doses of intermittent preventive treatment during pregnancy. The study outcome demonstrated a fair knowledge about malaria in pregnancy and poor attitude of health workers which discourage clients from accessing the malaria prevention interventions. However, most study participants were not aware of how to prevent malaria in pregnancy. The researchers recommended targeted health education messages for pregnant women, their partners and the health workers as measures to increase their awareness on IPTp and ITN use in preventing malaria during pregnancy.

Chaponda et al. (2015) employed quantitative design in a cross-sectional study to examine the burden and predictors of malaria in pregnancy among 1086 pregnant women during their first ante-natal clinic visit in two health centers of rural Zambia. A multivariate logistic regression analysis that was conducted showed that the prevalence of malaria identified by microscopy was 31.8% (95% CI: 29.0–34.5; N = 1079) and by polymerase chain reaction (PCR) was 57.8% (95% CI: 54.9–60.8; N = 1074). Further analysis yielded a risk of malaria infection that was 81% higher among pregnant women that attended one of the primary health centers (adjusted OR = 1.81; 95% CI: 1.38–2.37, $P < 0.001$). The authors concluded that the detected high prevalence of malaria by PCR in

these pregnant women suggested ineffective past malaria control efforts. Thus, governments and malaria development partners and funding agencies should devise a new strategy with better outcomes.

Economic Impact of Malaria in Pregnancy

In Nigeria, malaria stretches the weak health system and exerts a severe social and economic burden on the nation. It retards the Gross Domestic Product (GDP) by 40% annually and costs an estimated 480 billion naira in user fees for treatments, prevention costs, and loss of man hours (NPC & ICF International, 2014).

According to Rogerson et al. (2018) the economic burden of MiP can be quantified in terms of financial and non-financial implications. The researchers highlighted the economic costs as provider costs, the health system costs; user fees, and cost to households who access these services. Others include economic impacts such as reduced labor productivity of women who have MiP, and the short-term and long-term consequences of low birthweight and other adverse outcomes in neonates (Rogerson et al., 2018). These economic burdens further stretch the economic pressure on the pregnant women and their households especially those in low SES category. The accompanying economic pressure further determines the health-seeking behavior of the pregnant women, either to avoid seeking formal care or patronize the informal sector and thus endanger the lives of the fetus and the mother.

The treatment for MiP in Nigeria is free of cost to pregnant women. But other costs at the health facilities, such as transportation and other indirect costs have considerable impacts on households' budgets of low SES pregnant women (Rogerson, et

al., 2018). Healthcare providers also introduce some other costs to the pregnant women especially during ANC. All these extra expenditures may reduce the pregnant women's access to formal healthcare (Rogerson et al., 2018). In situations of stock-out of free medications, these pregnant women are compelled to procure the medications from private pharmacies and patent medicine vendors. In Nigeria, the cost of ACTs averages at $3.6, about three times the cost of SP; thus, a two to three days' income will be needed to treat a malaria case with an ACT in Nigeria where over 50% of the population live below $2 per day (Ezenduka et al., 2014).

Researchers Botto-Menezes et al. (2016) demonstrated that health provider costs for the management of confirmed cases of MiP usurped 1% of the monetary value of the total Brazil's healthcare budget. The costs to provide interventions during pregnancy are shown in table 1. Botto-Menezes et al. (2016) and Hansen et al. (2012) examined the costs of treating malaria in pregnancy whereas other studies focused on exact or estimated costs of preventive interventions (Fernandes et al., 2015; Hansen et al., 2012; Matangila et al., 2014; Renggli et al., 2013; Willilo et al., 2016). Furthermore, some scholars investigated both preventive and treatment costs of malaria in pregnancy (Botto-Menezes et al., 2016; Sicuri et al., 2015).

Pregnant women incur direct and indirect costs in their quest to prevent or treat malaria (Botto-Menezes et al., 2016; Sicuri et al., 2015). The direct expenditures include fees, drugs and transportation of ITNs whereas the indirect costs are associated with decreased productivity of the pregnant women, adverse effects of LBW, and other neonatal consequences (Rogerson et al., 2018). Many scholars have demonstrated that

direct costs to the pregnant women are major impediments to the management of malaria in pregnancy (Graffy et al., 2012; Hill et al., 2014; Hill et al., 2015; Klein et al., 2016; Pell et al., 2013; Singh, Brown, & Rogerson, 2013; Thiam, Kimotho, & Gatonga, 2013; Willey et al., 2012). Lack of liquidity among pregnant women of low SES exacerbates the poor management of MiP. Furthermore, Maheu-Giroux and Castro, (2014) demonstrated that removal of user fees enhances the delivery of IPTp among pregnant women.

Table 1

Provider Costs of Prevention and Treatment for Malaria in Pregnancy, by Country (Rogerson et al., 2018)

Study and year of publication & Country	Year cost data were calculated	Outpatient care per malaria episode (US$)	In patient care ($ per night)	Delivery of ITN	Cost of ITN ($ per distributed net)	Delivery of IPTp or chemoprophylaxis	Cost of IPTp or chemoprophylaxis ($)	Cost of other methods ($)
Botto-Menezes et al. (2016) Brazil	2011	103·51 (P vivax); 83·59 (P falciparum	118·51	-	-	-	-	-
Fernandes et al. (2015) Kenya & Mali	2011	-	-	-	-	ANC	0.63 per dose	-
Hansen et al. (2012) Uganda	2004–05	0.7		ANC	Impregnation and distribution: 1·71	ANC	0.79 (two doses)	ITN & IPTp; 2.48
Matangila et al. (2014) Democratic Rep of Congo	2013	-	-	-	-	-	ANC	One thick smear: 2·62; one RDT: 1·16
Renggli et al. (2013) Tanzania	2010	-	-	Campaign	Financial: 5.3	-	-	-
Willilo et al. (2016) Tanzania	2013	-	-	-	-	-	ANC	RTD:1·28 per woman; 10·70 per positive RDT

Note. RDT – Rapid Diagnostic Test, ANC – Antenatal Clinic, IPTp – Intermittent preventive therapy during pregnancy, ITN – insecticide treated nets,

Prevention and Control of Malaria in Pregnancy

Due to its underlying health risks, malaria in pregnancy remains a major public health challenge and a priority for the Roll Back Malaria (RBM) Partnership. In Nigeria and other SSA countries, where malaria transmission is high, the RBM partnership recommends a tripartite approach to prevent and control malaria in pregnancy (Ameh et al., 2016; Diala et al., 2013; WHO, 2004). These are effective case management of malaria infection, use of insecticide treated nets (ITN) and intermittent preventive treatment (IPTp). Surprisingly, more than a decade after the introduction of ITNs and IPTp, their coverages are still very low. Desai et al. (2018) in a study that examined the prevention of malaria in pregnancy, discovered that only 39% of pregnant women slept under an ITN. Likewise, the World Health Organization, (2016) revealed that only 31·5% of eligible pregnant women received three or more doses of IPTp in 2015. In another study by Walker et al. (2014) the IPTp uptake was 21.6%. Attendance to antenatal clinic provides the opportunities for the healthcare providers to deliver these interventions to the pregnant women. Unfortunately, the high attendance to antenatal clinic in malaria endemic countries (van Eijk et al., 2013) has not translated to high uptake of ITNs and IPTp by pregnant women. Other malaria prevention and control strategies in Nigeria include Indoor Residual Spraying (IRS) and Environmental Management (Federal Ministry of Health, 2005b; Mbachu et al., 2012). In Asia and Latin America, with low transmission of malaria, the control of malaria in pregnancy is based on enhanced surveillance and effective case management, with insecticide-treated nets and other vector control measures (Crawley et al., 2007).

In Nigeria, the national policy for the treatment of malaria recommended the use of artemisinin combination therapy (ACT) as the first-line treatment for uncomplicated malaria for all age groups except for pregnant women and children below five years (Federal Ministry of Health, 2011). The ACTs are provided by the Federal Ministry of Health and distributed to all public health centers free of cost to the clients. However, most times clients are compelled to procure ACTs from private pharmacy shops and patent medicine vendors due to frequent stock-outs of ACTs in public health facilities. Most clients of low socioeconomic status, who could not purchase ACTs, rely on government's supply and this may account for ACT's low coverage in Nigeria (Ibe et al., 2015; The Global Fund, 2008). Likewise, clients who engage in informal health-seeking behavior may not likely accept ACT as the drug of choice in the treatment of uncomplicated malaria. Quinine is the drug of choice for the treatment of uncomplicated malaria in pregnancy during the first trimester, while ACT is used during the second and third trimesters (Federal Ministry of Health, 2011). Parenteral quinine is used to treat complicated malaria cases during pregnancy irrespective of gestational age (Federal Ministry of Health, 2011). Sulphadoxine-pyrimethamine (SP) is a strategy for intermittent preventive treatment of malaria during pregnancy (IPTp) and also serves as a drug of choice for people who cannot tolerate ACT and during periods of ACT stock-outs in health facilities (Kalanda et al., 2006). Cost and frequent stock out of ACTs in public health facilities have been recorded as the major reasons for low coverage rates. These treatment choices were formulated over a decade ago but they are still valid to date.

IPTp is part of Nigeria's tripod strategy to prevent and control MiP. It involves the use of at least two doses of SP, at four weeks apart, during the second and third trimesters of pregnancy. The administration of SP is usually supervised by a skilled healthcare provider, free of cost for the pregnant women, through Directly Observed Treatment (DOT) in public and faith based/NGO antenatal facilities (FMOHN, 2005b). In Nigeria, the Federal Ministry of Health adopted the IPTp as part of focused ANC in 2005 and established a 90% target for pregnant women to receive at least two doses of SP in the second and third trimesters of pregnancy (FMOHN, 2005b). Nigeria has not achieved this IPTp target (Akaba et al., 2013; Esu et al., 2013; Iliyasu et al., 2012; Klein et al., 2016; Onoka et al., 2012; Onwujekwe et al., 2012; Tobin-West & Asuquo, 2013; Yusuf et al., 2016). According to Hill et al. (2013) the major barriers to achieving IPTp and ITN targets include ambiguous policy and guidance on IPTp; pregnant women's poor antenatal care attendance; sup-optimal healthcare provider performance and knowledge gap on the time lag between IPTp doses. Other barriers include poor quality of healthcare delivery system as a result of poor planning and organizational flaws at health facility level, SP stock-outs and user fees. Additionally, concerns about its benefit are worrisome (McClure et al., 2013). Hill et al. (2013) also highlighted the key determinants of IPTp coverage as SES, education, gravidity/parity, and knowledge about malaria/IPTp, use of ITNs and number and timing of antenatal clinic visits. Wealthier and highly educated women were more likely to receive IPTp than poor women and women with less or no education (Hill et al., 2013). Due to the rising parasite resistance to sulphadoxine-pyrimethamine, researchers have started to explore substitutes for IPTp. Tagbor et al.

(2015) demonstrated the use of rapid diagnostic tests to screen women for malaria at the first or each antenatal visit and treatment of malaria positive women with long acting artemisinin combination therapy. In a similar study, Desai et al. (2015) compared IPTp, intermittent screening with malaria RDTs and treatment of malaria positive women with dihydroartemisinin–piperaquine, and intermittent preventive treatment with dihydroartemisinin–piperaquine. The result revealed that dihydroartemisinin-piperaquine reduced the prevalence of malaria at delivery by 10% (n=459) whereas IPTp reduced prevalence of malaria by 3% (n=457); (relative risk 0.32, 95% CI 0.18–0.56; $p<0.0001$). Conversely, intermittent screening and treatment with dihydroartemisinin–piperaquine was associated with a higher incidence of malaria infection (232.0 events; 1.21, 1.03–1.41; $p=0.0177$) (Desai et al., 2015). Furthermore, Kayentao et al. (2013) demonstrated in a meta-analysis that three doses of IPTp were superior to the current two doses being administered.

The World Health Organization, (2017b) recommended between four to eight contacts for pregnant women in the presence of a health care provider to reinforce communication between them and enhance the detection of danger signs and the management of potential health risks including MiP. The WHO named this improved interaction between pregnant women and healthcare providers “Focused Antenatal Care” (World Health Organization, 2012b). Focused antenatal care is an integrated procedure that examines the holistic health status of the pregnant woman. It includes family planning, birth preparedness, voluntary counselling and testing (VCT), prevention of mother-to-child transmission (PMTCT) of HIV, tetanus vaccination, and the prevention,

early detection, and treatment of sexually transmitted infections (STI), urinary tract infections (UTI), and malaria (World Health Organization, 2012b). In Nigeria, the reproductive health programs deliver IPTp and malaria case management medications to pregnant women. However, the malaria control programs provide the needed technical support while the federal and states' Ministries of Health coordinate their activities and ensure adequate collaboration between the two programs.

Regular and proper use of long-lasting insecticide-treated nets (LLINs) is another strategy to prevent and control MiP (Diala et al., 2013). Occasionally, the Federal Ministry of Health embarks on free distribution of LLINs/ITNs to improve ownership and consequently the utilization of the treated bed nets. However, utilization of the treated bed nets is never equal to its ownership. Researchers Mbachu et al. (2012) demonstrated in a study in Anambra state, Nigeria, that ownership and utilization of LLINs were 80.5% and 64.4% respectively. Even with the documented studies on the cost effectiveness, safety and efficacy of ITNs, pregnant women still experience some perceived barriers on the use of ITNs. Hill et al. (2013) categorized the barriers to ITN uptake into three broad groups. They are the perspectives of the healthcare providers, the household/social/cultural level and the perspective of pregnant women. O'Meara et al. (2011) described ITN stock-out as a major barrier to ITN uptake. So, not all pregnant women who attended focused ANC would receive ITN. In some instances, free bednets are distributed to pregnant women who have attended at least four focused ANC sessions in compliance to the WHO recommendations. The household/social/cultural barriers highlighted costs of ITNs as the main hindrance to ITN use (Aluko & Oluwatosin, 2012;

Amoran et al., 2012). Hence, pregnant women of low SES and who did not receive free bednets during mass campaigns are not likely to own and use a bednet. Other impediments to ITN use include lack of husband's support (Akaba et al., 2013), place of residence (Ankomah et al., 2012; Auta, 2012; De Allegri et al., 2013) and weather influences on ITN use. In Nigeria, the power supply is unreliable. Thus, the use of electric fans and air conditioners are unpredictable. Pregnant women may feel uncomfortable to use a bednet during the hot seasons because bednets impede on the free flow of air (Akaba et al., 2013).

Furthermore, not all households who possess bednets/ITN/LLINs use them or use them in accordance with guidelines. Free bednets/ITN/LLINs are not always used as recommended (Dupas et al., 2016). Bednets/LLINs/ITNs could be used in the fishing communities as fishing nets and in other rural communities to tend nursery beds. Inappropriate use of free bednets/ITN/LLINs amounts to waste of resources. Unfortunately, the introduction of cost-sharing for bednets/ITN/LLINs to check improper use discourages demand and reduces access for the low SES potential users (Tarozzi et al., 2014). Some households may stay out up until midnight. During those periods, they may be exposed to mosquito bites. Afterwards, they retire to their rooms and sleep under a bednet/ITN/LLIN which may not be very useful as they had already been bitten by mosquitoes. ITN has been shown to be effective in reducing malaria episodes when they are used appropriately. According to Eisele, Larsen, and Steketee, (2010) ITNs reduced uncomplicated malaria in children by 51% and decrease all-cause mortality by 18% in children below five years. In a similar study in Afghanistan, ITN use reduced malaria

incidence by 40% (AOR 0.60; 95% CI 0.40– 0.91) (Howard et al., 2015). A study in northern Nigeria revealed that the use of ITNs is associated with the use of SP-IPTp (Iliyasu et al., 2012).

Barriers to ITN use are similar to barriers to achieving IPTp targets as discussed above. Researchers Hill et al. (2013) showed that the key determinants of ITN use among pregnant women were employment status, education, marital status, age, knowledge about malaria/ITNs and receipt of IPTp. The scholars revealed that women who were nineteen years or more and married were very likely to use an ITN. Additionally, there was a direct relationship between the women's education status, knowledge of ITNs or malaria and ITNs use. The scholars also discovered that pregnant women who were gainfully employed are more likely to use ITNs than pregnant women who were farmers or housewives.

Studies related to Socioeconomic Status and Malaria Parasitaemia

Socioeconomic status is a socio-structural variable that is grounded on the interface between people's social, cultural, and economic backgrounds (Rubin et al., 2014). SES is most often linked to medical outcomes. There exists a direct relationship between SES and medical care. If SES is low, medical care is insufficient (Lee et al., 2016; Leppälahti et al., 2013). SES impacts on people's behavior (Ostrove & Cole, 2003). Thus, it determines what people's choices are, what they do, how they do it, their values, and even their physical and mental health (Kraus & Stephens, 2012). Thus, SES is supposed to determine the incidence of malaria among pregnant woman and their preferred health-seeking behavior options to prevent, control and treat malaria. Low SES

is often equated to poverty. Poverty is the state of multidimensional deprivation in which basic needs cannot be met (Herdman et al., 2016). Many scholars have linked low SES/poverty to poor health outcomes (Herdman et al., 2016; Quon & McGrath, 2014). At micro level, inverse gradients have been established for many health outcomes, including arthritis, diabetes and adverse birth outcomes (Kim et al., 2018). However, the relationship between low SES/poverty and malaria at household and population level produced conflicting results (Sonko et al., 2014). Researchers have proffered explanation for the mixed results. The contrasting results depend on the methodology used to measure malaria and SES. According to de Castro and Fisher, (2012) self-reported malaria or fever may overestimate the malaria burden while differential reporting of morbidity across socioeconomic groups may also influence the results. Conversely, at macro level, the association between SES and malaria parasitaemia is well defined. Higher SES is associated with better health outcomes in most areas, both domestically and internationally (Biggs et al., 2010; Egen et al., 2017). Clouston, Yukich and Anglewicz, (2015) posited that inequalities in wealth could influence the provision of information about malaria among households. Low SES households may provide wrong information about their malaria status.

Studies related to Health-seeking Behavior and Malaria Parasitaemia

Health or care seeking behavior is any action an individual who has a health challenge takes to remedy the condition (Oberoi et al., 2016). It can be formal or informal (El Kahi et al., 2012). Health-seeking behavior is enmeshed in the classical triad of delays in accessing healthcare needs as propounded by Thaddeus and Maine, (1994).

According to Thaddeus and Maine, (1994) the delays in seeking healthcare needs occur at three levels: deciding to seek care, identifying and reaching the medical facility and receiving adequate and appropriate treatment. Kakkar et al., (2013) posited that contextual factors that determine the treatment sources people seek when symptoms of illness occur include the people's knowledge or awareness, sociocultural traits, beliefs, household decision making to seek care, social networks, gender and economic status. Researchers Ihaji, Gerald and Ogwuche, (2014) included community norms, and expectations as well as provider-related characteristics and behavior whereas Chinweuba et al. (2017) highlighted accessibility of health facility as part of the key determinants of pregnant women's preventive and treatment seeking behaviors.

When pregnant women manifest malaria symptoms, there is a time lag before treatment commences. How long the time lag will last depends on the pregnant woman's internal and external environments (Ezenduka et al., 2014). Her knowledge, SES, income, and her household's decision making machinery form part of the internal milieu whereas assurance of stock availability, attitude of healthcare providers and accessibility to health facility constitute some of the major external settings (Ezenduka et al., 2014). Even when the pregnant woman had decided to visit a health facility, in a rural setting, the bad terrain remains a deterrent. However, in an urban setting, where presumably pregnant women of higher SES reside, bad terrain may not be an obstacle to accessing health care needs.

There exists an inverse relationship between time lag from manifestation of symptoms and treatment seeking with SES. The poorest SES groups spend longer time

between the onset of symptoms and treatment seeking (Ezenduka et al., 2014). The low SES individuals resort to self-medication when they take ill. As these self-medication treatments may not be potent, they waste a lot of time before they seek for proper medical attention (Ezenduka et al., 2014). Prompt and effective treatment of malaria in pregnancy and other illnesses can save lives and reduce mortality and morbidity (Tusting et al., 2013). The pregnant woman can obtain proper medical attention in public or private health facilities. In Nigeria, the public health facilities offer the diagnosis and treatment of malaria in pregnancy free of cost to the pregnant woman whereas the private health facilities charge user fees; thus, pregnant women of low SES are more likely to attend public health facilities rather than private health facilities (Kamal-Yanni, Potet, & Saunders, 2012). However, this outcome contrasted earlier research finding in South-East Nigeria that low SES individuals were found to use lower level healthcare providers (traditional healers and patent medicine vendors) while high SES study participants relied more on public health facilities (Onwujekwe, 2005). The mixed results were due to the age profile of respondents although the proportion of those that attended public facilities was significantly higher among the poorest SES group (Mangham et al., 2011). For clarity on the available choices of a place of care, the three options of public, private and traditional methods should be studied concurrently.

Health messages that discourage the adoption of informal health-seeking behavior among pregnant women may not be adequate due to poor knowledge on the inherent dangers. When health messages demonstrate perceived threat of informal health-seeking behavior to people and also persuade them to adopt formal health-seeking behavior, the

likelihood of behavior change may be greatly enhanced. Akaba et al. (2013) summarized the malaria preventive health behaviors of pregnant women in Nigeria. The scholars reported poor knowledge of malaria infection and treatment seeking behaviors in the rural areas throughout the six geopolitical zones in Nigeria.

Literature Related to Study Design

Literature Related to Case-Control Study

Yamamoto et al. (2010) conducted a population-based matched 1:2 case-control study to investigate the association between SES and the incidence of malaria infection plus fever. The authors recruited 98 cases and 185 controls from the Demographic Surveillance System (DSS) survey dataset of 74,000 entries. SES, house tenure and electricity were the identified socioeconomic variables in the study. Univariate and multivariate analysis of the research findings showed similar trends. The roof or wall materials, type of latrine and proximity to a large body of water such as river or ponds were not associated with the incidence of malaria (P>0.05). However, floors of earth bricks (OR 0.24, 95% CI: 0.10-0.60, P=0.002 [univariate]; OR 0.22, 95% CI: 0.07-0.64, P=0.01 [multivariate]) had more risk of malarial infection. The likelihood of malaria infection increased with decreased SES (unadjusted OR 0·47, 95% CI: 0·20– 1·08). Furthermore, running tap water within the household's neighborhood (OR 0.31, 95% CI: 0.11-0.88, P=0.03), electrification of home (OR 2.11, 95% CI: 1.02-4.36, P=0.05) and house age <10 years (OR 3.30, 95% CI: 1.10-9.89, P=0.02) lowered the risk of malaria infection.

Literature Related to Cross-Sectional Survey

Akaba et al. (2013) conducted a prospective cross-sectional survey to examine the association between knowledge and utilization and barriers to the utilization of malaria preventive measures by pregnant women in Nigeria. The authors recruited 403 consenting pregnant women during their first booking for ANC.

The research results revealed statistically significant associations between ownership of ITN and utilization the night before the interview (X^2 = 64.972, P = 0.000); parity of the pregnant women and their use of ITN before and also during pregnancy (P = 0.035 and P = 0.021, respectively). Conversely, the researchers reported no statistically significant association between knowledge of malaria and the use of ITN the night before the interview (X^2 = 3.487, P = 0.480).

In a cross-sectional study to investigate the effects of maternal socioeconomic deprivation on adverse pregnancy outcomes in Ghana, Amegah et al. (2013) assessed the importance of maternal SES as a determinant of birth weight and gestational duration and evaluated main fundamental pathways for the influence of SES. The researchers employed 559 mothers accessing postnatal services at four health facilities with huge client flow. Maternal age, parity and gender of newborn were measured as possible confounders while self-reported incidents of MiP, pre-pregnancy body mass index (BMI) and cooking fuel used during pregnancy were assessed as mediating factors.

Multivariate linear regression analysis showed that low SES led to a 292 g (95% CI: 440–145) reduction in birth weight. Other SES-related factors that led to reduced

birth weight include neighborhood poverty (221 g; 95% CI: 355–87), studentship during pregnancy (291 g; 95% CI: 506–76), low education (187 g; 95% CI: 355–20), and low income (147 g; 95% CI: 277–17). Amegah et al. (2013) further established a causal pathway analysis; they showed that malaria infection (6–20%), poor nutrition (2–51%) and indoor air pollution (10–62%) significantly mediated the observed effects of SES on birth weight. Further analysis revealed a 218% (RR: 3.18; 95% CI: 1.41–7.21) risk increase of LBW and 83% (RR: 1.83; 95% CI: 1.31–2.56) of PTB among low income mothers (low SES).

Anchang-Kimbi et al. (2015) used cross-sectional survey to explore the prevalence and risk factors for P. *falciparum* infection and malaria among pregnant women. The authors recruited 303 pregnant women who reported for first antenatal clinic visit at two medical centers in the mount Cameroon area.

Anchang-Kimbi et al. (2015) used univariate and multivariate statistical analyses to demonstrate that marital status and human residences' nearness to bushes and/or standing water were risk factors for P. *falciparum* infection and malaria. The results revealed a malaria and asymptomatic infection prevalence of 16.0% (95% CI=11-20%) and 10.5% (95% CI=7.3-15%) respectively. Furthermore, the researchers observed that age and gravidity were significant factors associated with P. *falciparum* infection and/or malaria. Also, research findings demonstrated that nearness of human residences to bush and/or standing water was an independent risk factor of P. *falciparum* infection (OR=3.3, 95% CI=1.6 – 7.0; P=0.002) and malaria (OR=5.2, 95% CI=2.0 – 14; P=0.001). The

study outcome equally showed that being unmarried was associated with increased risk (OR=2.6:95% CI=1.1 – 6.0; P=0.032) of P. *falciparum* infection.

Dixit et al. (2016) employed a cross-sectional survey to highlight the determinants of malaria treatment-seeking behaviors from different perspectives. The scholars collected the study's data on malaria treatment-seeking behavior from 832 households, fifteen health centers, and 135 retailers by random sampling technique.

According to Dixit et al. (2016) 47.5–78.9% of the residents visited hospitals, clinics, or dispensaries whereas 6.3–26.1% of the residents preferred pharmaceutical retailers for healthcare needs. A reasonable proportion (40.3-59.4%) of the residents delayed seeking care for more than 24 h after fever onset. Even after adjustment, the preference of visiting a pharmaceutical retail facility to a hospital was still statistically significant. There was no association between travel time and delay in seeking care. The average total cost per patient per visit was lower in public health facilities ($1.40 US) than private health facilities ($2.06 US). The authors concluded that a proper grasp of the attending health-seeking behavior will aid governments and stakeholders to design appropriate malaria preventive measures and programs.

According to Herdman et al. (2016) multidimensional poverty (low SES) is correlated with longer delays in seeking care in hospitals and the resultant expenditure has severe impacts in low income individuals and households. The author aimed to explore the association between poverty and pre-hospital delays for patients with acute febrile illnesses in a cross-sectional study that involved 527 acutely ill adults and children aged over 6 months. The multivariate regression model analysis of the study findings

yielded an association between the median time from onset of symptoms to arrival at the hospital for low SES adults and medium/high SES adults (Poor=123 hours, Non-poor=101 hours; 95%CI: 17-46, P=0.009). However, there was no statistically significant difference in the delays before reaching the hospital for children from poor (low SES) and non-poor (medium/high SES households) (Poor=97hours, Non-poor=.119 hours; 95% CI:17-46, P=0.394). Further analysis revealed that both the poor (low SES) and non-poor (medium/high SES) households preferred seeking care at informal private sector health facilities before visiting the referral hospital if their health needs were not met. Also, the low SES study participants ascribed delay in decision making and seeking care at the hospital to lack of money (P<0.001) and are more exposed to expenditures greater than 25% of their monthly income (P<0.001).

Ibe et al. (2015) investigation was a multi-stage cluster cross-sectional survey on health-seeking behavior, patient-provider interaction and quality of care received by febrile patients of different SES groups in South-East Nigeria. The authors collected information on SES, health-seeking behavior, patient-provider interaction, and treatment received from 1642 febrile patients and caregivers as they exit public health centers, pharmacies and patent medicine dealers.

Principal components analysis results uncovered that 29% of the poorest SES group visited public health centers, 13% preferred pharmacies and 58% chose patent medicine dealers (p<0.01) for healthcare needs. On the other hand, among study participants in the richest SES group, a few (4%) used public health center; instead they preferred pharmacies (44%) and patent medicine dealers (52%, p<0.001). Further

analysis revealed that there were better interactions between the poorest SES groups and the healthcare provider, although it did not transform the poor quality of care for the low SES study participants. Whereas the richest SES group requested specific medicine; the poorest SES groups discussed the manifested symptoms, were physically examined and depended on the healthcare providers for diagnosis and treatment. Unfortunately, the poorest SES groups were least likely to request or receive antimalarial medications ($p<0.001$). Both poorest and richest SES groups indicated non-adherence to ACT as the recommended treatment for uncomplicated malaria.

Muhammad et al. (2016) conducted a descriptive cross-sectional survey on parturient women to explore the use of malaria preventive measures during pregnancy and the risk of malaria infection, anemia and LBW babies. The researchers interviewed 168 pregnant women who presented at the labor ward for delivery.

Bivariate analysis (Chi square test) and multiple logistic regressions recorded that 43.0% of the pregnant women received up to two doses of IPTp-SP. According to Muhammad et al. (2016), other risk factors of malaria infection include malaria infection at ANC registration (OR: 6.6; 95% CI: 3.4–13.0), non-adherence to DOTS for IPTp-SP (OR: 4.6; 95% CI: 2.2–9.5) and receiving less than two doses of IPTp-SP (OR: 3.1; 95% CI: 1.5–6.7).

Researchers Sonko et al. (2014) did a cross-sectional study using the 2010/2011 Gambia Malaria Indicator Survey (MIS) to assess the association of SES and malaria infection in children and the general population. The authors selected a dataset that contains 12,274 entries from 4,500 households.

Sonko et al. (2014) used simple and multiple logistic regressions and survey data analysis procedures to demonstrate a no statistically significant association between malaria parasitaemia and age ($p = 0.438$), sex ($p = 0.621$) and health region ($p = 0.133$) among children six to 59 months old. When Sonko et al. (2014) adjusted for sex, age, and health region, the likelihood of having malaria parasitaemia decreased with increasing wealth quintile. Children (six to 59 months old) from the second (OR = 0.42; 95% CI: 0.25; 0.73, $p = 0.002$), third (OR = 0.52; 95% CI: 0.29; 0.95, $p = 0.03$), fourth (OR = 0.27; 95% CI: 0.12; 0.61, $p = 0.002$) and richest (OR = 0.12; 95% CI: 0.05; 0.33, $p < 0.001$) quintiles were less likely to have malaria parasitaemia than children from the poorest quintiles. The same inverse relationship was noticed with poor walls (OR = 1.8; 95% CI: 1.1; 3.0, $p = 0.01$), floors (OR = 1.5; 95% CI: 1.0; 2.2, $p = 0.03$), roofs (OR = 1.6; 95% CI: 1.1; 2.3, $p = 0.01$), and windows (OR = 1.7; 95% CI: 1.3; 2.3, $p < 0.001$). The researchers noted that the inclusion of socio-economic component into the malaria control interventions will meaningfully reduce the burden of malaria in low SES communities.

Uzochukwu and Onwujekwe, (2004) investigation was a cross-sectional study to examine the socio-economic differences and health-seeking behavior for the diagnosis and treatment of malaria in Enugu state, Nigeria. The scholars probed how socio-economic differences and health-seeking behavior of 1549 female household primary care givers influence the choice of malaria diagnosis and treatment.

The authors used multiple regression analysis, chi-square tests and principal component analysis (PCA) to demonstrate that the trend for malaria diagnosis, from

commonest to least-commonest is self- diagnosis, laboratory tests, community health workers, family members and traditional healers. Further analysis revealed that patent medicine dealers were the first choice of malaria care; this was followed by government hospitals, the Bamako Initiative (BI) health centers, traditional medicine healers, private clinics, community health workers and "does nothing at home." Other research outcomes showed that poor households (low SES) preferred self-diagnosis to other methods while least poor (high SES) study participants used patent medicine dealers and community health workers less often.

Literature Related to Cohort Study

Chaponda et al. (2015) carried out a prospective cohort study to determine the prevalence and predictors of malaria parasitaemia among 1086 Zambian pregnant women who were followed up from their registration for ANC up until delivery. The independent variables were gravidity, age of pregnant woman, marital status, bednet ownership, bednet usage, wealth index and site of recruitment while dependent variable was malaria in pregnancy.

The Multivariate logistic regression analysis of the research data showed that PCR method is better than microscopy method in detecting malaria parasitaemia (PCR was 57.8%, 95% CI: 54.9–60.8; N = 1074; Microscopy was 31.8%, 95% CI: 29.0–34.5; N = 1079). The results equally revealed that HIV infection and site of recruitment are predictors of malaria parasitaemia. HIV-infected study participants had 46% greater risk of malaria parasitaemia than HIV-uninfected women (AOR = 1.46; 95% CI: 1.00–2.13, P = 0.045). Also, the risk of malaria infection in Nchelenge health center was 81% higher

in Kashikishi health center (AOR = 1.81; 95% CI: 1.38–2.37, P < 0.001). Other predictors of malaria infection from the univariate analysis (at P < 0.1) results include marital status, recruitment site, age, gravidity, wealth quintiles, bednet ownership, bednet usage, and HIV status. On the other hand, the multivariate analysis identified wealth quintile, HIV status and site of recruitment as predictors of malaria infection.

Mbu et al. (2014) administered a five-year nested longitudinal cohort study at tertiary level of Cameroon's healthcare delivery. The authors reviewed the socio-obstetrical characteristics of 2525 pregnant study participants that developed malaria parasitaemia between 2007 and 2011. The study participants were recruited at ANC booking and they received three doses of SP between 18-20 weeks, 26-28 weeks and 32-34 weeks of gestation.

According to Mbu et al. (2014) the research outcomes established low gravidity (OR 6.5, 95% CI: 3.8=11.3, P<0.0001); low parity (OR 4.6, 95% CI: 2.7-7.9, P<0.001) and primary level of education (OR 4.6, 95% CI: 2.8-7.9, P<0.001) as predictors of malaria in pregnancy. Other determinants of malaria in pregnancy from the study include pregnant women's age between 15-19 years (OR 5.5, 95% CI: 3.9-5.3, P<0.001), gestational age between 20-30 weeks (OR 6.8, 95% CI: 4.1-11.7, P<0.001) and more than ten weeks' interval between first and second SP (OR 5.5, 95% CI: 3.2-9.3, P<0.001).

Tusting et al. (2016) investigation was a cohort study on 318 children aged six months to ten years to examine the association between SES (described in the study as socioeconomic position, SEP), potential determinants and malaria in Nagongera, rural

Uganda. The participants were recruited from 100 households and followed up for 36 months.

In the analysis of research findings, the authors used principal component analysis (PCA) to create the wealth index from selected variables and then ranked the households into quartiles for a categorical measure of SEP. The authors used cross tabulations, Pearson's chi-square test, logistics regression, univariate Moran's I and univariate Anselin Moran's I to show the effects of the independent variables on the dependent variable. The Pearson's chi-square test and logistics regression analyses results, after controlling for age and gender, showed that children who live in modern house types had 49% lower odd of malaria parasitaemia than children who reside in traditional house types (AOR 0.51, 95% CI: 0.36– 0.71, P<0.001). Other analysis results revealed that the odds of malaria parasitaemia were 48% lower in wealthier children (high SES) than in poor children (low SES) (AOR 0.52, 95% CI: 0.35–0.78, P=0.001) and 36% lower in children with good food security (high SES) (AOR 0.64, 95% CI: 0.47–0.88, P= 0.007).

Literature Related to Literature Review Design

Tusting et al. (2013) conducted a systematic review and meta-analysis to evaluate whether SES has impact on malaria infection in children aged 0-15 years. In this systematic review and meta-analysis, Tusting et al. (2013) reviewed cross-sectional, case-control and cohort studies totaling 4696 publications. However, only 20 of the reviewed articles met the criteria for inclusion in the qualitative analysis. Fixed-effects meta-analysis and random-effects analysis results demonstrated a consistent trend of higher odds of malaria parasitaemia in poorest children (low SES) than in the least poor children

(high SES) (unadjusted OR 1·66, 95% CI: 1·35–2·05, p<0·001, I^2=68%; AOR 2·06, 95% CI: 1·42–2·97, p<0·001, I^2=63%). The scholars ended the systematic review and meta-analysis by noting that socioeconomic development should be fused into malaria control interventions for a more effective and sustainable outputs.

Summary and Conclusion

The literature review established current publications on malaria in pregnancy. Though most of the investigations highlighted malaria in children and malaria in the general population, some of the reviewed studies focused on malaria in pregnancy in Nigeria (Akaba et al., 2013; Ibe et al., 2015; Muhamad et al., 2016; Uzochukwu & Onwujekwe, 2004). While Sonko et al. (2014) in their systematic review and meta-analysis recorded mixed results on the association between SES and malaria, other scholars, in Nigeria and elsewhere, demonstrated inverse relationship between SES and malaria infection. The literature equally stressed the association between health-seeking behavior and malaria. Dixit et al. (2016) examined the relationship between health-seeking behavior and malaria in Kenya while Herdsman et al. (2016) and Uzochukwu and Onwujekwe, (2004) explored the effects of both SES and health-seeking behavior on malaria in Bangladesh and Nigeria respectively. None of these studies underscored malaria in pregnancy. More so, only Uzochukwu and Onwujekwe, (2004) conducted their investigation in Nigeria more than a decade ago. There is, therefore, limited research on the impact of SES and health-seeking behavior on malaria in pregnancy in Nigeria. This study will apply 2015 NMIS to determine the impact of SES and health-seeking behavior on malaria in pregnancy using the SCT model which will be the first of its kind in the

country. This cross-sectional study will clarify the distribution of malaria in pregnancy across the various socioeconomic and health-seeking behavior classifications in Nigeria.

Chapter 3 will include a description of the methodology and research design to explore the research questions, and the hypotheses mentioned hitherto, by examining the impact of SES and health-seeking behavior on malaria in pregnancy in Nigeria.

Chapter 3: Research Method

Introduction

The purpose of this study was to understand the impact of socioeconomic status and health-seeking behavior on the occurrence of malaria during pregnancy. Socioeconomic and behavioral variables are critical for pregnant women when malaria occur as they contribute to the sustenance of malaria parasitaemia in pregnancy and in the general population (Sonko et al., 2014). Unfortunately, these distal but primary causes of malaria are ignored in malaria control efforts in developing countries such as Nigeria (Dickinson et al., 2012). After the analysis of 2015 Nigeria Malaria Indicator Survey data, I measured the degree of the influence of SES and health-seeking behavior and determined the distribution of malaria in pregnancy along these independent variables. Other social demographic variables which might confound the research outcomes include age of pregnant women, gestational age, gravidity/parity, and marital status, region of residence, ethnicity, antenatal visits, religion, and coverage by health insurance. These possible confounders were controlled during data analysis.

The remaining part of this chapter includes the methodology, population, research design and its connection to the research questions in this study. This chapter will also discuss the data collection techniques, sampling and sampling procedures. The concluding part of this chapter will focus on threats to validity and ethical considerations.

Rationale and Research Design

There was limited knowledge on the impact of SES and healh seeking behavior on malaria in pregnancy in Nigeria. Uzochukwu and Onwujekwe (2004) posited that

sociocultural and behavioral variables predict the treatment options that are available to pregnant women when malaria occurs. Many other authors focused on other aspects of MiP such as knowledge, attitude, perception and burden of MiP (Dhiman et al., 2012; Ezebialu et al., 2012; Onyeneho et al., 2015; Rijken et al., 2012; Takem et al., 2013; Taylor et al., 2013); methods of malaria prevention and delivery outcomes (Muhammad et al., 2016); health hazards attributed to MiP (Wogu et al., 2013); benefits of ITN and IPTp (Yusuf et al., 2016); the level of coverage and access to LLIN and ACT amongst pregnant women and children below five years (Mbachu et al., 2012); and prevalence and high morbidity of MiP (Dhiman et al., 2012; Ezebialu et al., 2012; Gunn et al., 2015; Obianumba 2012; Rijken et al., 2012; Takem et al., 2012). None of these scholars investigated the association between SES, health-seeking behavior, and MiP. More so, at macro levels, the relationship between SES and malaria is well-known (Castro & Fisher, 2012; Dickinson et al., 2012; Ricci, 2012; Tusting et al., 2013). However, at micro levels, the asssociation between SES and malaria yielded mixed results (Sonko et al., 2014; Tusting et al., 2016).

This study employed a non-experimental, quantitative and cross-sectional secondary data analysis using data from 2015 Nigeria Malaria Indicator Survey. The population of study are the self-reported pregnant women who had malaria infection during the period of the survey. According to Creswell, (2009) cross-sectional studies examine the characteristics of a study population at a point in time. Though such studies are low in internal validity, their external validity is high such that the research outcomes can be generalized to the entire study population as long as the sample size is a

representation of the study population and the statistical power, alpha level and effect size are within normal range (Castro & Fisher, 2012; Frankfort-Nachmias & Nachmias, 2008). Cross-sectional studies do not present time and resource constraints. More so, the study utilized secondary data which facilitates timely completion. The application of cross-sectional strategy in this research is apt because it has the requisite capacity to either accept or reject (not accept) the null hypotheses of zero associaion between SES, health-seeking behavior and malaria in pregnancy among Nigeria women. However, it cannot establish cause-effect relationship (Castro & Fisher, 2012; Frankfort-Nachmias & Nachmias, 2008). The theoretical framework for this research will be Social Cognitive Theory (Bandura, 1986).

Research Questions and Hypothesis

This study focused on three research questions (RQs) in an attempt to understand the relationship between SES, health-seeking behavior and malaria in pregnancy among Nigeria women. The research questions and their corresponding hypothses are as folows:

Research Question 1: Is there an association between socioeconomic status and incidence of malaria in pregnancy among Nigerian women?

The independent variable is socioeconoimc status and the dependent variable is malaria incidence in pregnancy among Nigeria women. The socioeconomic status was quantified as income level (wealth index), educational level and occupation. The outcome variable is malaria in pregnancy. The covariates are age, ethnicity, antenatal visits, marital status, religion, coverage by health insurance and region of residence.

$H_0$1: There is no association between socioeconomic status and incidence of malaria in pregnancy among Nigerian women controlling for age, ethnicity, antenatal visits, marital status, religion, coverage by health insurance and region of residence.

H_a1: There is an association between socioeconomic status and incidence of malaria in pregnancy among Nigerian women controlling for age, ethnicity, antenatal visits, marital status, religion, coverage by health insurance and region of residence.

Research Question 2: Does socioeconomic status predict the choice of health-seeking behavior during malaria in pregnancy in Nigeria?

The independent variable is socioeconomic status while the outcome variable is health-seeking behavior. Health-seeking behavior is categorized as formal and informal. Formal health-seeking behavior consists of obtaining healthcare needs in a health facility with skilled healthcare workers while informal health-seeking behavior involves clients visiting herbalists, unskilled health workers, traditional birth attendants, and native doctors when illness occur. The covariates are age, ethnicity, antenatal visits, marital status, religion, coverage by health insurance and region of residence.

$H_0$2: **S**ocioeconomic status does not predict the choice of health-seeking behavior during malaria in pregnancy in Nigeria, controlling for age, ethnicity, antenatal visits, marital status, religion, coverage by health insurance and region of residence.

H_a2: **S**ocioeconomic status predicts the choice of health-seeking behavior during malaria in pregnancy in Nigeria, controlling for age, ethnicity, antenatal visits, marital status, religion, coverage by health insurance and region of residence.

Research Question 3: Are there differences in malaria incidence and different health-seeking behavior among pregnant women in Nigeria?

The independent variable is malaria incidence and the dependent variable is different health-seeking behavior (formal versus informal). The outcome variable is health-seeking behavior. The covariates are age, ethnicity, antenatal visits, marital status, religion, coverage by health insurance and region of residence.

$H_0$3: There is no difference in malaria incidence and different health-seeking behavior of pregnant women in Nigeria, controlling for age, ethnicity, antenatal visits, marital status, religion, coverage by health insurance and region of residence.

H_a3: There is difference in malaria incidence and different health-seeking behavior of pregnant women in Nigeria, controlling for age, ethnicity, antenatal visits, marital status, religion, coverage by health insurance and region of residence.

Methodology

Study Population Using Secondary Data

This study's participants were extracted from 2015 Nigeria Malaria Indicator Survey (NMIS) participants. The pregnant women in the surveys formed the study population. Nigeria's current population is estimated at 177.1 million based on an annual

growth rate of 3.2% (NMEP et al., 2016). Pregnant women constitute 5% of the total population. Quantitatively, the pregnant women in Nigeria were estimated at 8.9 million.

Research Setting and Sample

This study examined 2015 NMIS dataset. The National Malaria Elimination Program (NMEP) and the National Bureau of Statistics (NBS) joined the NPC to execute the 2015 NMIS. The dataset belongs to the NPC. The ICF International funded and offered technical assistance to implement the national survey through the United States Agency for International Development (USAID) funded DHS MEASURE program. The United States President's Malaria Initiative (PMI); the Global Fund to Fight AIDS, Tuberculosis, and Malaria; and the United Kingdom Department for International Development (DFID) through the Support to National Malaria Program (SuNMaP) provided extra funding for the NMIS 2015. Other partners who provided technical assistance for the conduct of the survey include the World Health Organization (WHO), United Nations Children's Fund (UNICEF), and Society for Family Health (SFH).

The 2015 NMIS was the second malaria indicator survey in Nigeria; the target populations for this survey were women of reproductive age (15-49 years) and children between the ages 0-59 months. The pregnant women who tested positive to malaria rapid diagnostic (RDT) test formed part of the study's participants. The baseline survey was conducted in 2010 (NMEP et al., 2016). The main aim of the 2015 NMIS was to provide information on malaria indicators and malaria prevalence at the national level, the 36 states and the Federal Capital Territory (NMEP et al., 2016). The survey questions focused on household characteristics, respondent's background, reproduction, pregnancy,

IPTp, fever in children, and knowledge of malaria. The hemoglobin level was measured and blood was tested for malaria among children age 6-59 months. The children that tested positive for malaria were treated according to national guidelines (NMEP et al., 2016). The 2015 NMIS was designed to evaluate the 2009-2013 National Malaria Strategic Plan (NMSP) goals and targets and to prompt the monitoring and evaluation of Nigeria's National Malaria Elimination Programme in the next 10 years (NMEP et al., 2016).

The 2015 NMIS was conducted from October to November 2015 with a nationally representative sample of more than 8,000 households in 329 clusters (NMEP et al., 2016). The survey participants included all women between the ages of 15-49 in the selected households. The women were asked questions on their knowledge and prevention of malaria during pregnancy and treatment of fever among their children. Children between the ages of 6-59 months were tested for anemia and malaria using finger- or heel-prick blood samples (NMEP et al., 2016). In addition, thick blood smears and thin films were made in the field and transported to the African Network for Drugs and Diagnostics Innovation (ANDI) Center of Excellence for Malaria Diagnosis, College of Medicine, University of Lagos. Children that tested positive for malaria were treated according to national guidelines. Similarly, the parents or guardians of children with a hemoglobin level below 8 g/dl were directed to the nearest health facility for follow-up care and were given a referral letter with the hemoglobin reading to show staff at the health facility (NMEP et al., 2016). ANDI center conducted microscopic examination of

the slides to confirm the presence of malaria parasites and to identify the parasites species. The test results were validated by the University of Calabar Teaching Hospital.

The 2015 Survey Implementation Committee (SIC), made up of 22 technical officers from survey implementing agencies and other development partners, coordinated the survey activities. The quality of the collected data was validated by 19 quality control officers who ensured that field staff complied with the instructions in the data collection protocol. They sampled four households in chosen clusters to double-check responses and coverage (NMEP et al., 2016).

Sample and Sampling Strategy

Nigeria adopts a four-tier administrative units in the following descending order of complexity and population: national, states, LGAs and wards (NPC & ICF International, 2014). The states are aggregated to form the six geo-political zones. The NPC further divided the wards into enumeration areas (EAs).

The NMEP designed the 2015 NMIS to provide data for the country, the six geo-political zones, the urban and rural areas, the 36 states and the FCT. It adopted the sampling frame of the 2006 National Population and Housing Census (NMEP et al., 2016). Although the sampling frame utilized the administrative sub-divisions in Nigeria (national, states, LGAs and localities), it further divided the localities into EAs. The primary sampling unit (PSU), referred to as a cluster for the 2015 NMIS, was defined on the basis of EAs from the 2006 EA census frame (NMEP et al., 2016).

The 2015 NMIS implemented a two-stage sampling approach. In the first stage, a national representative 333 clusters (EAs) were selected (nine each from all the 36 states

and FCT). The urban and rural areas had 138 and 195 clusters respectively. From June to July 2015, the field staff developed the sampling frame by mapping all the households in the 333 clusters in the country. The NPC enumerators used GPS receivers to document the coordinates of the 2015 NMIS sample clusters (NMEP et al., 2016). In the second stage, the field staff selected 25 households per cluster by equal probability systematic sampling (NMEP et al., 2016). The survey focused on women between the ages of 15-49 years who were permanent residents in the households or visitors who were present the previous night before the survey. The sample size for the 2015 NMIS was 8,028 which translated to 1,333 women in each of the six geo-political zones or approximately 217 women in each of the 36 states and FCT (NMEP et al., 2016).

The 2015 NMIS used household questionnaires, woman's questionnaires and biomarker questionnaires to execute the survey. Apart from administering the questionnaires in the English language, three other versions of the questionnaires were developed in Hausa, Igbo and Yoruba languages to facilitate comprehension in the rural areas. The questionnaires were programmed on tablet computers, and interviewers administered the questionnaires using computer-assisted personal interviewing (CAPI) (NMEP et al., 2016).

The contents of the household questionnaires include line-list of all the usual members and visitors in the selected households, demographic information of the listed households' members, and characteristics of the household's dwelling units such as ownership and use of mosquito nets, source of water, materials used for the floor of the

house and type of toilet facilities. Data on age and sex were used to choose for the individual interview (NMEP et al., 2016).

The woman's questionnaires were administered on all women from 15-49 years. The collected data include background characteristics, ANC and malaria prevention during pregnancy and most recent birth, malaria prevention and treatment, and knowledge about malaria (symptoms, causes, prevention, drugs used in treatment) (NMEP et al., 2016). The biomarker questionnaires documented the results of the anemia and malaria testing as well as the signatures of the fieldworker and the study participants who gave consent.

Survey Teams and Questionnaires

About 37 interviewing teams were involved in the data collection for the 2015 NMIS. Each team had five members: a supervisor, two interviewers (one of whom was a nurse), a laboratory scientist, and a driver. Also 19 field coordinators and two central coordinators from NMEP, NPC, NMEP, and other RBM partners coordinated and supervised fieldwork activities (NMEP et al., 2016). The field teams used blood from finger (or heel) prick and SD BIOLINE Malaria Ag P.f (HRP-II)™ (Standard Diagnostics, Inc.) RDT kits to test for P. falciparum in the collected blood sample (NMEP et al., 2016). P. falciparum is the primary cause of malaria in Nigeria. Furthermore, thick and thin blood smears were prepared in the field. Each blood smear slide had a duplicate bar code and was adequately marked for identification (NMEP et al., 2016). The slides were dried in a dust-free environment and stored in slide boxes. The laboratory scientists prepared the thin smears at the end of every day by dipping the

slides in absolute methanol. The thick and thin smear slides and completed questionnaires (hard copies) were gathered from the field and moved to zonal staining centers. Subsequently, they were shipped to the ANDI Center of Excellence for Malaria Diagnosis, College of Medicine, University of Lagos for logging and microscopic reading (NMEP et al., 2016). Thick smears were first used to identify the presence of Plasmodium infection and then the thin smears for all positive thick smears were used to determine the Plasmodium parasite species (NMEP et al., 2016).

The household and individual response rates for the 2015 NMIS were 98.8% (7,745 out of 7,841) and 99.1% (8,034 out of 8,106) respectively. A total of 8,148 households were selected for the sample. During the survey, about 7,841 were occupied. The response rate among households in rural areas was 99% whereas the response rate in urban areas was 98%. The response rate among eligible women in urban and rural areas did not differ by residence (NMEP et al., 2016).

Data Entry and Validation

The electronic copies of the 2015 NMIS questionnaires were programmed onto tablet computers that are equipped with Bluetooth software to facilitate electronic transfer of files. Field teams transferred completed questionnaires to the team's supervisor for onward daily delivery to the central data processing office using the Internet. The survey data officials used CSPro software program for data editing, weighting, cleaning, and tabulation. The received data were checked for data discrepancies and outliers. Data editing and cleaning focused on structure and internal consistency checks to ensure completeness of work in the field (NMEP et al., 2016).

Power Analysis

Frankfort-Nachmias and Nachmias, (2008) documented a two-tailed, 95% confidence interval for studies to establish associations between variables if they existed. Statistical power is the likelihood of identifying a real effect. Mathematically, statistical power is notated as one minus beta (1-β) (Laureate Education, 2013). According to Ellis (2010), a statistical power of 0.8 is satisfactory to reject the null hypotheses. In other words, a study is scientifically acceptable if it has 80% chance of detecting the effects of the independent variables on the dependent variable. The failure of a research to reject null hypotheses is referred to as a type II error (Frankfort-Nachmias & Nachmias, 2008). The statistical power of a study is defined by sample size, the alpha level, and the effect size (Sullivan, 2012).

Effect size measurements are used to compare the magnitude of experimental treatments from one experiment to another (Laureate Education, 2013). Effect size is an easy method of calculating the difference between two groups; it has many demonstrated benefits over the single use of tests of statistical significance (p value). Effect size focuses on the size of the difference rather than confounding this with sample size (Sullivan, 2012). Typically, the preferred statistical analysis determines the degree of the effect size. For instance, Cohen's conventions for effect size for the F test are .10 for a small effect size, .25 for a medium effect size, and .40 for a large effect size (Laureate Education, 2013).

An alpha level of 0.05 and a medium effect size of 0.5 are universal in *z-test* logistics regression analysis (Sullivan, 2012). A 5% Alpha level typifies a one in twenty

times chance of rejecting null hypotheses. Alpha level is also referred to as the level of significance. A G*Power 3.1.9.2 software was used to compute the sample size using 0.8 statistical power, 0.05 alpha level, and a medium effect size of 0.5 (Faul, Erdfelder, Lang, & Buchner, 2007). Accurate sample size determination is essential for adequate representation of the study population. The A priori G*Power calculation showed that the minimum sample size that is required in this study is 473.

Assumptions

A fundamental assumption in this study was that the dependent variable was categorical and dichotomous (Park, 2005). Furthermore, the other assumptions were that there were no multicollinearity, no substantial outliers, and the data were normally distributed (Frankfort-Nachmias & Nachmias, 2008).

Selection Criteria

The sample size of this dissertation consisted of pregnant women between the ages of 15-49 years in randomly selected households across Nigeria. The malaria status of the pregnant women was categorized as *yes* and *no*.

Data Storage and Access

Although the NPC and NMEP, in collaboration with NBS and other development partners, anchored the implementation of the 2015 NMIS, the DHS Program is a repository of the NMIS datasets. These datasets are available for scholars' use. Dataset access was facilitated by formal online application to the DHS program (Azunia, 2017). The website demanded online submission of the study's title, abstract and researcher's

demographic characteristics. Access was granted within 24 hours of submitting the request. The letter of approval to use the datasets will be affixed at the Appendix section.

Instrumentation

This researcher extracted the study variables from the 2015 NMIS datasets for Nigeria. The datasets are domiciled in the public domain under the control of the DHS Program. The datasets gathered nationally representative samples from all the 36 states and the FCT in Nigeria. The reliability and validity of the datasets are high on the premise that they are national datsets and collected countrywide representative samples (Bower et al., 2016).

The use of secondary data in this study reduced the financial burden that primary data collection would have necessitated. In addition, this researcher spent less time to obtain necessary approvals to use the datasets. The datasets were compiled by the NPC and NMEP in association with ICF International, government ministries and agencies, NBS and other development partners. The 2015 NMIS was preceded by the maiden malaria indicator survey in Nigeria in 2010 (NMEP et al., 2016).

The 2015 NMIS dataset is appropriate for this study because it contains relevant statistics and it is the most recent malaria indicator survey that could be applied to answer research questions on the impact of SES and health-seeking behavior on MiP in Nigeria. The dataset provides updated information on household characteristics, participants' demographic data, malaria indicators and malaria prevalence, reproductive, maternal and child health (RMCH), health-seeking behavior, and MiP. Other useful variables in the dataset include intermittent preventive treatment, fever in children, hemoglobin level

among children from 6-59 months, and knowledge of malaria, adult and childhood mortality, anthropometric characteristics of women and children under five years, and domestic violence (NMEP et al., 2016).

Researchers Azunia, (2017) and Odekina, (2015) had used similar datasets to conduct studies in Cameroon and Nigeria respectively. Azunia, (2017) applied 2011 Cameroon Demographic and Health Survey to investigate the proper use of ITNs and antimalarial drugs and the roles of education and SES in malaria prevention and control efforts in rural Cameroon. The author employed a quantitative cross-sectional study design and the socioecological framework to explore the associations between the independent and dependent variables. The research outcomes revealed that there were significant association ($p<0.05$) between SES and health-seeking behavior; education and proper use of antimalarial drugs; proper use bednets and malaria prevalence among children that are less than five years old, and healthcare preference and malaria treatment outcomes among children under 5 and pregnant women (Azunia, 2017). Likewise, Odekina, (2015) merged 2008 NDHS and 2013 NDHS to assess how SES, nutritional status, literacy/educational level, access to household sanitation facilities modified the life expectancy of the women of Edo State, Nigeria. The scholar grouped the independent variables as social determinants. Azunia, (2017) and Odekina, (2015) also used quantitative cross-sectional study designs in their surveys. SCT and selected constructs of health belief model were employed in the study. Regression analysis results showed that employment was the best predictor of life expectancy. Other variables that had positive effects on life expectancy were type of place of residence, persons responsible for

decisions on reproductive health issues and listening to the radio (Odekina, 2015). The 2015 NMIS dataset is, therefore, a suitable secondary source of data for my dissertation.

Operationalization of Variables

Dependent Variable

The dependent variable in this research is malaria in pregnancy which is a categorical variable. This study investigated the pregnant participants. The RDT results for malaria were categorized as positive or negative.

Independent Variables

The primary independent variables in this research project were SES and health-seeking behavior. SES was an ordinal categorical variable since it provided good information about the order of choices; the variable had natural and ordered categories and the distances between the categories were unknown (Agresti, 2013). SES in this dissertation is defined by income level (wealth index), education level and occupation. The wealth index is a categorical variable classified as poorest, poorer, middle, richer and richest (NMEP et al., 2016). The education level is an ordinal categorical variable that has a particular order (Frankfort-Nachmias & Nachmias, 2008). The health-seeking behavior was captured as “place first sought treatment” in the malaria indicator survey dataset. Health-seeking behavior is an ordinal categorical variable with exact order (Frankfort-Nachmias & Nachmias, 2008).

Covariates

The covariates are age of pregnant women, gestational age, ethnicity, antenatal visits, marital status, religion, coverage by health insurance, type of health insurance,

geopolitial region and region of residence. These covariates have been shown in similar studies to affect the research results. Table 3 shows the study variables, their levels of measurement and their designations.

Table 2

Variables in the Study

S/n	*Label*	*Level of Measurement*	*Role of Variable*	*Research Question*
1	*Malaria in pregnancy*	*Dichotomous*	*Dependent*	*RQ1, RQ3*
2	*Income level*	*Continuos*	*Independent*	*RQ1, RQ2*
3	*Highest education level*	*Categorical*	*Independent*	*RQ1, RQ2*
4	*Occupation*	*Categorical*	*Independent*	*RQ1, RQ2*
5	*Wealth index*	*Categorical*	*Independent*	*RQ1, RQ2*
6	*Place first sought treatment for fever*	*Categorical*	*Independent*	*RQ2 RQ3*
7	*Ethnicity*	*Categorical*	*Covariate*	*RQ1, RQ2, RQ3*
8	*Antenatal clinic visit*	*Categorical*	*Covariate*	*RQ1, RQ2, RQ3*
9	*Marital status*	*Categorical*	*Covariate*	*RQ1, RQ2, RQ3*
10	*Religion*	*Categorical*	*Covariate*	*RQ1, RQ2, RQ3*
11	*State of residence*	*Categorical*	*Covariate*	*RQ1, RQ2, RQ3*
12	*Region of residence*	*Categorical*	*Covariate*	*RQ1, RQ2, RQ3*
13	*Type of place of residence*	*Dichotomous*	*Covariate*	*RQ1, RQ2, RQ3*
14	*Place of delivery*	*Categorical*	*Covariate*	*RQ1, RQ2, RQ3*
15	*Coverage by health insurance*	*Dichotomous*	*Covariate*	*RQ1, RQ2, RQ3*
16	*Type of health insurance*	*Categorical*	*Covariate*	*RQ1, RQ2, RQ3*
17	*Age of pregnant woman*	*Continuous*	*Covariate*	*RQ1, RQ2, RQ3*
18	*Number of pregnant women*	*Continuous*	*Descriptive statistics*	

Data Analysis Plan

This study will employ multinomial logisics regression, (a component of International Business Machine [IBM] Statistical Package for Social Sciences, [SPSS]) version 24, to answer the research questions and examine the hypotheses. The regression model data analysis will focus on the association of the predictor variables - SES and health-seeking behavior - on MiP in Nigeria. This study will be performed at 95%

confidence interval and 80% power (Faul et al., 2007). A 5% level of significance will be used in the research to test the likelihood of rejecting the null hypothesis.

Descriptive statistical analysis will be carried out to show the age distinction and distribution of MiP among the geopolitical regions in the country. This will support a policy focus on balancing the health inequities and access to malaria prevention techniques and behaviors among pregnant women when malaria occur (Chege, 2018). Inferential statistical analysis will be conducted to confirm that the associations between the predictor variables and outcome variable are not due to chance (Frankfort-Nachmias & Nachmias, 2008).

The 2015 NMIS dataset was screened for missing data, outliers and linearity (Frankfort-Nachmias & Nachmias, 2008). According to Forthofer et al. (2007) and Frankfort-Nachmias and Nachmias, (2008) any data that is three standard deviations below or above the mean can be classified as an outlier. However, Leys et al. (2013) posited that outliers can be identified at two and half times below or above the standard deviation. Missing data will be labeled as "missing data" for exact analysis of the observed relationships between the variables (Little et al., 2013) while outliers and illogical data will be removed (Odekina, 2015). This dissertation needs a minimum sample size of 473 for a multivariate logistics regression model with a noncentrality parameter of 2.8073471, a critical *t* of 1.9650459, and a degree of freedom of 468. There were four predictors in the analysis. For this study, I intend to use all the relevant secondary data from 2015 NMIS dataset as study samples (Odekina, 2015).

Data Analysis Plan for Individual Research Questions

Data analysis plans for the research questions and the hypotheses are illustrated below:

Research Question 1: Is there an association between socioeconomic status and incidence of malaria in pregnancy among Nigerian women?

The independent variable was socioeconoimc status and the dependent variable was malaria incidence in pregnancy among Nigeria women. The socioeconomic status was quantified as income level (wealth index), educational level and occupation. The moderator variables were income (wealth index), education level and occupation. The outcome variable is malaria in pregnancy. The covariates were age, ethnicity, antenatal visits, marital status, religion, coverage by health insurance and region of residence.

$H_0 1$: There is no association between socioeconomic status and incidence of malaria in pregnancy among Nigerian women controlling for age, ethnicity, antenatal visits, marital status, religion, coverage by health insurance and region of residence.

$H_a 1$: There is an association between socioeconomic status and incidence of malaria in pregnancy among Nigerian women controlling for age, ethnicity, antenatal visits, marital status, religion, coverage by health insurance and region of residence.

Data analysis plan for Research Question 1. The multivariate logistic regression was used to examine the association between selected socioeconomic status variables (education, wealth index/income, and occupation) and the incidence of MiP among Nigerian women.

Research Question 2: Does socioeconomic status predict the choice of health-seeking behavior during malaria in pregnancy in Nigeria?

The independent variable was socioeconomic status while the outcome variable was health-seeking behavior. Income (wealth index), education level and occupation formed the moderator variables. Health-seeking behavior was categorized as formal and informal. Formal health-seeking behavior consisted of obtaining healthcare needs in a health facility with skilled healthcare workers while informal health-seeking behavior involved clients visiting herbalists, unskilled health workers, traditional birth attendants, and native doctors when malaria occur. The covariates are age, ethnicity, antenatal visits, marital status, religion, coverage by health insurance and region of residence.

$H_0$2: **S**ocioeconomic status does not predict the choice of health-seeking behavior during malaria in pregnancy in Nigeria, controlling for age, ethnicity, antenatal visits, marital status, religion, coverage by health insurance and region of residence.

H_a2: **S**ocioeconomic status predicts the choice of health-seeking behavior during malaria in pregnancy in Nigeria, controlling for age, ethnicity, antenatal visits, marital status, religion, coverage by health insurance and region of residence.

Data analysis plan for Research Question 2. The multivariate logistic regression will be used to test the significance of selected socioeconomic status variables (education, wealth index/income, and occupation) on health-seeking behavior among pregnant women when malaria occurs.

Research Question 3: Are there differences in malaria incidence and different health-seeking behavior among pregnant women in Nigeria?

The independent variable is malaria incidence and the dependent variable is different health-seeking behavior (formal versus informal). The outcome variable is health-seeking behavior. The covariates are age, ethnicity, antenatal visits, marital status, religion, coverage by health insurance and region of residence.

$H_0$3: There is no difference in malaria incidence and different health-seeking behavior among pregnant women in Nigeria, controlling for age, ethnicity, antenatal visits, marital status, religion, coverage by health insurance and region of residence.

H_a3: There is difference in malaria incidence and different health-seeking behavior among pregnant women in Nigeria, controlling for age, ethnicity, antenatal visits, marital status, religion, coverage by health insurance and region of residence.

Data analysis plan for Research Question 3. The multivariate logistic regression will be used to test the significance of the difference in malaria incidence and different health-seeking behavior among pregnant women when malaria occurs.

Validity

External

The external validity of a study expresses generalizability of research results and representativeness of sample settings and proceedures (Aronson et al., 2007; Creswell, 2008). The use of nationally representative samples during the 2015 NMIS survey and

the random sampling technique applied for data collection confer high external validity. The research outcomes can be generalized beyond the study population.

Internal

A study is high in internal validity if the observed effects on the outcome variable are solely due to the manipulations of the predictor variables. Scholars make wrong conclusions if their studies are low in internal validity (Pourhoseingholi, Baghestani, & Vahedi, 2012). Confounders lower internal validity by combining with the predictor variables to cause the observed effects on the dependent variable (Green & Salkind, 2014). The use of secondary datasets in this study limits the threat to internal validity as causal inferences will not be examined. However, statistical methods will be used to adjust for the effects of possible confounders (Pourhoseingholi et al., 2012).

Ethical Considerations

This dissertation was authorized by Walden University IRB before the data could be examined to ensure the protection of participants' rights. The 2015 NMIS datasets are available in the public domain for research purposes when the requisite authorization is granted. This research did not constitute biological or physical harm to study participants. Nonetheless, all personal identifiers and demographic details of the participants were deleted to protect the identity of the study participants.

Summary

Chapter 3 focused on the methodology that was used in this research. This study was a cross-sectional secondary data analysis from the 2015 NMIS datasets. A quantitative design was used to examine the impact of SES and health-seeking behavior

on MiP in Nigeria. The study involved a nationally representative sample and thus, would be generalizble in Nigeria. Chapter 4 will discusss data collection and results of the analysis.

Chapter 4: Results

Introduction

The purpose of the study was to understand how SES and health-seeking behavior predict malaria in pregnancy in Nigeria. Secondary data from 2015 Nigeria Malaria Indicator Survey was used in a cross-sectional survey and quantitative research methods to study the gap in knowledge. Multivariate logistics regression was used to examine the variations of the intervention variable (SES – income level/wealth index, educational level and occupation and health-seeking behavior (formal and informal). The region of residence, religion, and the nearest health facility type were also evaluated as covariates in the multivariate logistics regression. These covariates were indicated because they are the environmental components of the construct of SCT. However, the type of the nearest health facility was not examined because it was not represented in the dataset. Other possible confounders that were described include age, ethnicity, antenatal visits, marital status, and coverage by health insurance.

Chapter 4 presented an analysis of data performed with IBM SPSS Statistic 24 software to answer the research questions and hypothesis as shown below:

Research Question 1**:** Is there an association between socioeconomic status and incidence of malaria in pregnancy among Nigerian women?

$H_0$1**:** There is no association between socioeconomic status and incidence of malaria in pregnancy among Nigerian women controlling for age, ethnicity, antenatal visits, marital status, religion, coverage by health insurance and region of residence.

H_A1: There is an association between socioeconomic status and incidence of malaria in pregnancy among Nigerian women controlling for age, ethnicity, antenatal visits, marital status, religion, coverage by health insurance and region of residence.

Research Question 2: Does socioeconomic status predict health-seeking behavior during malaria in pregnancy in Nigeria?

H_02: **S**ocioeconomic status does not predict health-seeking behavior during malaria in pregnancy in Nigeria, controlling for age, ethnicity, antenatal visits, marital status, religion, coverage by health insurance and region of residence.

H_A2: **S**ocioeconomic status predicts health-seeking behavior during malaria in pregnancy in Nigeria, controlling for age, ethnicity, antenatal visits, marital status, religion, coverage by health insurance and region of residence.

Research Question 3: Are there differences in malaria incidence and different health-seeking behavior among pregnant women in Nigeria?

H_03: There is no difference in malaria incidence and different health-seeking behavior among pregnant women in Nigeria, controlling for age, ethnicity, antenatal visits, marital status, religion, coverage by health insurance and region of residence.

H_A3: There is difference in malaria incidence and different health-seeking behavior among pregnant women in Nigeria, controlling for age, ethnicity, antenatal visits, marital status, religion, coverage by health insurance and region of residence.

In this chapter, I also discussed data collection and baseline descriptive and demographic characteristics of the sample. The descriptive statistics that illustrate the

sample and the statistical analysis findings, organized by research questions and hypotheses, also form integral part of this chapter.

Data Collection

The 2015 Nigeria Malaria Indicator Survey (NMIS) data was used in this study. The 2015 NMIS contains variables that are needed in this study. These variables include formal and informal health-seeking behavior, income level/wealth index, education level and occupation. The dataset also has information on the study's covariates such as the region of residence, religion, the nearest health facility type, age, ethnicity, antenatal visits, marital status, and coverage by health insurance.

The 2015 NMIS data is available in the public domain. I made a request to the DHS program and provided the title and the abstract of the study. The permission to use the data was granted to me. The approval letter is in Appendix section.

The samples for the 2015 NMIS were collected during October and November 2015 in a nationally representative sample of more than 8,000 households in 329 clusters (NMEP et al., 2016). The 2015 NMIS provided information on the entire country, the rural and urban areas, the six geopolitical regions, the Federal Capital Territory Abuja and the 36 states of Nigeria. The 2006 National Population and Housing Census (NPHC) formed the sampling frame for the 2015 NMIS (NMEP et al., 2016). Each locality in Nigeria was divided into enumeration areas (EA) during the 2006 population census. The 2006 census enumeration area formed the framework for creating primary sampling unit (PSU), referred to as a cluster for the 2015 NMIS. A two-stage sampling strategy was used to implement the 2015 NMIS. In the first stage, 333 clusters were nationally

selected. A total of nine clusters (EAs) were selected from each state, including the Federal Capital Territory. The resulting samples from all the EAs were nationally representative. Line listing of all the households and mapping of all the clusters was conducted in June and July 2015 using the global positioning systems (GPS) to document the coordinates of the clusters. The resulting list of households served as the sampling frame for the second stage (NMEP et al., 2016).

Twenty-five households were chosen in each cluster by equal probability systematic sampling during the second stage of selection process. All women who were between the ages of 15-49 and who either resided in the household or visitors present in the households on the night before the survey were interviewed (NMEP et al., 2016). The sample size for the 2015 NMIS was 8034, about 1,339 from each of the six geopolitical zones in Nigeria.

Three questionnaires were used during the 2015 NMIS: household, women's and biomarker questionnaires (NMEP et al., 2016). The household questionnaire collected basic information on the demographic characteristics of the listed persons, including age, sex, education, relationship to the head of the household and the characteristics of the household dwelling unit; the woman's questionnaire gathered data from women (15-49 years) on background characteristics, birth history and childhood mortality, ANC and malaria prevention for most recent birth and pregnancy, malaria prevention and treatment and knowledge about malaria (symptoms, causes, prevention, drugs used in treatment) (NMEP et al., 2016). Lastly, the biomarker questionnaire documented the results of the

anemia and malaria tests; it also kept details of the signatures of the respondents who have informed consent and the fieldworker.

Rationale for Using Malaria Indicator Survey Data

The 2015 Malaria Indicator Survey data has high internal and external validity values. The internal validity is high because the observed survey results can be attributed to the studied risk factors and the applied interventions in the survey (NMEP et al., 2016). The high internal validity is informed by the robust processes to control confounders, information bias and the effects of time such as history and maturation. Likewise, the external validity is high due to the nationally representative quality of the survey samples, thus, the research findings are relevant and can be generalized to other populations, locations and times. The two-stage sampling strategy (random sampling and equal probability systematic sampling techniques) in the survey addressed possible selection bias. The large sample size in demographic health surveys provides an opportunity for diverse research topics (Azunia, 2017) and data manipulations to address varied research interests.

Data Exclusion

All cases with missing data were excluded from analysis. The total sample size for the 2015 NMIS was 8,034 which translated to 1,339 women in each of the six geo-political zones or approximately 217 women in each of the 36 states and FCT (NMEP et al., 2016). However, only 4,444 of the women were pregnant during the survey period. All non-pregnant women were excluded from the study. The A priori G*Power calculation showed that the minimum sample size that is required in this study is 473.

Descriptive Statistics

There were 4,444 pregnant women out of 8,034 women in the 2015 Malaria Indicator Survey. Table 3 shows the mean, standard deviation with standard error, minimum and maximum values for age and number of ANC visit of the study participants. The mean age of the pregnant women was 27.29 with a standard deviation of ±6.90 whereas it was 4.48 with a standard deviation of ±5.65 for number of ANC visits.

Table 3

Age and Number of ANC Visit

Variable	Mean±STD	S.E	Min	Max	Total
Age	27.29±6.90	0.1	15	49	4423
Number ANC Visit	4.48±5.65	0.1	0	30	3125

Table 4 shows that the north had 3,094 (69.6%) pregnant women while the south had 507 (11.4%) participants. Study participants from the west represented 11.1% (492) whereas 351 (7.9%) of the pregnant women were from the eastern part of Nigeria. Of all the pregnant women in the study, 2979 (67%) were from the rural areas whereas 1402 (31.5%) were urban women. The largest proportion of pregnant women had no education 47% (2089), with pregnant women who had secondary education coming second with 27.7% (1231). The remaining study participants had primary education (n = 845, 19%) and tertiary education (n = 279, 6.3%). Most of the pregnant women in the study were employed (n = 2113, 47.5%). The unemployed and self-employed participants represented 34.7% (1541) and 17.5% (776) respectively. Up to 96.7% (4296) of the study

participants were either married or co-habiting with their partners while 104 (2.3%) were single. Only 44 (1%) of the pregnant women were divorced/separated/widowed.

Table 4

Descriptive Statistics of Variables

Variable	Frequency	Percent (%)	Weighted Percent (%)
Region of Residence			
North	3094	69.60	69.60
South	507	11.40	11.40
East	351	7.90	7.90
West	492	11.10	11.10
Type of Residence			
Rural	2979	67.00	68.00
Urban	1402	31.50	32.00
Missing	63	1.4	
Educational Level			
None	2089	47.00	47.00
Primary	845	19.00	19.00
Secondary	1231	27.70	27.70
Tertiary	279	6.30	6.30
Occupation			
Unemployed	1541	34.70	34.80
Employed	2113	47.50	47.70
Self Employed	776	17.50	17.50
Missing	14	0.30	
Marital Status			
Single	104	2.30	2.30
Married/Cohabiting	4296	96.70	96.70
Divorce/Separated/Widowed	44	1.00	1.00

Table 5 shows that Islam and Christianity recorded the highest number of adherents 60.8% (2702) and 37.5% (1668) respectively. Only about 1.3% (58) of the participants were traditional believers and other religions. Pregnant women from other ethnic groups, other that the three major ethnic groups of Hausa, Igbo and Yoruba, in

Nigeria, recorded the highest number of participants 47.2% (2096). This was followed by the Hausa (*n*=1479, 33.3%), Igbo (*n*=438, 9.9%) and Yoruba (*n*=431, 9.7%) in order of decreasing frequency. Almost all the pregnant women 4346 (97.8%) did not have health insurance coverage whereas study participants that were enrolled in the national health insurance scheme and missing data represented 76 (1.7%) and 22 (0.5%) respectively. About 38.7% (1632) of the study participants were not pregnant while 32.3% (1361) were pregnant during the survey. Missing data accounted for 29% (1221). The distribution of formal and informal health-seeking behavior in pregnancy were 991 (23.5%) and 1648 (39.1%) respectively. The missing data was 37.4% (1575) of the study population. The study participants' health-seeking behavior during malaria in pregnancy were formal (*n*=591, 14%), informal (*n*=742, 17.6%) and missing data (*n*=2881, 68.4%). Pregnant women in the poorer category of wealth index accounted for 23.7% (1052) followed by those in the poorest group 23.1% (1028) and middle class 19.5% (866). Pregnant women in the richer classification were fourth with 18.6% (828) while those in the richest group formed 15.1% (670) of the study population.

Table 5

Descriptive Statistics of Variables

Variable	Frequency	Percent (%)	Weighted Percent (%)
Religion			
Christianity	1668	37.50	37.70
Islam	2702	60.80	61.00
Traditional/Others	58	1.30	1.3
Missing	16	0.40	
Ethnicity			
Hausa	1479	33.30	33.30
Igbo	438	9.90	9.90
Yoruba	431	9.70	9.70
Others	2096	47.20	47.20
Health Insurance			
Yes	76	1.70	1.70
No	4346	97.80	98.3
Missing	22	0.50	
Malaria in Pregnancy			
No	1632	38.7	54.5
Yes	1361	32.3	45.5
Missing	1221	29.0	
Health-seeking Behavior in Pregnancy			
Formal	991	23.5	37.6
Informal	1648	39.1	62.4
Missing	1575	37.4	
Health-seeking Behavior in Malaria in Pregnancy			
Formal	591	14.0	44.3
Informal	742	17.6	55.7
Missing	2881	68.4	
Wealth Index			
Poorest	1028	23.10	23.10
Poorer	1052	23.70	23.70
Middle	866	19.50	19.50
Richer	828	18.60	18.60
Richest	670	15.10	15.10

Table 6 shows the outputs of Multicollinearity analysis. The values of "Condition Index", "Eigen Value", "Tolerance" and "Variance Inflation Factor (VIF)" were within acceptable limits and depicted no correlation among the independent variables or with a combination of two or more other independent variables. In research question one analysis, the VIF for wealth index was 1.821 whereas it was 1.846 and 1.026 for educational level and occupation respectively. The VIF estimates for wealth index, educational level and occupation in research question two were 1.652, 1.667 and 1.013 respectively. A VIF of 1.00 for malaria in pregnancy showed no correlation with independent variable in research question three.

Table 6

Multicollinearity Analysis

	Eigenvalue	Condition Index	Tolerance	VIF
RQ 1				
Constant	3.399	1.000		
Wealth Index	0.434	2.800	0.549	1.821
Educational Level	0.113	5.497	0.542	1.846
Occupation	0.055	7.889	0.974	1.026
RQ 2				
Constant	3.525	1.000		
Wealth Index	0.328	3.279	0.605	1.652
Educational Level	0.100	5.924	0.600	1.667
Occupation	0.047	8.705	0.987	1.013
RQ 3				
Constant	1.916	1.000		
Malaria in Pregnancy	0.084	4.788	1.000	1.000

To test the hypothesis that there is an association between socioeconomic status and incidence of malaria in pregnancy among Nigerian women, a cross tabulation was performed as shown in Table 7. The results of the Chi-square analysis revealed a

significant association between socioeconomic status and malaria in pregnancy. Socioeconomic status was characterized by wealth index [X^2 (4, N = 3,141) = 264.90, p = 0.00]; Education [X^2 (3, N = 3,141) = 243.67, p = 0.00] and occupation [X^2 (2, N = 3,129) = 18.03, p = 0.00]. The percent who had malaria in pregnancy ranged from a low of 27 (poorest) to a high of 66.6 (richest); 32.6 (no education) to 69.8 (tertiary); and 40.4 (unemployed) to a high of 50.1 (self-employed). These proportions are not adjusted for the effects of other variables.

Table 7

Cross Tabulations and Chi-Square Results for MiP by SES

	Malaria in Pregnancy					
Variable	Yes (%)	No (%)	Total (%)	X^2	*df*	*P-Value*
Socio-Economic Status						
Wealth Index				264.90	4	0.00
Poorest	216 (27.0)	584 (73.0)	800			
Poorer	282 (37.4)	473 (62.6)	755			
Middle	314 (52.6)	283 (47.4)	597			
Richer	343 (59.9)	230 (40.1)	573			
Richest	277 (66.6)	139 (33.4)	416			
Total			3,141			
Education				243.67	3	0.00
No Education	521 (32.6)	1079 (67.4)	1600			
Primary	316 (52.6)	285 (47.4)	601			
Secondary	477 (61.9)	294 (38.1)	771			
Tertiary	118 (69.8)	51 (30.2)	169			
Total			3,141			
Occupation				18.03	2	0.00
Unemployed	414 (40.4)	611 (59.6)	1025			
Self Employed	281 (50.1)	280 (49.9)	561			
Employed	733 (47.5)	810 (52.5)	1543			
Total			3,129			

Table 8 shows results of the Chi-square analysis that tested the hypothesis that socioeconomic status predicts health-seeking behavior during malaria in pregnancy in Nigeria. It revealed a significant association between wealth index [X^2 (4, N = 1,404) = 13.54, p = 0.009] and education [X^2 (3, N = 1,404) = 10.86, p = 0.013] with health-seeking behavior during malaria in pregnancy. However, occupation [X^2 (2, N = 1,400) = 0.57, p = 0.753] had no statistically significant relationship with health-seeking behavior during malaria in pregnancy. The percent who had formal health-seeking behavior ranged from a low of 33 (poorest) to a high of 47.6 (richer); 37 (primary education) to 52.2 (tertiary); and 43.5 (unemployed and employed) to a high of 46 (self-employed). These proportions are not adjusted for the effects of other variables.

Table 8

Cross Tabulations and X^2 Results for Health-seeking Behavior during MiP by SES

	Health-seeking Behavior during Malaria in Pregnancy					
Variable	Formal (%)	Informal (%)	Total (%)	X^2	*df*	*P-Value*
Socioeconomic Status Wealth Index				13.54	4	0.009
Poorest	70 (33.0)	142 (67.0)	212			
Poorer	119 (42.8)	159 (57.2)	278			
Middle	140 (45.6)	167 (54.4)	307			
Richer	160 (47.6)	176 (52.4)	336			
Richest	127 (46.9)	144 (53.1)	271			
Total			1,404			
Education				10.86	3	0.013
No Education	238 (46.7)	272 (53.3)	510			
Primary	115 (37.0)	196 (63.0)	311			
Secondary	204 (43.4)	266 (56.6)	470			
Tertiary	59 (52.2)	54 (47.8)	113			
Total			1,404			
Occupation				0.57	2	0.753
Unemployed	177 (43.5)	230 (56.5)	407			
Self Employed	127 (46.0)	149 (54.0)	276			
Employed	312 (43.5)	405 (56.5)	717			
Total			1,400			

The results of the test of hypothesis of differences in malaria incidence and different health-seeking behavior among pregnant women in Nigeria are presented in Table 9. The Chi-square analysis revealed a significant association between malaria in pregnancy and health-seeking behavior [X^2 (1, N = 2,919) = 97.44, p = 0.00]. The percent who had formal health-seeking behavior ranged from a low of 38.4 (no/don't know) to a high of 56.7 (yes). These proportions are not adjusted for the effects of other variables.

Table 9

Cross Tabulations and X^2 Results for Health-seeking Behavior by MiP

	Health-seeking Behavior during Malaria in Pregnancy					
	Formal (%)	Informal (%)	Total (%)	X^2	*df*	*P-Value*
Malaria in Pregnancy				97.44	1	0.00
Yes	792 (56.7)	606 (43.3)	1398			
No/Don't Know	584 (38.4)	937 (61.6)	1521			
Total			2,919			

Table 10 shows the logistics regression results that established statistically significant relationship between some of the elements of SES and malaria in pregnancy. The results showed that the poorest and poorer categories were 35.7 times ($p = 0.000$) and 51.6 times ($p = 0.000$) less likely to have malaria during pregnancy respectively whereas the middle and richer groups were 81.2 times ($p = 0.173$) and 92.9 times ($p = 0.610$) less likely to develop malaria when they are pregnant. However, the relationships between the middle and richer wealth index categories were not statistically significant ($p>0.05$). There was a statistically significant association ($p = 0.000$) between study participants with no education and occurrence of malaria during pregnancy; they were 39.6 times less likely to develop malaria when they are pregnant. The association between those with primary and secondary education and occurrence of malaria in pregnancy were not statistically significant ($p>0.05$). Likewise, the relationships between the unemployed and self-employed pregnant women with malaria in pregnancy were not statistically significant ($p>0.05$).

Table 10

Cross Tabulations and Logistics Regression Results for MiP by SES

		Malaria in Pregnancy	
Variables	Exp B	95% CI	*P-Value*
Socioeconomic Status			
Wealth Index			
Poorest	0.357	0.258--0.496	0.000
Poorer	0.516	0.378-0.703	0.000
Middle	0.812	0.601-1.096	0.173
Richer	0.929	0.698-1.235	0.610
Richest	Ref	Ref	Ref
Education			
No Education	0.396	0.262-0.598	0.000
Primary	0.675	0.446-1.020	0.062
Secondary	0.784	0.537-1.145	0.208
Tertiary	Ref	Ref	Ref
Occupation			
Unemployed	0.939	0.791-1.113	0.466
Self Employed	1.131	0.922-1.387	0.239
Employed	Ref	Ref	Ref

The logistics regression results in Table 11 showed that all the elements of SES (except poorest group [p = 0.000] of wealth index) had a relationship with health-seeking behavior that were not statistically significant (p>0.05). The poorest category was 229.3 times more likely to adopt informal health-seeking behavior.

Table 11

Cross Tabulations and Logistics Regression Results for Health-seeking Behavior by SES

	Health-seeking Behavior during MiP		
Variables	Exp B	95% CI	*P-Value*
Socioeconomic Status			
Wealth Index			
Poorest	2.293	1.444-3.640	0.000
Poorer	1.335	0.886-2.010	0.167
Middle	1.078	0.739-1.571	0.698
Richer	0.940	0.665-1.327	0.724
Richest	Ref	Ref	Ref
Education			
No Education	0.872	0.531-1.430	0.587
Primary	1.627	0.993-2.667	0.053
Secondary	1.403	0.909-2.166	0.126
Tertiary	Ref	Ref	Ref
Occupation			
Unemployed	1.033	0.803-1.328	0.801
Self Employed	0.885	0.666-1.175	0.399
Employed	Ref	Ref	Ref

The relationship between malaria in pregnancy and health-seeking behavior during malaria in pregnancy is displayed in table 12. The study participants who were not pregnant or who did not know their pregnancy status were 209.7 times more likely to take on informal health-seeking behavior (p=0.000).

Table 12

Cross Tabulations and Logistics Regression Results for Health-seeking Behavior by MiP

	Health-seeking Behavior during MiP		
Variable	Exp (B)	95% CI	P-Value
Malaria in Pregnancy			
No/Don't Know	2.097	1.809-2.431	0.000
Yes	Ref	Ref	Ref

Table 13 showed the multivariate logistics regression results of SES and malaria in pregnancy while controlling for age, region of residence, marital status, and enrollment in health insurance scheme, number of ANC visits, religion and ethnicity. The Wald criterion established that only poorest (Wald = 27.663, *p* 0.000), poorer (Wald = 10.364, *p* 0.001), and no education (Wald = 17.925, *p* 0.000) made significant contribution to prediction. The significance values of the Wald statistics of the following predictors indicate that middle (Wald = 1.71, *p* 0.190), richer (Wald = 0.10, *p* 0.92), primary education (Wald = 1.805, *p* 0.179), and secondary education (Wald = 0.759, *p* 0.384) did not make a significant contribution to prediction. Other independent variables that had no significant influence on malaria in pregnancy are unemployed (Wald = 2.455, *p* 0.117) and self-employed (Wald = 1.725, *p* 0.189).

Table 13 equally indicated that the covariates with significant influence on the association between SES and malaria in pregnancy include north region (Wald = 12.798, *p* 0.000), East region (Wald = 20.787, *p* 0.000), health insurance (Wald = 4.238, *p* 0.04) and number of ANC visits (Wald = 23.089, *p* 0.000). Others include Islam (Wald = 5.224, *p* 0.022) and Hausa ethnic group (Wald = 6.016, *p* 0.014). The p-values of the Wald statistics of age (Wald = 0.464, *p* 0.496), South region (Wald = 3.254, *p* 0.071), single (Wald = 0.136, *p* 0.713) and married/co-habiting pregnant women (Wald = 0.007, *p* 0.934) showed that these covariates did not have statistically significant impact on the association between SES and malaria in pregnancy. Other covariates that appeared to have no influence on the relationship between SES and malaria in pregnancy are

Christianity (Wald = 0.660, *p* 0.417, Igbo and Yoruba ethnic groups whose Wald statistics and p-values are (Wald = 0.331, *p* 0.565) and (Wald = 1.280, *p* 0.258) respectively.

Table 13

Multivariate Logistic Regression Analysis showing the effects of Covariates on the relationship between SES and MiP

			Malaria in pregnancy				95% CI for EXP(B)	
Variables	B	SE	Wald	*df*	Sig	Exp(B)	Lower	Upper
Socioeconomic Status								
Wealth Index								
Poorest	.996	.190	27.663	1	0.000	2.709	1.869	3.928
Poorer	.583	.181	10.364	1	0.001	1.791	1.256	2.555
Middle	.228	.174	1.716	1	0.190	1.256	0.893	1.768
Richer	.016	.163	0.010	1	0.920	1.017	0.739	1.399
Richest	Ref	Ref	Ref		Ref	Ref	Ref	Ref
Educational Level								
No Education	1.054	.249	17.925	1	0.000	2.868	1.761	4.671
Primary	.322	.239	1.805	1	0.179	1.379	0.863	2.205
Secondary	.192	.220	0.759	1	0.384	1.211	0.787	1.864
Tertiary	Ref	Ref	Ref		Ref	Ref	Ref	Ref
Occupation								
Unemployed	.150	.096	2.455	1	0.117	1.161	0.963	1.401
Self Employed	-.146	.111	1.725	1	0.189	0.864	0.695	1.075
Employed	Ref	Ref	Ref		Ref	Ref	Ref	Ref
Age	-.304	.791	0.464	1	0.496	0.996	0.983	1.008
Region								
North	-.774	.216	12.798	1	0.000	0.461	0.302	0.705
East	-1.440	.316	20.787	1	0.000	0.237	0.128	0.440
South	-.412	.228	3.254	1	0.071	0.663	0.424	1.036
West	Ref	Ref	Ref		Ref	Ref	Ref	Ref
Marital Status								
Single	.245	.666	0.136	1	0.713	1.278	0.346	4.719
Married/Cohabiting	-.035	.427	0.007	1	0.934	0.965	0.418	2.230
Divorced/Separated/Widow	Ref	Ref	Ref		Ref	Ref	Ref	Ref
Health Insurance (No/Yes)	.974	.473	4.238	1	0.040	2.649	1.048	6.695
Number of ANC Visit	-.019	.004	23.089	1	0.000	0.981	0.974	0.989
Religion								
Christianity	-.314	.387	0.660	1	0.417	0.730	0.342	1.559
Islam	-.881	.385	5.224	1	0.022	0.414	0.195	0.882
Traditional/Other Religion	Ref	Ref	Ref		Ref	Ref	Ref	Ref
Ethnicity								
Hausa	.253	.103	6.016	1	0.014	1.288	1.052	1.576
Igbo	-.159	.276	0.331	1	0.565	0.853	0.497	1.465
Yoruba	-.258	.228	1.280	1	0.258	0.773	0.494	1.208
Others	Ref	Ref	Ref		Ref	Ref	Ref	Ref

To test the effects of covariates (age, region of residence, marital status, and enrollment in health insurance scheme, number of ANC visits, religion and ethnicity) on the association between SES and health-seeking behavior during malaria in pregnancy, a multivariate logistics regression analysis was conducted as shown in Table 14. The analysis revealed that poorest category of wealth index (Wald = 10.552, p 0.001), no education (Wald = 11.670, p 0.001) and primary education (Wald = 11.770, p 0.001) had significant influence on prediction of health-seeking behavior during pregnancy. Other predictor variables made no significant impact on prediction ($p>0.05$). They include poorer (Wald = 2.250), middle (Wald = 0.283), richer (Wald = 0.323), secondary education (Wald = 3.471), unemployed (Wald = 3.123) and self-employed (Wald = 0.241).

The table also revealed covariates that made significant contribution to the association between SES and health-seeking behavior. They are northern and eastern regions of residence (Wald 12.102, p 0.001; Wald 3.926, p 0.048 respectively), Hausa (Wald = 20.555, p 0.000) and Igbo ethnic groups (Wald = 15.392, p 0.000).

Table 14

Multivariate Logistic Regression Analysis showing the effects of Covariates on the relationship between SES and Health-seeking Behavior during MiP

		Health-seeking Behavior During MiP					95% CI for EXP(B)	
Variables	B	SE	Wald	*df*	Sig	Exp(B)	Lower	Upper
Socioeconomic Status								
Wealth Index								
Poorest	-.881	0.271	10.552	1	0.001	0.414	0.244	0.705
Poorer	-.370	0.241	2.250	1	0.134	0.691	0.426	1.120
Middle	0.123	0.230	0.283	1	0.595	1.130	0.720	1.775
Richer	0.118	0.207	0.323	1	0.570	1.125	0.749	1.689
Richest	Ref	Ref	Ref		Ref	Ref	Ref	Ref
Educational Level								
No Education	-1.113	0.326	11.670	1	0.001	0.329	0.174	0.622
Primary	-1.054	0.307	11.770	1	0.001	0.348	0.191	0.636
Secondary	-.498	0.267	3.471	1	0.062	0.608	0.360	1.026
Tertiary	Ref	Ref	Ref		Ref	Ref	Ref	Ref
Occupation								
Unemployed	-.262	0.148	3.123	1	0.077	0.770	0.576	1.029
Self Employed	-.080	0.163	0.241	1	0.623	0.923	0.670	1.271
Employed	Ref	Ref	Ref		Ref	Ref	Ref	Ref
Age	0.000	0.010	0.000	1	0.990	1.000	0.980	1.020
Region								
North	1.268	0.364	12.102	1	0.001	3.553	1.739	7.257
East	-.879	0.444	3.926	1	0.048	0.415	0.174	0.991
South	0.078	0.380	0.042	1	0.837	1.081	0.513	2.278
West	Ref	Ref	Ref		Ref	Ref	Ref	Ref
Marital Status								
Single	-1.127	1.357	0.690	1	0.406	0.324	0.023	4.627
Married/Cohabiting	0.459	0.660	0.483	1	0.487	1.582	0.434	5.769
Divorced/Separated/Widow	Ref	Ref	Ref		Ref	Ref	Ref	Ref
Health Insurance (No/Yes)	-.164	0.419	0.154	1	0.695	0.848	0.373	1.930
Number of ANC Visit	-.003	0.004	0.467	1	0.494	0.997	0.989	1.006
Religion								
Christianity	-1.192	0.651	3.352	1	0.067	0.304	0.085	1.088
Islam	-.561	0.651	0.743	1	0.389	0.570	0.159	2.044
Traditional/Other Religion	Ref	Ref	Ref		Ref	Ref	Ref	Ref
Ethnicity								
Hausa	0.721	0.159	20.555	1	0.000	2.056	1.506	2.808
Igbo	1.487	0.379	15.392	1	0.000	4.424	2.105	9.300
Yoruba	0.715	0.361	3.919	1	0.048	2.044	1.007	4.149
Others	Ref	Ref	Ref		Ref	Ref	Ref	Ref

The results of the multivariate logistics regression analysis to demonstrate the effect of covariates (age, region of residence, marital status, and enrollment in health insurance scheme, number of ANC visits, religion and ethnicity) on the relationship

between malaria in pregnancy and health-seeking behavior are presented in Table 15. The results show that malaria in pregnancy made significant contribution to the choice of health-seeking behavior during pregnancy. The odds of pregnant women that did not have bouts of malaria to engage informal health-seeking behavior was 55.1 times higher than that of pregnant women that had malaria (OR = 0.551). The p-values of the Wald statistics revealed that north (Wald = 7.502, p 0.006), and east regions of residence (Wald = 4.710, p 0.030), health insurance (Wald = 7.098, *p* 0.008) and number of ANC visits (Wald = 16.713, *p* 0.000) made significant influence on the association between malaria in pregnancy and health-seeking behavior during pregnancy. Other covariates that had significant impact on the relationship between malaria in pregnancy and health-seeking behavior during pregnancy include religion and ethnicity. Their respective Wald statistics and p-value are: Christianity (Wald = 6.181, *p* 0.013), Islam (Wald = 4.947, *p* 0.026), Igbo ethnic group (Wald = 29.697, *p* 0.000) and Yoruba ethnic group (Wald = 18.696, *p* 0.000). Age and marital status had no significant influence on the prediction of health-seeking behavior during pregnancy in this study population.

Table 15

Multivariate Logistic Regression Analysis showing the effects of Covariates on the relationship between MiP and Health-seeking Behavior

		Health-seeking Behavior During MiP					95% CI for EXP(B)	
Variables	B	SE	Wald	*df*	Sig	Exp(B)	Lower	Upper
Malaria in pregnancy								
No	-.579	0.083	51.974	1	0.000	0.551	0.469	0.648
Yes	Ref	Ref	Ref		Ref	Ref	Ref	Ref
Age	-.004	0.006	0.471	1	0.492	0.996	0.983	1.008
Region								
North	0.609	0.223	7.502	1	0.006	1.840	1.189	2.845
East	-.748	0.344	4.710	1	0.030	0.474	0.241	0.930
South	-.056	0.242	0.054	1	0.815	0.945	0.589	1.518
West	Ref	Ref	Ref		Ref	Ref	Ref	Ref
Marital Status								
Single	0.159	0.753	0.045	1	0.739	1.173	0.268	5.128
Married/Cohabiting	0.931	0.494	3.554	1	0.214	2.538	0.964	6.686
Divorced/Separated/Widow	Ref	Ref	Ref		Ref	Ref	Ref	Ref
Health Insurance (No/Yes)	-1.036	0.389	7.098	1	0.008	0.355	0.166	0.760
Number of ANC Visit	0.014	0.003	16.713	1	0.000	1.014	1.007	1.021
Religion								
Christianity	1.040	0.418	6.181	1	0.013	2.829	1.246	6.421
Islam	0.929	0.418	4.947	1	0.026	2.532	1.117	5.743
Traditional/Other Religion	Ref	Ref	Ref		Ref	Ref	Ref	Ref
Ethnicity								
Hausa	0.016	0.099	0.026	1	0.872	1.016	0.838	1.232
Igbo	1.697	0.311	29.697	1	0.000	5.456	2.964	10.043
Yoruba	1.013	0.234	18.696	1	0.000	2.754	1.740	4.358
Others	Ref	Ref	Ref		Ref	Ref	Ref	Ref

Table 16 shows the change in Odd Ratio (OR) between logistics regression and multiple logistics regression analysis attributable to covariates. On the relationship between SES and malaria in pregnancy, the covariates (north and east regions of residence, health insurance, number of ANC visits, Islam and Hausa ethnic group) had positive effect modification on pregnant women in the poorest (87%) and poorer (71%) categories of wealth index and those with no education (86%).

The North & East regions of residence, Hausa & Igbo ethnic groups had negative effect modification among study participants in the poorest category of wealth index (-454%), no education (-165%) and primary education (-368%) in the relationship between SES and health-seeking behavior during malaria in pregnancy.

Many covariates had negative effect modification (-281%) on the association between malaria in pregnancy and health-seeking behavior during pregnancy. They include North & East regions of residence, health insurance, number of ANC visits, Christianity, Islam, Igbo and Hausa ethnic groups ($p<0.05$).

Table 16

Changes in Odd Ratio between Logistics Regression and Multiple Logistics Regression Analysis Attributable to Covariates.

Variables	Covariates with p<0.05	Logistics Regression EXP(B)	Multiple Logistics Regression EXP (B)	Percentage Change in EXP(B)	Inference
Wealth Index	North & East regions, Health Insurance, Number of ANC visits, Islam & Hausa ethnic group	Socioeconomic Status and Malaria in Pregnancy			
Poorest		0.357	2.709	87	Effect modification
Poorer		0.516	1.791	71	Effect modification
Education Level					
No education		0.396	2.868	86	Effect modification
Wealth Index	North & East regions, Hausa & Igbo ethnic groups	Socioeconomic Status and Health-seeking Behavior During Pregnancy			
Poorest		2.293	0.414	-454	Effect modification
Education Level					
No Education		0.872	0.329	-165	Effect modification
Primary		1.627	0.348	-368	Effect modification
MiP	North & East regions, Health Insurance, Number of ANC visits, Christianity, Islam, Igbo & Hausa ethnic groups	Malaria in Pregnancy and Health-seeking Behavior During Pregnancy			
Not pregnant/Don't know		2.097	0.551	-281	Effect modification

Summary

This study was based on three research questions and their corresponding hypotheses. The first research question was "Is there an association between socioeconomic status and incidence of malaria in pregnancy among Nigerian women?" Based on the above results, the null hypothesis that "there is no association between socioeconomic status and incidence of malaria in pregnancy among Nigerian women controlling for age, ethnicity, antenatal visits, marital status, religion, coverage by health insurance and region of residence" was rejected although some of the elements that were used in determining SES did not have association with the incidence of malaria in pregnancy. The alternate hypothesis was found to be true. There was a statistically significant difference in the odds of pregnant women with varying SES and the incidence of malaria during pregnancy.

The investigation of the second research question on whether "socioeconomic status predicts health-seeking behavior during malaria in pregnancy in Nigeria?" revealed that the null hypothesis which stated that SES does not predict health-seeking behavior during malaria in pregnancy in Nigeria, controlling for age, ethnicity, antenatal visits, marital status, religion, coverage by health insurance and region of residence was rejected. However, some of the components of socioeconomic status did not have statistically significant relationship with health-seeking behavior. The alternate hypothesis was accepted. The odds of pregnant women with different socioeconomic status were statistically different with their choice of health-seeking behavior when they have malaria.

The third question examined whether there are differences in malaria incidence and different health-seeking behavior among pregnant women in Nigeria. The above results rejected the null hypothesis that there is no difference in malaria incidence and different health-seeking behavior among pregnant women in Nigeria, controlling for age, ethnicity, antenatal visits, marital status, religion, coverage by health insurance and region of residence. The alternate hypothesis was accepted. There was statistically significant difference in malaria incidence and different health-seeking behavior among pregnant women in Nigeria, controlling for age, ethnicity, antenatal visits, marital status, religion, coverage by health insurance and region of residence. Pregnant women that did not have malaria had higher odds of taking up informal health-seeking behavior than pregnant women who had malaria (OR 0.551).

Chapter 5 discusses interpretation of the research findings, limitations of the study and the social change implications of this study. The recommendations will also be addressed.

Chapter 5: Discussion, Conclusions, and Recommendations

Introduction

The purpose of this cross-sectional research is to examine the impact of SES and health-seeking behavior on malaria in pregnancy in Nigeria using secondary dataset from the Demographic and Health Survey (DHS) program. The 2015 Nigeria Malaria Indicator Survey (2015 NMIS) was used. A total of 8,034 women participated in the survey; 4,444 of them were pregnant (NMEP et al., 2016). The DHS data is in the public domain without personal identifiers. SCT was used to examine how variations in SES (characterized by wealth index, educational level and occupation) and health-seeking behavior (defined by formal and informal methods) determine the incidence of malaria during pregnancy. Age, ethnicity, antenatal visits, marital status, religion, coverage by health insurance and region of residence were included as covariates because they have been individually shown, in other studies, to play a role in the incidence of malaria during pregnancy.

The 2015 Nigeria Malaria Indicator Survey dataset was cleaned and SPSS version 24 was used to conduct descriptive statistics, bivariate analysis, and multivariate logistics regression analysis focusing on the predictor and dependent variables and the covariates. The results of the analysis provided the evidences for accepting or rejecting the research questions and hypotheses. A statistically significant association was found to exist between socioeconomic status and malaria in pregnancy. Region of residence, health insurance, ANC visits, religion and ethnicity were found to modify the relationship

between the predictor and dependent variables. Age and marital status did not have confounding influence on the association between socioeconomic status and malaria in pregnancy. Variations in SES also had statistically significant relationship on health-seeking behavior during pregnancy. The covariates that had effect modification outcome were region of residence and ethnicity. Age, marital status, health insurance, ANC visits, and religion did not have any significant effect. Analysis that focused on the third research question showed that malaria in pregnancy determined the choice of health-seeking behavior during pregnancy. Covariates that modified the association include region of residence, health insurance, ANC visits, religion, and ethnicity while age and marital status did not have significant effect on the relationship between malaria in pregnancy and health-seeking behavior during pregnancy.

Interpretation of Findings

The findings of this cross-sectional study are consistent with the outcomes of previous research on malaria in pregnancy.

Research Question 1

Research Question 1**:** Is there an association between socioeconomic status (defined by wealth index, education and occupation) and incidence of malaria in pregnancy among Nigerian women? The null hypothesis stated that there is no association between socioeconomic status and incidence of malaria in pregnancy among Nigerian women controlling for age, ethnicity, antenatal visits, marital status, religion, coverage by health insurance and region of residence. The results of this study showed that poorest and poorer categories of wealth index and ‘no education’ were significant

predictors of malaria in pregnancy without considering the effects of possible confounders. After controlling for age, ethnicity, antenatal visits, marital status, religion, coverage by health insurance and region of residence, poorest and poorer categories of wealth index and ‘no education’ retained their statistically significant effect on the prediction of malaria in pregnancy. However, middle and richer categories of wealth index, primary and secondary education and occupation were not significant predictors of malaria in pregnancy.

It was expected that occupation would have made a significant contribution to predicting malaria in pregnancy as recorded by Hill et al. (2013) while primary education should have determined the occurrence of malaria in pregnancy as earlier documented (Mbu et al., 2014). However, the study findings showed that occupation, primary and secondary education did not predict malaria in pregnancy. This could be due to the dependence of the pregnant women on their husbands for support. Accordingly, the impacts of their occupation, earning and what they spend for health care needs would be determined by their husband’s occupation and income. The occupations of the pregnant women are inconsequential in predicting the occurrence of malaria during pregnancy.

This study revealed inverse relationship between the likelihood of developing malaria during pregnancy in poorer and poorest wealth index and socioeconomic status. The same antithetical association was recorded between educational level and malaria in pregnancy. Thus, study participants in high SES category and high educational level acquire malaria in pregnancy at a lesser rate than those in low SES category and low educational level respectively. The result of this study is consistent with other studies

(Chaponda et al., 2015; Donovan et al., 2012; Sonko et al., 2014; Tusting et al., 2013; Tusting et al., 2016; Yamomoto et al., 2010) but disagrees with Somi et al. (2007) who demonstrated negative association between malaria and SES. Other scholars, Somi et al. (2008) also established no association between malaria and SES while Onwujekwe et al. (2009) showed that study participants of higher SES were more likely to have malaria than their counterparts of lower SES. The scholars posited that self-reported malaria is higher among high SES groups but the poor are less likely to report malaria symptoms resulting in over-reporting and under-reporting of malaria illness among the rich and poor individuals respectively. In Chaponda et al. (2015) study, univariate analysis (at $P < 0.1$) of the research data showed that predictors of malaria parasitaemia during pregnancy include wealth index, marital status, age of pregnant women, bednet ownership, bednet usage, HIV status, and gravidity. However, the multivariate analysis identified wealth index, HIV status and site of recruitment as predictors of malaria in pregnancy. Furthermore, Tusting et al. (2016) also demonstrated that study participants in high SES have lower odds of malaria parasitaemia. The study showed that high socio-economic position was associated with lower odds of malaria (highest versus lowest wealth index tertile: adjusted Odds Ratio 0.52, 95% CI 0.35–0.78, P=0.001). Other studies with similar outcomes of inverse association between SES and malaria parasitaemia include Ayele, Zewotir, & Mwambi (2012), Ayele, Zewotir, & Mwambi (2014), Biggs et al. (2010), Castro & Fisher (2012), Dickinson et al. (2012), Egen et al. (2017), Herdman et al. (2016), Mbu et al. (2014), Quon & McGrath (2014), Ricci (2012) and Yamamoto et al. (2010).

In contrast to the inverse relationship between SES and malaria, Sonko et al. (2014) and Tusting et al. (2016) documented mixed associations between SES and malaria. Tusting et al. (2016) did not observe any association between socioeconomic position and incidence of clinical malaria. However, the scholars discovered that socioeconomic position was associated with increased odds of malaria parasitaemia. In Sonko et al. (2014) study, a strong link was established between malaria and low SES at macro level (national) while at micro level (household and population), mixed results were documented.

The study also showed that 'no education' was a significant predictor of malaria in pregnancy. This agrees with other studies conducted (Afulani, 2015; Gupta et al., 2014; Kim et al., 2018; Mbu et al., 2014; Yusuf et al., 2016). Educational level is linked to the likelihood of seeking appropriate malaria prevention and treatment during pregnancy. Educated women have a tendency of complying with the WHO recommended four to eight ANC visits than less educated women (Afulani, 2015; Gupta et al., 2014; Kim et al., 2018). During the ANC visits, the pregnant women interact with the healthcare workers who alert them on best practices for a successful gestation period. In addition, education was likely to determine the neighborhood where pregnant women reside as well-educated women may not dwell in unbefitting areas. The educational level did not significantly influence the occurrence of malaria in pregnancy after 'no education' level. Malaria morbidity in study participants who had attained primary education (OR 1.379, 95% CI, 0.863-2.205, p 0.179) was similar to those with secondary school (OR 1.211, 95% CI, 0.787-1.864, p 0.384). There should have been a difference in

the malaria morbidity of pregnant women who had attained primary and secondary education. However, in Nigeria and other SSA countries where poverty is widespread, the neighborhoods are shared by a population mix of the educated and those who are not educated.

Furthermore, north and east regions of residence, coverage by health insurance, antenatal visits, Islam and Hausa ethnic group had effect modification impact on the relationship between SES and malaria in pregnancy. The result of the current study that health insurance coverage modified the association between SES and malaria in pregnancy is consistent with the result of a previous study that health insurance coverage was a significant risk factor for adverse pregnancy outcomes (Kim et al., 2018). Adverse pregnancy outcome could be a consequence of malaria in pregnancy (Amegah et al., 2013; Desai et al., 2007; Rogerson et al., 2018). The authors showed that health insurance through medical aid made a significant contribution to the prediction for preterm delivery (OR: 1.35, P=0.022), preeclampsia (OR: 1.98, P<0.001), gestational diabetes mellitus (OR: 1.43, P=0.055), and obstetric hemorrhage (OR: 1.25, P=0.010).

Age, marital status, Christianity, Igbo and Yoruba ethnic groups did not have either confounding or effect modification impact on the association between SES and malaria in pregnancy. Sonko et al. (2014) also reported that age had no association with malaria parasitaemia. However, documentations from earlier studies showed that age (Mbu et al., 2014) and marital status modified the occurrence of malaria parasitaemia during pregnancy (Anchang-Kimbi et al., 2015). Single pregnant women in Nigeria are often ashamed to join other married pregnant women in ANC visits to health facilities

due to the stigma attached to single motherhood. Other scholars linked marital status with ITN use to prevent malaria infection (Chaponda et al., 2015; Hill et al., 2013).

Research Question 2

Research Question 2: Does socioeconomic status predict health-seeking behavior during malaria in pregnancy in Nigeria? The null hypothesis stated that socioeconomic status does not predict health-seeking behavior during malaria in pregnancy in Nigeria, controlling for age, ethnicity, antenatal visits, marital status, religion, coverage by health insurance and region of residence. The logistic regression analysis results in this study showed that only the poorest group of the wealth index made a significant contribution to predict the association between SES and health-seeking behavior. However, the multivariate logistic regression analysis results established that poorest wealth index group (OR 0.414, 95% CI, 0.244-0.705, p 0.001), no education (OR 0.329, 95% CI, 0.174-0.622, p 0.001) and primary education (OR 0.348, 95% CI, 0.191-0.636, p 0.001) were significant predictors of the relationship between SES and health-seeking behavior.

These findings that wealth index and education made significant contributions to the association between SES and health-seeking behavior are consistent with the outcomes of the research by Azunia (2017), Ibe et al. (2015), Kakkar et al. (2013), Larsen et al. (2016) and Onabanjo and Nwokocha (2012).

In their study, Larsen et al. (2016) visualized health-seeking behavior in a continuum of care from high (formal) to low (informal) levels. The scholars illustrated that wealth index, parity, timeliness of ANC initiation, religion, district of residence and nearest health facility type were significant predictors of maternal healthcare seeking.

Women in highest wealth index group were three times more likely to seek highest two levels of care versus the lowest level (high RRR 2.92, 95% CI, 1.27–6.71, mid-level RRR 2.71, 95% CI, 1.31–5.62). These agree with the findings in this study where women in the poorer wealth index group (OR 0.414, 95% CI, 0.244-0.705, p 0.001) were 41.4 times less likely to adopt informal health-seeking behavior and those in richer wealth index group were 112.5 times less likely to take up informal health-seeking behavior. In a similar study by Herdsman et al. (2016), adult participants from poor households preferred unqualified allopathic practitioner to qualified private doctor while participants from high SES households showed affinity to consult a qualified private doctor.

In the Kakkar et al. (2013) study, SES had significant prediction on health-seeking practice in rural India. However, literacy (educational level) and age of family member did not make significant contribution to predicting the health-seeking practice. This may be due to the high number of ANC attendance in Nigeria (van Eijk et al., 2013) which provided opportunities for the pregnant women to update their knowledge on pregnancy and the attendant risks including malaria in pregnancy.

In contrast to Kakkar et al. (2012), Onabanjo and Nwokocha (2012) applied multistage sampling technique to collect quantitative and qualitative data from 927 respondents to demonstrate that education had significant prediction on treatment seeking behavior among pregnant women in Ondo state, Nigeria although both studies agreed that SES is an important predictor of health-seeking behavior. Additionally, Onabanjo and Nwokocha (2012) also revealed that moderate difference existed in rural (X=1.52, SD=0.49) and urban (X=1.29, SD=0.45) study participants' choice of treatment options.

Individuals of low and high SES generally reside in the rural and urban areas respectively.

Furthermore, Ibe et al. (2015) collected data from study participants on previous treatment seeking for the illness episode and the reasons for the choice of provider as they leave pharmacies, public health facilities and patent medicine dealers (PMD). The pharmacies and the public health facilities can be classified as formal healthcare providers while the patent medicine dealers are informal healthcare providers. Though the study participants were not pregnant women, the analysis showed that the poorer SES groups had sought treatment elsewhere for their current illness prior to seeking treatment at the study facilities ($p=0.002$). The traditional healers and herbalists form the majority of informal healthcare providers in the study area and often represent the first choice of medical attention for people in low SES.

Occupation did not have a statistically significant impact on health-seeking behavior during pregnancy. This may be due to the free health care cost for pregnant women which allows low SES women to access health care needs which ordinarily would have been impossible if they were to pay user fees.

Research Question 3

Research Question 3: Are there differences in malaria incidence and different health-seeking behavior among pregnant women in Nigeria? The null hypothesis stated that there is no difference in malaria incidence and different health-seeking behavior among pregnant women in Nigeria, controlling for age, ethnicity, antenatal visits, marital status, religion, coverage by health insurance and region of residence. Both logistics and

multivariate logistics regression analyses results, in this study, showed that malaria in pregnancy had a significant prediction of the health-seeking behavior during pregnancy (OR 0.551, 95% CI: 0.469-0.648, *p* 0.000). Expectedly, pregnant women who had malaria are concerned about their safety and the safety of the fetus; as such they would visit health facilities where they would access formal medical attention. The World Health Organization (2017b) had recommended that pregnant women should attend ANC from four to eight visits for every pregnancy. Ameh et al. (2016) documented that about 90% of pregnant women in Nigeria utilize ANC services. The health education sessions during ANC visits provide the opportunities for pregnant women to learn the best practices they should adopt for their safety and care of the fetus.

The northern and eastern regions of residence, health insurance, number of ANC visits, religion (Christianity and Islam), Igbo and Yoruba ethnic groups modified the association of malaria in pregnancy and health-seeking behavior. In northern Nigeria, pregnant women, often times are not allowed to decide on their health-seeking options; it is the exclusive reserve of the husband as the head of the household. On the other hand, in eastern Nigeria, pregnant women are at liberty to make informed decisions on their health-seeking behavior, probably due to cultural and religious reasons. These two extremes in health-seeking behavior modify the pregnant woman's health-seeking behavior either positively or negatively. Health insurance coverage in Nigeria is not yet universal. About 98% of study participants are not under any health insurance coverage. Federal and some states' civil servants are the beneficiaries of the health pool fund. The foregoing underscores the modification effect on the pregnant woman's health-seeking

behavior. The pregnant women with health insurance coverage had unlimited access to formal health-seeking behavior options while those without health insurance coverage resort to user-fees. User-fees hinder the pregnant woman's choice of medical care in a formal setting (Graffy et al., 2012; Hill et al., 2014; Hill et al., 2015; Klein et al., 2016; Pell et al., 2013; Singh, Brown, & Rogerson, 2013; Thiam, Kimotho, & Gatonga, 2013; Willey et al., 2012). Graffy et al. (2012) explored young people's perspective on non-adherence to protective measures against malaria, HIV and unplanned pregnancy in a qualitative study in Uganda. The scholars concluded that cost, rural isolation, quality and availability of health care services determine study participants' compliance to health advice. Hill et al. (2014) conducted a systematic review and meta-analysis of 37 studies, mostly conducted in Africa, to demonstrate the factors that influence the health-seeking behavior and choice of medicines among pregnant women seeking treatment for malaria. The researchers concluded that cost, patients' preference, concerns over the side effects and drug safety, and drug availability determine the choice of malaria treatment pregnant women adopt. The qualitative study that was conducted in Kenya and Mali by Hill et al. (2015) revealed that pregnant women preferred formal health-seeking behavior from a health professional during bouts of malaria, but the high cost of treatment at health facilities force them to herbal remedies or drugs bought from shops. The authors, Klein et al. (2016), conducted a qualitative study in Mali to explore the uptake of IPT during pregnancy. They concluded that both actual and perceived costs of health care services are barriers to seeking health care needs in a formal setting. In their study, Pell et al. (2013) showed that direct and indirect costs affect the pregnant woman's compliance to

the WHO recommended number of attendance for ANC sessions. Low SES pregnant women who could not afford these costs may seek healthcare needs elsewhere, often in informal settings. The review and narrative synthesis of 59 studies in Sub-Sahara Africa by Singh, Brown and Rogerson (2013) revealed that cost, education level, knowledge of malaria, community involvement, socio-economic status and parity are the major barriers for ownership and use of ITNs. A systematic review by Thiam, Kimotho and Gatonga (2013) recorded that both direct (out-of-pocket health expenditure) and indirect costs such as lost time deter positive health-seeking behavior. Willey et al. (2012) in their systematic review of 32 publications that described 20 African studies, equally identified costs, stock-out and poor logistics support as common barriers to ITN delivery included cost, stock-outs and poor logistics. The modification effect of ANC visits recorded in this study is coordinated with the transfer of knowledge on pregnancy risky behaviors that form part of the health education sessions during ANC visits. In Nigeria, 90% of pregnant women attain the WHO recommended four to eight ANC visits before delivery (Ameh et al., 2016). Thus, the pregnant women are empowered to make informed decisions on the appropriate health-seeking behavior to adopt during pregnancy. The modification of the association between malaria in pregnancy and health-seeking behavior by religion confirms adequate use of religious leaders and institutions to mobilize women for their health needs especially during pregnancy. The Igbo and Yoruba ethnic groups equally had effect modification on the prediction of health-seeking behavior by malaria in pregnancy. The restriction of the average Hausa pregnant woman from taking decisions

on health-seeking options may have explained the no-effect modification by the Hausa ethnic extraction.

From the outcome of earlier studies, we had expected age and marital status of the pregnant women to modify the relationship between malaria in pregnancy and health-seeking behavior. The expectation on age was based on the assumption that it could be used as proxy for gravidity. Age, marital status and gravidity had been shown in earlier studies to be significant predictors of P. falciparum parasitaemia (Anchang-Kimbi et al., 2015; Mbu et al., 2014).

Study Results in Relation to the Social Cognitive Theory Model

The social cognitive theory used in this dissertation study makes it possible for the readers to understand the essence of using a theoretical model to study health behaviors at personal, behavioral and environmental levels. The variables in this study expressed these three levels of interaction. The SCT model describes the relationships between individuals, their behaviors and the environment and how these interact to define human behaviors (Nouwen et al., 2009; Omona, 2009; Tiemey et al., 2011). The consideration of these tripartite factors during the design of malaria intervention programs elaborate an inclusive package that will deliver the goals and objectives of such interventions.

At personal level, the pregnant woman takes the lead in preventing malaria occurrence. The knowledge of malaria and its prevention methods are critical in applying the preventive measures. Knowledge of the women in the survey about malaria was 87% although the regions have differing proportions of women’s knowledge on malaria.

Knowledge about malaria has a direct relationship with education and wealth (NMIS, 2015). However, other enabling factors that facilitates the application of the knowledge are the pregnant woman's SES, age, marital status, coverage by health insurance, nutritional status and co-morbidities. Earlier studies showed that malaria in pregnancy was linked to some personal attributes of the pregnant women such as socioeconomic status, age, marital status, knowledge, and coverage by health insurance (Akaba et al., 2013; Clouston, Yukich & Alglewicz, 2015; Kibusi, Kimunai & Hines, 2015; Onabanjo & Nwokocha, 2012). SES (defined in this study by wealth index, occupation and educational level) is closely associated with the income and expendable funds for the pregnant woman to seek healthcare needs especially in Nigeria where health insurance coverage is low and user fees remain a plausible option for healthcare financing. According to NMIS (2015), wealth index was deduced from data on the household's possession of consumer goods, dwelling features, source of drinking water, sanitation facilities, and other descriptions that relate to a household's SES. The survey team generated the weighted values for wealth index using principal component analysis (PCA). The product of the PCA was standardized and applied in the analysis. Other personal traits of the pregnant woman include nutritional status, occupation (NMIS, 2015). The household wealth index has a direct link with the capacity of the pregnant woman to purchase and consume nutritious food while occupation determines the dispensable funds available for the pregnant woman to prevent malaria or to engage in formal health-seeking behavior if malaria occurs. However, occupation did not predict

malaria in pregnancy and health-seeking behavior during malaria in pregnancy in this study.

The behavioral components of the SCT that were examined in this study are health-seeking behavior and ANC visit. The WHO (2017b) recommended that the pregnant woman should attend between four to eight ANC sessions during pregnancy. These ANC visits encourage interaction with health workers to identify and resolve any impending pregnancy complications so as to improve pregnancy outcomes. Pregnant women of higher socioeconomic status, education, and knowledge of the importance of ANC visit were found to attend at least four ANC (Afulani, 2015; Gupta et al., 2014; Kim et al., 2018). The focused ANC sessions provide opportunities for the health workers to educate the pregnant women on pregnancy, its outcomes and complications and how to minimize them. The ANC sessions offer opportunities for health workers to update the pregnant woman's knowledge about pregnancy and its best practices. This may explain the statistically significant impact of the number of ANC visits on the association between the independent and dependent variables in the three research questions (SES and malaria in pregnancy, SES and health-seeking behavior during malaria in pregnancy, and malaria in pregnancy and health-seeking behavior).

At the environmental level, many factors encourage pregnant women to adhere to formal health-seeking behavior and thereby prevent malaria in pregnancy. Nearest health facility type, region of residence, states of residence and religion are the environmental enablers that interact with personal and behavioral factors of social cognitive theory in the study. The states of residence in this dissertation are subsumed in the region of

residence. The 36 states and the Federal Capital Territory are merged to form the six geopolitical zones of north central, north east, north west, south east, south south and south west. However, for ease of analysis, the regions of residence were represented with the four cardinal points of east, north south and west.

The Federal Ministry of Health implements malaria control programs in all the regions in Nigeria. This include distribution of free LLIN/ITN during focused ante-natal sessions, intermittent preventive therapy during pregnancy, and free anti-malaria medications for effective case management. However, these free medications and medical services are only available in government-owned health facilities. Private health facilities still charge user-fees for medical services to the pregnant women. The frequent stock-out of anti-malaria medications in public health facilities (Kalanda et al., 2006) and the long delays encountered by pregnant women in such facilities may discourage them from engaging in such formal health-seeking behavior. The low-SES pregnant women may not be able to afford the high cost of medical services in private facilities especially in rural areas. Though, the type of nearest health facility type was not captured in the database, it plays a critical role in determining the choice of health-seeking behavior available to the pregnant women.

Religion is an easy tool to mobilize people in Nigeria. Focused ANC sessions are often heralded by prayer sessions and devotion to God. Thus, religion, as an instrument of mass mobilization, can be used to sensitize pregnant women on the danger signs of pregnancy and the importance of formal health-seeking behavior. Figure 2 (page 26) shows the graphic representation of the variables in the three interactional levels of SCT.

Limitations of the Study

An important limitation in this study was that the Malaria Indicator Survey (2015) data was not exclusively designed to answer my research questions. Some variables in this dissertation were re-categorized and recoded to answer research questions. Second, the use of secondary data did not allow for control of the quality of collected data. National surveys such as Malaria Indicator Surveys (2015) are liable to measurement errors and information bias from respondent recall and self-report (Eisele et al., 2012) The respondents in large surveys such as Malaria Indicator Survey (2015) may have recall bias such that some self-reported data may not be of the required standard. Furthermore, there were many missing data in the survey which may have affected the internal validity of this study. The inability to control for all the identified confounding and modifying variables, such as gravidity and parity, was a major limitation as I was confined to the available data in the secondary dataset. Additionally, there was no data on alternative medicine which has been applied widely in the treatment of diseases such as malaria, HIV/AIDS, diabetes, sickle cell anemia and hypertension (Ekeanyanwu, 2011). However, the study results are important as they demonstrated the impact of socioeconomic status and health-seeking behavior on malaria in pregnancy in Nigeria.

Recommendations

The designers of malaria intervention programs for pregnant women should look beyond the immediate cause of malaria illness and explore other remote causes which are shown in this study to include socioeconomic status and health-seeking behavior.

Malaria interventions planners should target low-SES pregnant women to reduce inequalities in the women's health care seeking behavior when malaria occur. Furthermore, these low-SES women should be reached through health education sessions during focused ANC visits about maternal health and malaria in pregnancy.

Federal government should provide insurance schemes to pregnant women within the low-SES group. Access to health insurance will promote preference for formal health-seeking behavior and medical consultation with qualified practitioners. According to Werner (2009), the pool fund in health insurance schemes will enable pregnant women to cope with high cost of in-patient care when this is necessary. In Bangladesh, patients within the low-SES category receive credit vouchers in advance of need for healthcare services. The practice was meant to reduce cost and promote formal health-seeking behavior (Ahmed & Khan, 2011).

Development partners should support further community-based randomized controlled study among pregnant women to establish causality between socioeconomic status, health-seeking behavior and malaria in pregnancy.

Implication for Social Change

Malaria in pregnancy is a topical issue such that despite the plethora of studies already conducted, the need still exists for better understanding of the impact of socioeconomic status and health-seeking behavior on its occurrence.

The Demographic and Health Survey program, who owns the 2015 Nigeria Malaria Indicator Survey data, would be sensitized on the study outcomes. Furthermore, the research findings that malaria in pregnancy predicted the health-seeking behavior of

pregnant towards formal methods (Orthodox/Western orientation) would be discussed with government institutions and other stakeholders to highlight the necessity of establishing health facilities especially in hard-to-reach areas where such amenities were not available. The study results clearly showed that government and development partners should not only concentrate on the immediate cause of malaria but integrate the distal but fundamental causes of malaria (socioeconomic status and health-seeking behavior) into malaria intervention programs (Sonko et al., 2014)

The better understanding of the impact of socioeconomic status and health-seeking behavior on malaria in pregnancy that were produced from this study would be discussed with Nigeria's Ministry of Health. This will help them to understand that there are differences between malaria in pregnancy and malaria in general population. This understanding would promote the development of new approaches and programs on women empowerment that would focus on strengthening the SES (mass education and enhanced income generation) and improving the health-seeking behavior of women.

The study highlighted the confounding effects of region of residence, health insurance, ANC visits, religion and ethnicity. It was apparent that there were differences in malaria occurrence during pregnancy and the pregnant woman's malaria health-seeking behavior in the east, north, south and west regions of Nigeria. My discussions with the Nigeria's Ministry of Health will highlight these regional differences so that they will design and implement region specific malaria intervention programs. Additionally, the study underscored the necessity of health insurance and ANC visits. Understanding these aspects of the study would make it easier for governments and its agencies to

develop intervention programs to address these confounders. Some of these programs might include region specific activities that are culturally sensitive with ethnic bias for ownership and acceptance by community members, informal health pool funding for healthcare needs, nationwide extension of focused ante-natal care sessions, and rational use of religious leaders as tools for mass mobilization and awareness creation. Finally, these projects would promote investments that would improve prevention and treatment of malaria in pregnancy, engender economic growth and development and women empowerment.

Conclusion

This dissertation explored how socioeconomic status and health-seeking behavior impact malaria in pregnancy in Nigeria. The study used a cross-sectional approach and a secondary dataset from the Demographic and Health Survey (DHS) program to analyze the association of the predictor variables and outcome variable.

The results indicated that socioeconomic status had significant impact on malaria in pregnancy and health-seeking behavior in the study population. It equally revealed that malaria in pregnancy made significant contribution to the choice of formal health-seeking behavior. No significant association was shown between occupation of the pregnant women with malaria in pregnancy and health-seeking behavior. These findings were supported by both logistics regression and chi-square analyses results with all the covariates being included in the final multivariate logistics regression models.

The Nigeria's Federal Ministry of Health, in line with other governments in Sub Sahara Africa, where malaria in pregnancy is endemic, targets the proximal causes of

malaria in pregnancy and neglects the distal but most important bases for the continued spread of malaria in pregnancy (Sonko et al., 2014). The recommendations highlighted in this study serve as starting points for the government to implement MiP intervention programs that will target the socioeconomic status and health-seeking behavior of the pregnant women as these will have major impact on malaria burden (Ricci, 2012; Tusting et al., 2013).

A MiP intervention program that may achieve the target of malaria elimination by 2020 in Nigeria should include strategies to address the socioeconomic disparities of pregnant women, which in turn, may improve their health-seeking behavior. Efforts to improve the overall impact of MiP elimination programs may derive particular benefits from strategies that improve the socioeconomic status of pregnant women and their health-seeking behavior.

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Appendix: Permission to Use Data

DHS Download Account Application
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You have been authorized to download "Survey" 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.

The files you will download are in zipped format and must be unzipped before analysis. To begin downloading, please login at: http://www.dhsprogram.com/data/dataset_admin/login_main.cfm . If you are approved for a large number of countries/datasets, we recommend that you use the new Bulk Downloading System. For instructions on bulk downloading, please go to: http://userforum.dhsprogram.com/index.php?t=msg&th=5246 .

Following are some guidelines:

After unzipping, please print the file with the .DOC/DOCX extension (found in the Individual and 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 related questions, please register to participate in the DHS Program User Forum at:
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